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FEDERAL GUIDANCE REPORT NO. 12

EXTERNAL EXPOSURE TO RADIONUCLIDES IN AIR, WATER, AND SOIL

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ERRATUM

p. 218 Table C.2. Scaled External Bremsstrahlung from Electrons for Water
For T = 1000.0 and k/T = 0.10, the table entry .0223 should read 1.0223.

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EXTERNAL EXPOSURE TO RADIONUCLIDES IN AIR, WATER, AND SOIL

Exposure-to-Dose Coefficients for General Application,
Based on the 1987 Federal Radiation Protection Guidance

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PREFACE

Federal radiation protection guidance is developed by the Administrator of the Environmental Protection Agency as part of his or her responsibility, under Executive Order 10831, to "... advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards and in the establishment and execution of programs of cooperation with States." The purpose of Federal guidance is to provide a common framework to ensure that the regulation of exposure to ionizing radiation is carried out in a consistent and adequately protective manner.

This Federal guidance report is the third of a series designed to provide technical information useful in implementing radiation protection programs. It is our hope that it will help ensure that regulation of exposure to radiation is carried out in a consistent manner that makes use of the best available information for relating concentrations of radioisotopes in environmental media to dose in human populations due to external radiation. The dose coefficients in this report are intended for use by Federal agencies having regulatory responsibilities for protection of members of the public and/or workers, such as the Environmental Protection Agency, the Nuclear Regulatory Commission, and Occupational Health and Safety Administration, as well as by those Federal agencies with responsibilities related to the management of their own and their contractor operations, such as the Department of Energy and the Department of Defense. We also encourage their use by State and local authorities.

Exposure to external radiation from contaminated soil, which is a central focus of the calculations carried out to produce this report, is a particularly timely subject. The Nation is at the beginning of perhaps the largest cleanup operation in its history, at the large collection of sites involved in the development of nuclear weapons and commercial nuclear power during the past half century. An accurate assessment of this exposure pathway is essential to the decisions that will be required to regulate, manage, and verify this cleanup.

The principal dose quantity, effective dose equivalent, has been calculated with the weighting factors used in Federal Guidance Report No. 11, which were those recommended in Radiation Protection Guidance to Federal Agencies for Occupational Exposure (EPA, 1987).

New estimates of radiation risk to the organs and tissues have been published since then (UNSCEAR, 1988; NAS, 1990) and updated weighting factors have been recommended by the International Commission on Radiological Protection (ICRP, 1991). However, new weighting factors have not yet been adopted for use in the United States and would require a number of adjustments to existing regulations. As the report notes, for most radionuclides these dose coefficients are not very sensitive to the choice of weighting factors. We are reviewing new weighting factors, as well as EPA's own estimates of organ-specific risk factors, and we will propose changes in the weighting factors as soon as it appears necessary and reasonable to do so. At that time, we will also publish revised versions of this report and of Federal Guidance Report No. 11.

The tables in this report are also available as computer files so that they may be more easily used in programs for assessing dose. We are simultaneously making the tables for internal exposure contained in Federal Guidance Report No. 11 available in the same format. Instructions for obtaining both of these sets of computer files may be found at the back of this report.

We gratefully acknowledge the work of the authors, Keith F. Eckerman and Jeffrey C. Ryman, without whose outstanding contributions over the past several decades tables such as these would not exist. This project was made possible through joint funding from three Federal agencies: the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency. We appreciate the consistent support of the DOE and NRC project officers, C. Welty and N. Varma, and S. Yaniv and R. Meck, respectively, throughout the lengthy term of this work. We also are indebted to H. Beck, S. Y. Chen, C. M. Eisenhauer, P. Jacob, G. D. Kerr, D. C. Kocher, and C. B. Nelson for their technical reviews. The report has been clarified and strengthened through their efforts. We would appreciate being informed of any errors or suggestions for improvements so that these may be taken into account in future editions. Comments should be addressed to Allan C. B. Richardson, Deputy Director for Federal Guidance, Criteria and Standards Division (6602J), U. S. Environmental Protection Agency, Washington, DC 20460.

Margo T. Oge, Director
Office of Radiation and Indoor Air

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I. INTRODUCTION

This report tabulates dose coefficients for external exposure to photons and electrons emitted by radionuclides distributed in air, water, and soil. It is intended to be a companion to Federal Guidance Report No. 11 (Eckerman et al., 1988), which tabulated dose coefficients for the committed dose equivalent to tissues of the body per unit activity of inhaled or ingested radionuclides. The dose coefficients for exposure to external radiation presented here are intended for the use of Federal agencies in calculating the dose equivalent to organs and tissues of the body, as were those in Federal Guidance Report No. 11. Note that the dose coefficients for air submersion in this report update those given in Federal Guidance Report No. 11.

These dose coefficients are based on previously developed dosimetric methodologies, but include the results of new calculations of the energy and angular distributions of the radiations incident upon the body and the transport of these radiations within the body. Particular effort was devoted to expanding the information available for the assessment of the radiation dose from radionuclides distributed on or below the surface of the ground. Details of the underlying calculations and of changes from previous work are presented in Section II and in the appendices.

Dose coefficients for external exposure relate the doses to organs and tissues of the body to the concentrations of radionuclides in environmental media. Since the radiations arise outside the body, this is referred to as external exposure. This situation is in contrast to the intake of radionuclides by inhalation or ingestion, where the radiations are emitted inside the body. In either circumstance, the dosimetric quantities of interest are the radiation doses received by the more radiosensitive organs and tissues of the body. For external exposures, the kinds of radiation of concern are those sufficiently penetrating to traverse the overlying tissues of the body and deposit ionizing energy in radiosensitive organs and tissues. Penetrating radiations are limited to photons, including bremsstrahlung, and electrons. The radiation dose depends strongly on the temporal and spatial distribution of the radionuclide to which a human is exposed. The modes considered here for external exposure are:

- submersion in a contaminated atmospheric cloud, i.e., air submersion,
- immersion in contaminated water, i.e., water immersion, and
- exposure to contamination on or in the ground, i.e., ground exposure.

Estimation of the dose to tissues of the body from radiations emitted by an arbitrary distribution of a radionuclide in an environmental medium is an extremely difficult computational task. Therefore, it has become common practice to consider simplified and idealized exposure geometries; i.e., the radionuclide concentration in the medium, seen from the location of an exposed individual, is uniform and effectively infinite or semi-infinite in extent. In particular, a semi-infinite source region is assumed for submersion in contaminated air (Poston and Snyder, 1974) and an infinite source region is assumed for immersion in contaminated water and exposures to contaminated soil (Kocher, 1981). Even for simplified geometries, calculation of the energy and angular distributions of radiations incident on the body and the transport of radiation within the body is a demanding computational problem.

If one assumes an infinite or semi-infinite source region with a uniform concentration *C(t)* of a radionuclide at time *t*, then the dose equivalent in tissue *T*, H_T, can be expressed as

$$H_T = h_T \int C(t)\, dt \quad , \tag{1}$$

where h_T denotes the time-independent dose coefficient for external exposure. The coefficient h_T represents the dose to tissue *T* of the body per unit time-integrated exposure, expressed in terms of the *time-integrated concentration of the radionuclide*; that is, h_T is defined as

$$h_T \equiv \frac{H_T}{\int C(t)\, dt} \quad . \tag{2}$$

An alternative interpretation considers h_T to represent the instantaneous dose rate in organ *T* per unit activity concentration of the radionuclide in the environment. In most applications, the dose H_T, not the instantaneous dose rate, is the quantity of interest, and thus the time integral of the concentration must be evaluated. Note that limits of integration have not been specified in Eqs. (1) and (2) since they depend upon the nature of the dose quantity H_T. For example, if H_T is to represent the dose associated with a single year of exposure then the integration in Eq. (1) would range from t_0 to $t_0 + 1$ years, where t_0 is the year of interest. However, if it were to represent the dose associated with a particular practice, e.g., annual emissions from a facility, then the integral might range over many years as the emitted radionuclide persists in the environment. Depending on the nature of the application it may be advantageous to view the numerical value of the coefficient h_T as either the instantaneous dose rate per unit concentration or as the dose per unit time-integrated concentration. In this report we follow the latter presentation.

The dose coefficient h_T for a specific radionuclide is uniquely determined by the type, intensity, and energy of the emitted radiations, the mode of exposure, and the anatomical variables that govern the energy deposition in organ or tissue *T*. The dose coefficient incorporates the transport of emitted radiations in the environment, their subsequent transport in the body, and estimation of the deposition of ionizing energy in the tissues of the body. Calculations of dose coefficients, as performed for this report, involve three major steps:

(1) computation of the energy and angular distributions of the radiations incident on the body for a range of initial energies of monoenergetic sources distributed in environmental media of interest;

(2) evaluation of the transport and energy deposition in organs and tissues of the body of the incident radiations, characterized above in terms of their energy and angular distributions, for each of the initial energies considered; and

(3) calculation of the organ or tissue dose for specific radionuclides, considering the energies and intensities of the radiations emitted during nuclear transformations of those nuclides.

The result of the first two steps is a set of dose coefficients for monoenergetic sources of photon or electron radiations. The last step simply scales these coefficients to the emissions of the radionuclides of interest.

A number of reports have tabulated dose coefficients for external irradiation of the body from radionuclides distributed in the environment (Poston and Snyder, 1974; Dillman, 1974; O'Brien and Sanna, 1978; Koblinger and Nagy, 1985; Jacob et al., 1986, 1988a, 1988b; Kocher, 1981, 1983; DOE, 1988; Saito et al., 1990; Chen, 1991; Petoussi et al., 1991). Because of limitations in computational methods or available information, some of these efforts have used oversimplified assumptions regarding the exposure conditions. For example, the radiations incident upon the body have often been assumed to be uniformly distributed in angle (an isotropic field) or to be incident perpendicular to the body surface while the body is uniformly rotated about its vertical axis (a rotational exposure). Variations in the intensity of the radiations with height above the ground frequently have been ignored in assessing the dose from radionuclides on or below the ground surface. In addition, bremsstrahlung has generally been ignored, despite the fact that for many radionuclides (e.g., pure beta emitters), it is the only source of radiation sufficiently penetrating in nature to result in a dose to underlying tissues of the body. In this report, we have attempted to address each of these aspects of the problem without the use of simplifying assumptions that would significantly alter the results.

The report is organized as follows. Section II describes the calculation of the dose coefficients. It also compares our results for monoenergetic photon sources to those of other researchers. Tabulations of coefficients for the extensive list of 825 radionuclides contained in Publication 38 of the International Commission on Radiological Protection (ICRP, 1983) are presented in Section III for each of the three exposure pathways. Section IV addresses some practical issues regarding application of the numerical data presented in Section III.

Further details of the computational methods are discussed in the appendices. Appendix A contains information on the radionuclides considered in this work that is needed for proper application of the dose coefficients. Of particular note is the information required to evaluate radioactive decay chains. Appendix B gives details of modifications to the adult anatomical model (Cristy and Eckerman, 1987) used in these calculations. The evaluation of bremsstrahlung yield from distributed beta emitters is discussed in Appendix C. Appendix D provides some sample calculations illustrating the application of external dose coefficients.

II. CALCULATIONAL METHODS

Photons and electrons are the most important radiations emitted by radionuclides distributed in the environment that can penetrate the body from outside to deposit ionizing energy within its radiosensitive tissues. This section presents the methods used to calculate the dose coefficients for external exposure to photons and electrons for submersion in contaminated air, immersion in contaminated water, and exposure to contaminated ground surfaces and volumes.

Some radionuclides produce bremsstrahlung that is sufficiently penetrating to be of potential importance in the estimation of external dose. In this work, the contribution from bremsstrahlung has been evaluated for all the exposure modes, as discussed in Appendix C. In rather unusual circumstances, spontaneous fission might also produce penetrating radiations of potential importance. This process has not been taken into account in calculating the dose coefficients presented in this report, although the data of Appendix A indicate the frequency of spontaneous fission.

Dosimetric quantities

The dose quantities addressed in this report are those used in radiation protection, namely the dose equivalent in various tissue and organs of the body and the effective dose equivalent as defined by the ICRP (1977) and adopted in 1987 for use in regulating occupational exposure in the United States (EPA, 1987). Since only penetrating radiations of low linear energy transfer (LET) are able to contribute to the dose to organs and tissues of the body, the dose equivalent and absorbed dose quantities in a tissue are numerically equal. That is, the radiation quality factor is unity for the radiations of concern here. The ICRP, in its 1990 radiation protection recommendations (ICRP, 1991), adopted a new dosimetric quantity[1], the effective dose, designated by E. Both the effective dose and the effective dose equivalent

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[1]In its 1990 recommendations the ICRP introduced less cumbersome names for the dosimetric quantities of radiation protection. The terms dose equivalent and effective dose equivalent were replaced by equivalent dose and effective dose, respectively. Strictly speaking, the newer quantities involve some differences from the earlier quantities in their definitions; for the most part, these details are not of concern here.

quantities are weighted sums of the doses to radiosensitive tissues of the body. The effective dose equivalent H_E, and the effective dose E, are defined as:

$$H_E = \sum_T w_T H_T \quad , \tag{3a}$$

and

$$E = \sum_T w_T^{/} H_T \quad , \tag{3b}$$

where H_T is the mean dose equivalent to organ or tissue T, the w_T are a specific set of weighting factors, and the $w_T^{/}$ are a set of weighting factors not specified as part of the definition of E, and can take any assigned values. Thus, the effective dose equivalent can be interpreted as a particular example of the effective dose. Values for w_T and the current recommendations of the ICRP for $w_T^{/}$ are shown in Table II.1. The factors w_T and $w_T^{/}$ correspond to the fractional contribution of organ or tissue T to the total risk of stochastic health effects when the entire body is uniformly irradiated. As seen in Table II.1, the weighting factors currently recommended by the ICRP to compute the effective dose explicitly consider a greater number of organs and tissues of the body. In addition the two sets of weighting factors differ in the manner that the dose to tissues not explicitly identified (the remainder) is evaluated. Of a more fundamental nature, it should be noted that the measures of health detriment used to derive the two sets of weighting factors are different. The weighting factors for the effective dose equivalent characterize the health detriment in terms of the risk of fatal cancers and hereditary defects in the first two generations. In the case of the currently recommended factors for effective dose, the health detriment is characterized by a weighting of the risks for both fatal and nonfatal cancers, the risk of hereditary defects over all future generations, and the relative loss of life expectancy, given a fatal cancer or a severe genetic disorder.

Since no decision has been made, at the time of this report, on changes in weighting factors for use in the United States, the tabulations by radionuclide of the dose coefficients in this report are based on the weighting factors specified for the effective dose equivalent quantity, the quantity used in Federal Guidance Report No. 11 (Eckerman et al., 1988). However, the effective dose, computed with the weighting factors currently recommended by the ICRP, is included in many of the preliminary tabulations and discussions. The results indicate that for many radionuclides of practical significance, for the exposure geometries considered here, the differences are small - on the order of a few percent. However, in some cases the differences can be large, so that specification of the w_T is an important consideration.

Zankl et al. (1992) have also investigated these differences for various external irradiation geometries and a few key radionuclides and reach similar conclusions.

The coefficient relating the dose equivalent H_T in organ or tissue T to the time integral of the nuclide's concentration in the environment is denoted by h_T. The notation and tabulation of the dose coefficients presented in this report follow the conventions and format of Federal Guidance Report No. 11. The radionuclide tabulations include the coefficients for the gonads, breast, lung, red marrow, bone surface, thyroid, and remainder, followed by that for the effective dose equivalent. The coefficient for the remainder group is the average of the doses to each of the five tissues comprising the remainder and thus w_T = 0.3 is applied to this numerical value to compute the effective dose equivalent. Although skin is excluded from the effective dose equivalent, we have included it in the tabulations since it frequently is the most highly irradiated tissue for external exposure.

Table II.1. Tissue Weighting Factors According to ICRP (1977, 1991).

Organ/Tissue	Weighting Factors	
	w_T (ICRP 26)	$w_T^{/}$ (ICRP 60)
Gonads	0.25	0.20
Breast	0.15	0.05
Colon		0.12
Red Marrow	0.12	0.12
Lungs	0.12	0.12
Stomach		0.12
Urinary Bladder		0.05
Liver		0.05
Esophagus		0.05
Thyroid	0.03	0.05
Bone Surface	0.03	0.01
Skin		0.01
Remainder	0.30[1]	0.05[2,3]

[1] The value 0.30 is applied to the average dose among the five remaining organs or tissues receiving the highest dose, excluding the skin, lens of the eye, and the extremities.

[2] The remainder is composed of the following tissues and organs: adrenals, brain, small intestine, upper large intestine, kidney, muscle, pancreas, spleen, thymus, and uterus.

[3] The value 0.05 is applied to the average dose to the remainder tissue group. However, if a member of the remainder receives a dose in excess of the highest dose in any of the twelve organs for which weighting factors are specified, a weighting factor of 0.025 is applied to that organ and a weighting factor of 0.025 is applied to the average dose in the rest of the remainder.

Organ doses from monoenergetic environmental photon sources

The calculation of organ doses from irradiation of the human body by photon emitters distributed in the environment requires the solution of a complex radiation transport problem. It is impractical to solve this problem for the precise spectrum of photons emitted by each radionuclide of interest. Therefore, organ doses were computed for monoenergetic photon sources at twelve energies from 0.01 to 5.0 MeV. The results of these calculations were then used to derive the dose coefficients in Tables III.1 through III.7, taking into account the detailed photon spectrum of each radionuclide. The following pages describe the methods used to compute organ dose coefficients for those monoenergetic sources.

Previous estimates of submersion dose (Poston and Snyder, 1974; O'Brien and Sanna, 1978; Eckerman et al., 1980; Kocher, 1981, 1983; DOE, 1988) were based on Monte Carlo calculations with (1) poor statistics for some organ doses (due to the limitations of early computer systems) or (2) minor errors in sampling the radiation field. It should be noted that Saito et al. (1990) have recently published a compilation of organ doses due to air submersion based on modern Monte Carlo methods that appears to overcome these limitations.

The seminal work of Beck and de Planque (1968) on dose due to contaminated soil, while accurately reflecting the radiation field, was limited to calculation of air dose for energies between 0.25 and 2.25 MeV, although the data were later used to generate a tabulation of air exposure rates for a number of nuclides (Beck, 1980). The next generation of calculations (Kocher, 1981, 1983; DOE, 1988; Kocher and Sjoreen, 1985) produced useful dose estimates for many nuclides, but was limited by simplifying assumptions regarding the energy and angular dependence of the radiation field (assumed to be equivalent to that for submersion) and the use of the point kernel method for characterizing the field strength. More recent efforts (Williams et al., 1985; Koblinger and Nagy, 1985; Jacob et al., 1986, 1988a, 1988b; Saito et al., 1990; Petoussi et al., 1991) have used relatively sophisticated methods for analyzing the energy, angular, and spatial dependence of the radiation field and computing organ doses for both mathematical and CT-derived phantoms of various ages. These data are primarily for plane sources at or near the air-ground interface, or for naturally-occurring radionuclides distributed to effectively infinite depth in the soil. The calculations of Chen (1991) include volume sources of many thicknesses as well as plane sources at the interface, but are only for effective dose equivalent based upon rotational normal beam exposure (ICRP, 1987).

The computational methods used in this work were chosen to give an accurate characterization of the energy and angular dependence of the radiation field incident on the body, since dose to the body is very sensitive to the direction of incident radiation, and also to overcome other limitations of earlier calculations. Organ doses were computed for 25 organs in an adult hermaphrodite phantom (Cristy and Eckerman, 1987). The mathematical phantom was modified, as described in Appendix B, to include the esophagus, a tissue given an explicit weighting factor in the current effective dose formulation of the ICRP (1991), and to improve the modeling of the neck and thyroid.

General description of the calculations

Estimating organ dose in a human phantom exposed to radiation from an external source consists of calculating an effect of interest in a geometrically complex object located in an otherwise geometrically simple (one- or two-dimensional) system. This process is mathematically described by the time-independent neutral-particle Boltzmann transport equation:

$$\begin{aligned}&\bar{\nabla}\cdot\bar{\Omega}\Phi(\bar{r},E,\bar{\Omega}) + \mu(\bar{r},E)\,\Phi(\bar{r},E,\bar{\Omega}) = \\ &\int dE'\int d\bar{\Omega}'\,\mu_s(\bar{r},E'\rightarrow E,\bar{\Omega}'\rightarrow\bar{\Omega})\,\Phi(\bar{r},E',\bar{\Omega}') + S(\bar{r},E,\bar{\Omega}) \quad ,\end{aligned} \tag{4}$$

where

$\Phi(\bar{r},E,\bar{\Omega})\,dE\,d\bar{\Omega}$	=	angular fluence at position $\bar{r}$ with energy in dE about E and direction in solid angle $d\bar{\Omega}$ about direction $\bar{\Omega}$;
$\mu(\bar{r},E)$	=	linear attenuation coefficient at position $\bar{r}$, and energy E;
$\mu_s(\bar{r},E'\rightarrow E,\bar{\Omega}'\rightarrow\bar{\Omega})\,dE\,d\bar{\Omega}$	=	the probability per unit path length that a particle with initial energy E' and direction $\bar{\Omega}'$ will undergo a scattering collision at point $\bar{r}$ and emerge with energy in dE about E and in $d\bar{\Omega}$ about $\bar{\Omega}$; and
$S(\bar{r},E,\bar{\Omega})\,dE\,d\bar{\Omega}$	=	number of source particles emitted at position $\bar{r}$ with energy in dE about E and direction in $d\bar{\Omega}$ about $\bar{\Omega}$.

Equation (4) is conveniently written in operator notation as

$$\hat{H}\,\Phi(\bar{p}) = S(\bar{p}) \quad , \tag{5}$$

where $\bar{p}$ represents position, energy, and direction phase space.

After the solution to Eq. (4) is obtained, the organ dose is computed from the following integral:

$$H_T = \int_{\bar{p}_T} \Phi(\bar{p})\,R(\bar{p})\,d\bar{p} \quad , \tag{6}$$

where

H_T = the effect of interest, i.e.,the organ dose;
$\bar{p}_T$ = phase space of tissue or organ T; and
$R(\bar{p})$ = the response function, i.e., the contribution to H_T due to unit angular fluence.

In principle, Eqs. (5) and (6) can be solved directly using Monte Carlo methods. However, this direct approach involves a combination of deep penetration (i.e., transport through many mean free paths of air and/or soil) and complex geometry (the human phantom). Calculations of this type require the use of sophisticated variance reduction techniques to overcome the inherent statistical nature of the Monte Carlo method. Often, the important regions of phase space are undersampled, and the effect of interest is underestimated (Armstrong and Stevens, 1969). To avoid the difficulties associated with a direct Monte Carlo solution, the solution is broken into two steps, using an important property of the transport equation.

In a problem involving distributed radiation sources and an effect on a target (the organ dose), a model using a closed surface surrounding the target can be postulated to estimate the effect (a closed surface surrounding the sources is equivalent). One can also consider a second model in which the target and its surrounding medium are the same, but on the other side of the closed surface is a vacuum or a perfect absorber. In the second model, an area source is constructed on the closed surface such that the strength per unit area in each direction and at each energy, $S_A(\bar{r}_s,\bar{\Omega},E)$, at each point $\bar{r}_s$ on the surface is equal to the flow rate $j_n(\bar{r}_s,\bar{\Omega},E)$ at the corresponding point in the first problem. It is possible to show rigorously (Chilton et al., 1984) that the effect on the target (organ dose in this application) is the same for both problems. Therefore, the sources for the first model may be replaced by the flow rate they create at the closed surface bounding the second model.

The problem of computing organ dose from environmental photon sources may thus be broken into two independent steps: (1) the calculation of the radiation field incident on a closed surface surrounding the human phantom model, and (2) the calculation of organ dose due to a surface source equivalent to the angular flow rate entering the boundary surrounding the phantom. To eliminate the geometric complexity of the human phantom from the calculation of the incident radiation field, the phantom must be removed from the problem. This may be done if the presence of the phantom in the original problem does not significantly perturb the incoming angular flow rate across the boundary surrounding the phantom. The phantom can affect the incoming directions of the radiation field only for those photons which, having interacted in the phantom, pass out of the surrounding surface, scatter in the surrounding media, and return across the boundary. This should be, at most, a second-order effect. Saito et al. (1990) have demonstrated that this perturbation is, as expected, not significant.

For the environmental photon sources considered in this report, the calculation of organ dose was broken into two independent calculations, as described above. The calculation of the radiation field due to a unit source strength was performed by methods appropriate to the kind of source, as described later. Then, an equivalent source was constructed on a cylindrical surface surrounding the phantom, and the organ doses resulting from this source were computed for all cases by the Monte Carlo method, also described later. The two steps of the calculation are illustrated in Figs. II.1 and II.2 for the case of a contaminated soil source (an isotropic plane source at depth d_S).

Description of the environmental sources

The source for the submersion dose calculations is a semi-infinite cloud containing a uniformly-distributed monoenergetic photon emitter of unit strength (1 Bq m^{-3}) surrounding a human phantom standing on the soil at the air-ground interface. The air composition, given in Table II.2, is for conditions of 40% relative humidity, a pressure of 760 mm Hg, a temperature of 20 °C, and a density of 1.2 kg m^{-3}. The dose coefficients for submersion can be readily scaled to account for a different air density.

Table II.2. Air Composition

Element	Mass Fraction
H	0.00064
C	0.00014
N	0.75086
O	0.23555
Ar	0.01281
Total	1.00000

The source for the contaminated soil calculations is an infinite isotropic plane source of monoenergetic photons of unit strength (1 Bq m^{-2}), located at the air-ground interface or at a specified depth in the soil. Again, a human phantom is standing on the soil at the air-ground interface. As noted later, the organ dose due to a source in the soil that is uniformly distributed from the surface to a specified depth may be readily computed from the doses due to a series of plane sources at different depths. The air composition is the same as for the submersion dose calculations (see Table II.2). The assumed soil composition is given in Table II.3, and is that for a typical silty soil (Jacob et al., 1986) containing 30% water and 20% air by volume. The soil density was taken to be 1.6×10^3 kg m^{-3}. It should be noted that the radiation field above the air-ground interface can, in some circumstances, be scaled to account for differences in soil

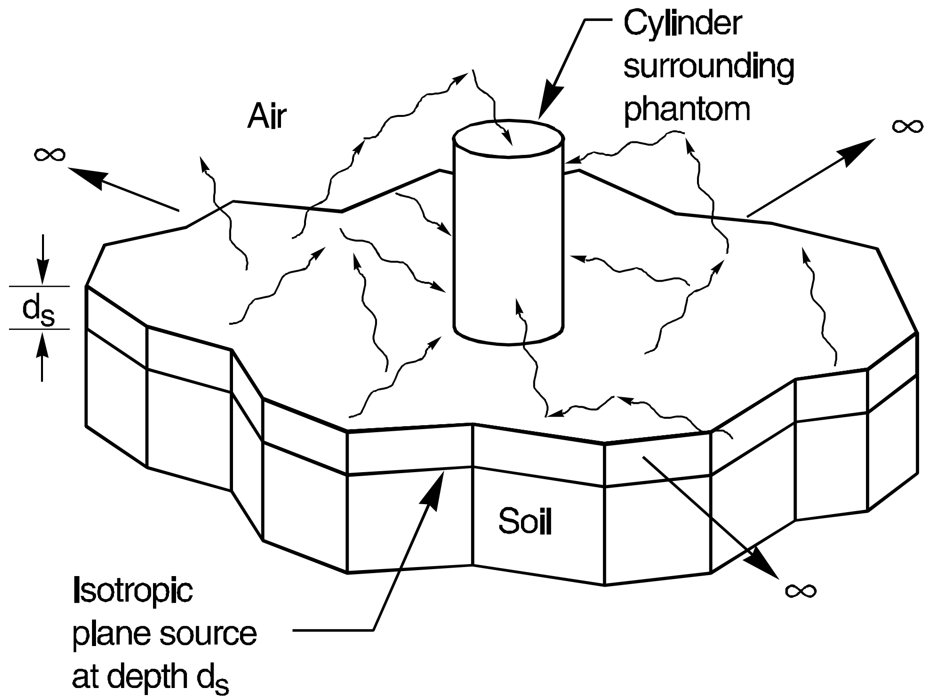

Fig. II.1. Calculation of radiation field due to a contaminated ground plane, on a cylinder surrounding the phantom location.

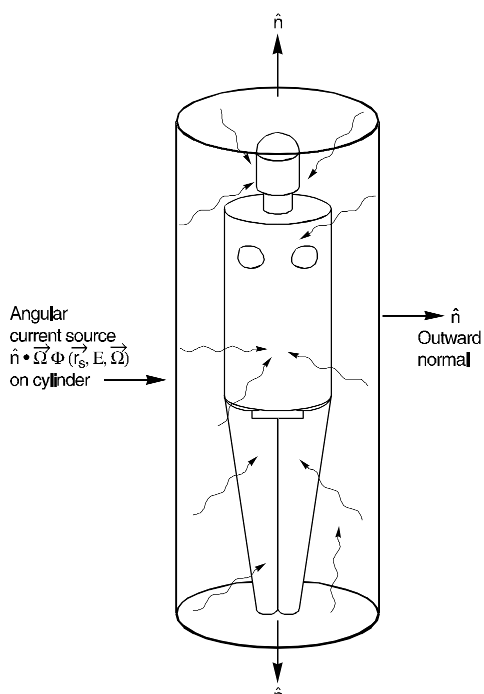

Fig. II.2. Calculation of organ dose from an angular current source on the cylinder surrounding the phantom.

density (Beck and de Planque, 1968; Chen, 1991). While the radiation field above the air-ground interface is relatively insensitive to soil composition for a plane surface source (Beck and de Planque, 1968), this is not true for distributed sources within the soil, as we later show.

Table II.3. Soil Composition

Element	Mass Fraction
H	0.021
C	0.016
O	0.577
Al	0.050
Si	0.271
K	0.013
Ca	0.041
Fe	0.011
Total	1.000

The source for the water immersion calculations is an infinite pool of water containing a uniformly-distributed monoenergetic photon emitter of unit strength (1 Bq m^{-3}). A human phantom is assumed to be completely immersed in the pool. The water density is 1.0×10^3 kg m^{-3} and the composition by mass fraction is 0.112 for H and 0.888 for O; i.e., pure water.

The radiation field from a semi-infinite cloud source

The dose near the air-ground interface from a semi-infinite cloud source has been taken to be one-half that due to an infinite cloud source, following the practice of Dillman (1974), Poston and Snyder (1974), and Kocher (1981, 1983). This has been shown (Ryman et al., 1981) to be a good approximation for air dose (within 20%) at energies of 20 keV or greater. At energies below 10 keV (the lowest energy considered here), the dose at the interface should still be one-half that due to an infinite source, but there will be an increase in dose with increasing height along the phantom. The mean free path of these photons is so short that the upper portions of the phantom are effectively exposed to an infinite source. Between 10 and 20 keV, there will be some increase in dose with increasing height, but since the increase over the dimensions of the body should be fairly small, it has not been considered here.

Given this approximation, the radiation field may be computed as that due to an infinite cloud source of a monoenergetic photon emitter. In this case, the transport equation (4) loses its dependence on spatial position and angle, and may be written, for scattered photons, as (Dillman, 1970, 1974)

$$f(E') = \mu(E')\,\phi^s(E') = K(E',E_0) + \int_{E'}^{E_0} f(E)\,K(E',E)\,dE \quad , \tag{7}$$

where

$\mu(E')$	=	the linear attenuation coefficient of air at energy E';
$f(E')dE'$	=	the number of photons per initial photon with energy in dE' about E'; and
$K(E',E_0)$	=	the probability per unit energy that a photon of initial energy E_0 will scatter and give rise to a photon of energy E'.

The scattered photon fluence is just

$$\phi^s(E) = \frac{S_V \times f(E)}{\mu(E)} \quad , \tag{8}$$

where S_V is the source strength per unit volume. The uncollided fluence is easily shown to be

$$\phi^u(E_0) = \frac{S_V}{\mu(E_0)} \quad . \tag{9}$$

An updated version of the PHOFLUX computer program, developed by Dillman (1974) to solve this Volterra-type integral equation, was used to compute the energy spectrum of scattered photons in an infinite cloud source as well as the intensity of uncollided photons. Photoelectric and pair production cross section data were taken from ENDF/B-V (Roussin et al., 1983). Klein-Nishina scattering cross sections were computed analytically. The resulting energy spectrum from a 100 keV source is shown in Fig. II.3. The discontinuity seen in the figure occurs at the minimum possible energy to which an initial photon may scatter. The slight bump corresponds to the minimum possible energy for a twice-scattered initial photon.

The radiation field from an infinite water source

In this case, no approximation to the source is necessary, and Eq. (7) above is directly applicable. The PHOFLUX program with ENDF/B-V cross sections was also used here to compute the energy spectrum of photons in an infinite water source. The resulting energy spectrum from a 100 keV source is presented in Fig. II.4.

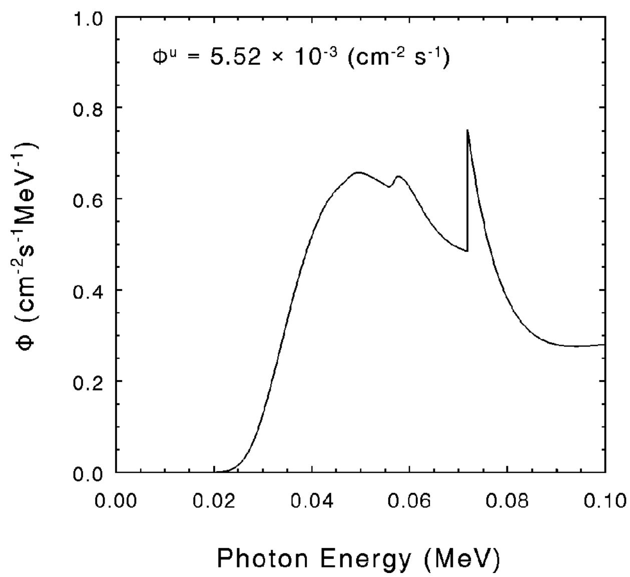

Fig. II.3. Energy spectrum of scattered photons for submersion in a 1 Bq m^{-3} 100 keV contaminated air source. ϕ^u is the uncollided flux density.

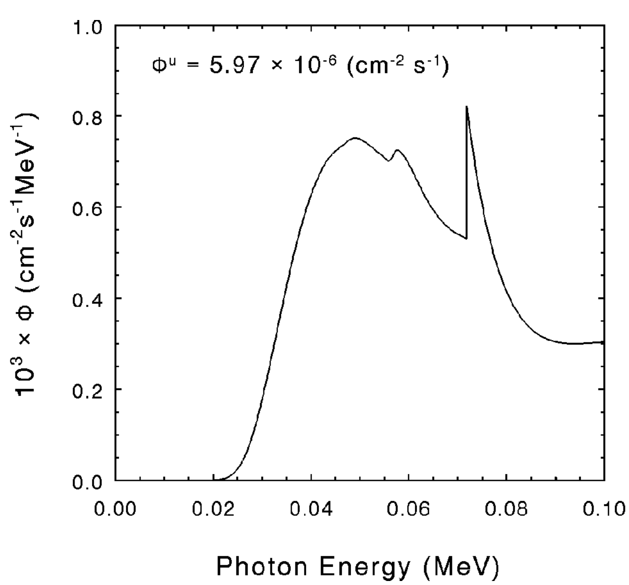

Fig. II.4. Energy spectrum of scattered photons for immersion in a 1 Bq m^{-3} 100 keV contaminated water source. ϕ^u is the uncollided flux density.

The radiation field from contaminated soil sources

In this case, the solution to the transport equation (4) is a function of only one spatial and one angular variable. It can be seen from Eq. (4) that the transport equation is linear with respect to the source term $S(\bar{r},E,\bar{\Omega})$. Therefore, the fluence $\Phi(\bar{r},E,\bar{\Omega})$ due to an isotropic infinite source uniformly distributed over a finite depth in the soil may be determined by superposition of the fluence for a series of isotropic infinite plane sources in soil.

The radiation field due to isotropic infinite plane sources at twelve energies from 0.01 to 5.0 MeV was computed for source depths of 0, 0.04, 0.2, 1.0, 2.5, and 4.0 mean free paths in soil (specified at the source energy). These depths were chosen to facilitate an accurate integration during the determination of the dose coefficients for sources uniformly distributed over specified depths. The uncollided angular photon fluence was computed analytically. A spatial-, energy-, and angular-dependent first collision source was generated from the uncollided angular fluence and the cross sections for scattering from the source energy into a series of energy groups. The scattered photon fluence due to the first-collision source was computed using the one-dimensional multigroup discrete ordinates method (Bell and Glasstone, 1970). Seventy energy groups between 5.3 and 0.00865 MeV were used. The group boundaries were selected to satisfy two criteria: (1) a relatively narrow group was present about each source energy of interest, and (2) photons scattering from any group could scatter to at least two other groups. A subset of the 70 groups was used for each source energy. The highest energy group was just that group containing the source, and the lowest group was that containing the low-energy cutoff, determined by λ_s + 14, where λ_s is the Compton wavelength (electron rest mass energy divided by photon energy) at the source energy. Since, by conservation of energy and momentum, the maximum change in Compton wavelength is 2 for a single scatter, a low-energy cutoff corresponding to λ_s + 14 ensures that a minimum of seven scatters is considered. Beck and de Planque (1968) state that a low-energy cutoff of λ_s + 13.2 included over 99% of the energy deposited in their air-dose calculations, except for the combination of very high source energies and very large interface-to-detector distances, which is not of interest here. The only exception to our use of the low-energy cutoff was for the 10 keV sources, in which case only 6 groups were used. At this energy, most photons are immediately absorbed, due to the high photoelectric cross section, and the scattered photon fluence decreases quite rapidly with decreasing energy.

In all calculations, the thickness of the air medium was three mean free paths (at the source energy). Photons scattered in the atmosphere at a height greater than three mean free paths must have traveled a minimum of six mean free paths from the source plane to reach the phantom location, and therefore cannot make a significant contribution to organ dose. For the plane sources at depths of 0, 0.04, 0.2, and 1.0 mean free paths, the thickness of the soil medium was taken as three mean free paths (at the source energy). For the sources at depths of 2.5 and 4 mean free paths, the soil thicknesses were taken as 3.5 and 5 mean free paths, respectively. As in the case of air, photons scattered at depths beyond the lower soil boundary would have to travel a minimum of six mean free paths from the source plane to reach the phantom location, and thus make no significant contribution to organ dose.

In transport problems involving an isotropic plane source, the angular fluence has a singularity at the source plane for directions parallel to the plane (Fano et al., 1959) which cannot be accommodated by the discrete ordinates formulation used here, and which can also cause problems when the Monte Carlo method is used. To avoid the numerical problems associated with the singularity, the uncollided angular fluence is computed analytically. Then, a first-collision source; i.e., a distributed source based on the spatial, energy, and angular distribution of photons produced by the first collision of source photons, is calculated from the analytic uncollided angular fluence. In photon transport, a collision which leads to secondary photons can include pair production as well as Compton scatter. The first-collision source, averaged over the spatial mesh cells of the discrete ordinates formulation, is taken to be the source term in the transport equation, which is solved for the angular fluence of scattered photons. Cell-averaged angular first-collision sources have no singularities, even in cells adjacent to the source plane. It should also be noted that the scattered angular fluence has a singular component at the source plane, and, at short distances from the source, will have components of large magnitude in directions nearly parallel to the plane. It has been demonstrated (Ryman, 1979) that discrete ordinates calculations for the scattered fluence due to a first-collision source must use an angular mesh which has several directions nearly parallel to the source plane. Failure to do so will give rise to scalar fluences that are depressed or enhanced in a physically unrealistic manner in regions near the source. It is also well known (Bell and Glasstone, 1970) that for plane geometries, the fluence near an interface is better represented when the angular quadrature directions are chosen from a double-P_N Gauss quadrature set. Therefore, a DP_{15} quadrature set with 32 directions was selected for these calculations.

A discrete ordinates solution of the transport equation in which the cross sections are represented by truncated Legendre polynomial expansions can give rise to physically unrealistic negative angular fluences, due to the negative oscillations in the cross section expansions. This problem is worse for highly anisotropic sources, narrow energy groups, and highly anisotropic scatter, e.g., Compton scatter of photons. Several studies have demonstrated (Odom and Shultis, 1976; Mikols and Shultis, 1977; Ryman, 1979) that this problem may be eliminated by the use of the exact-kernel cross section representation, i.e., use of a discrete scattering matrix rather than a polynomial representation. In this work, a one-dimensional multigroup discrete ordinates code (KSLAB1), developed by one of the authors (Ryman, 1979), which uses the exact-kernel representation of group-to-group transfer cross sections, was used to perform the radiation field calculations. The group-to-group transfer cross sections, which included Compton (Klein-Nishina) scattering and the production of annihilation radiation, when appropriate, were generated from the data of Biggs and Lighthill (1968, 1971, 1972a, 1972b). The spatial mesh in the air and the soil was tailored to each problem to ensure that (1) negative angular fluences were not generated as a result of a too-coarse mesh spacing, and (2) the angular fluence had converged with respect to mesh size.

The accuracy of the solutions was checked by comparing the energy and angular dependence of the air kerma (i.e., *dose to air*) 1 m above a 1.25 MeV plane source at the air-ground interface with the calculations of Beck and de Planque (1968) and with the calculations and measurements given in the Shielding Benchmark Problems report (Garrett, 1968). Excellent agreement was found in both cases.

The angular dependence of the air kerma one meter above the air-ground interface is shown in Figs. II.5 through II.8 for 100 keV sources at various depths. The ninety-degree angle corresponds to radiation incident from the horizon. In these figures, one should note the relative importance of the scattered and unscattered components of the kerma and the changes in the angular distributions with increasing depth.

Organ dose from an isotropic field

The radiation fields for the submersion and water immersion sources are isotropic, neglecting the small effect on the incoming angular current caused by the presence of the phantom. The organ dose due to an isotropic field was computed using the continuous energy Monte Carlo photon transport code ALGAMP (Ryman and Eckerman, 1993), which is an updated and combined version of the original ALGAM (Warner and Craig, 1968) and BRHGAM (Warner, 1973) codes incorporating the Cristy phantom series (Cristy and Eckerman, 1987). As described in Appendix B, a modified version of the adult hermaphrodite phantom was used for this work. Organ doses in ALGAMP are estimated by scoring energy deposition in all organs except skeletal tissues. A collision-density fluence estimator for the skeleton is combined with fluence-to-dose conversion factors for active marrow and bone surface (Eckerman, 1984; Eckerman and Cristy, 1984; Kerr and Eckerman, 1985, 1987) to estimate doses for those organs.

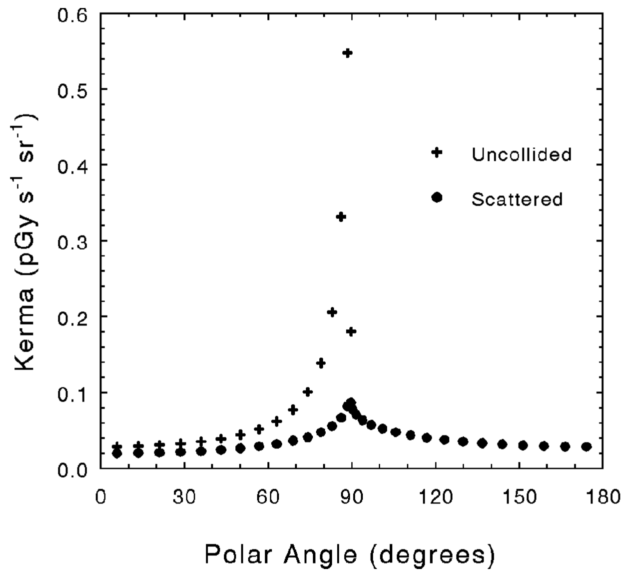

Fig. II.5. Angular dependence of air kerma for a 1 Bq m^{-3} 100 keV isotropic plane surface source.

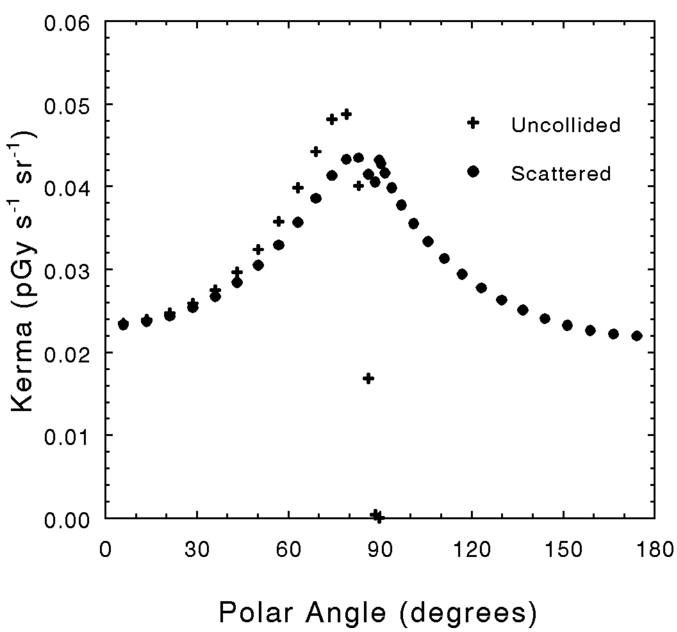

Fig. II.6. Angular dependence of air kerma for a 1 Bq m^{-3} 100 keV isotropic plane source 0.2 mean free paths deep.

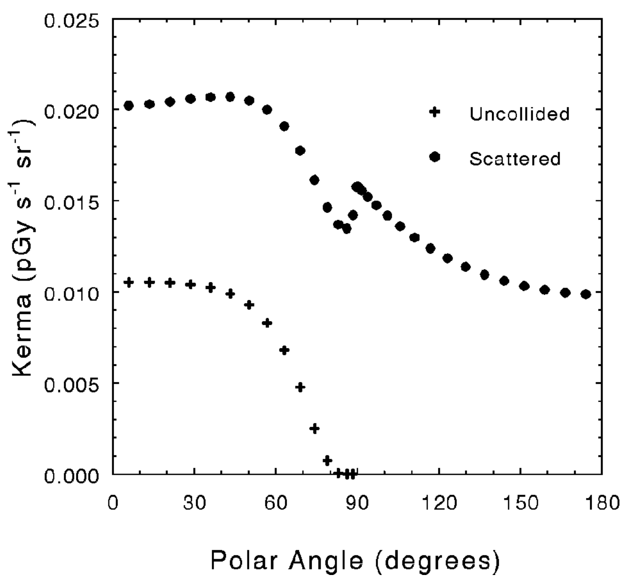

Fig. II.7. Angular dependence of air kerma for a 1 Bq m^{-3} 100 keV isotropic plane source 1 mean free path deep.

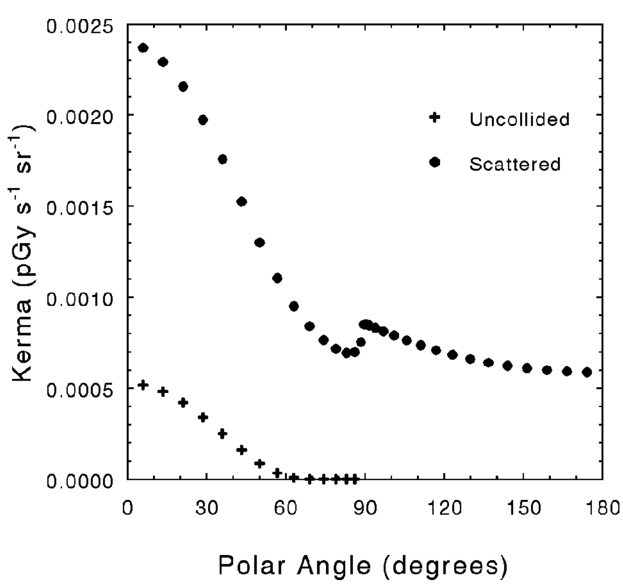

Fig. II.8. Angular dependence of air kerma for a 1 Bq m^{-3} 100 keV isotropic plane source 4 mean free paths deep.

Calculations were performed for twelve monoenergetic sources ranging from 0.01 to 5.0 MeV. These were carried out using a cosine current source, which corresponds to an isotropic fluence, sampled uniformly on the curved and end surfaces of a cylinder surrounding the phantom. Ten million histories were sampled for each calculation. The organ doses from the monoenergetic sources incident on the phantom were folded with the spectra generated by the PHOFLUX code for the air submersion and water immersion sources and normalized to unit source strength to produce the final organ dose coefficients for monoenergetic sources in contaminated air and water, presented in Tables II.4 and II.5. The coefficients include those for effective dose equivalent (h_E), effective dose (e) using the ICRP 60 weighting factors, and air kerma (k_{AIR}) or water kerma (k_{WATER}). Note that air kerma and water kerma are doses to air and water, not to tissue free in air or water. Since the dose coefficients are inversely proportional to the density of the source medium, scaling to a different density is straightforward.

Organ dose from contaminated soil

The uncollided and scattered angular fluences from an isotropic plane source of radiation were computed as a function of energy, angle, and height above the air-ground interface as described earlier. These fluence data were used to construct an angular current source on a cylinder surrounding the phantom as a function of position, energy, and polar angle. It may be noted that the angular current is given by the relationship $j(\bar{r},E,\bar{\Omega}) = \bar{\Omega}\cdot\hat{n}\,\Phi(\bar{r},E,\bar{\Omega})$ where $\hat{n}$ is the outward-directed normal to the surface. For the top and bottom surfaces of the cylinder, the construction of the angular current source is obvious, since $\bar{\Omega}\cdot\hat{n}$ is just the absolute value of the polar angle used in the discrete ordinates calculations. On the side of the cylinder, $\bar{\Omega}\cdot\hat{n}$ is not an angle used in the calculations. Saito et al. (1990) developed two approximations for the relationship between the angular fluence and the current, but no approximation is necessary. The angular fluence is isotropic with respect to an azimuthal angle about the normal to the source plane, due to the symmetry of the one-dimensional radiation field, so the angular current, as a function of polar angle, can be computed analytically from the angular fluence data.

A calculation of organ doses was performed using ALGAMP (Ryman and Eckerman, 1993) for each of the 72 combinations of source energy and plane source depth, sampling the photon energy, angle, and position from cumulative distribution functions corresponding to the angular current sources described above. As for the calculations for isotropic sources in air and water, ten million histories were generated for each calculation. Since the discrete ordinates calculations were performed for a first-collision source generated by a unit strength plane source, the organ dose coefficients are computed directly by the Monte Carlo calculations; no further normalization is needed. For the 10, 15, and 20 keV sources (primarily at 10 keV), a few of the organ dose coefficients were estimated to be zero, since low-energy photons are not very penetrating, and small organs (e.g., ovaries) are often missed by those few photons which do penetrate the body to that depth. For a few organs, the coefficients of variation were so large that their dose coefficients were judged to be unreliable. The dose coefficients for those organs were also set to zero. However, the procedure described below for integrating organ dose coefficients for plane sources over source depth to obtain dose coefficients for volume sources involves the logarithm of the dose coefficients; therefore, dose coefficients cannot be zero. Even had there been no numerical difficulties, the prudent approach was to assign nonzero values to all dose coefficients. Therefore, in the tabulations for monoenergetic sources, the zero values were replaced by values from a log-log extrapolation as a function of source energy. The dependence of the organ dose coefficients on energy shows this to be a conservative approach. As a practical matter, the values of the dose coefficients obtained by extrapolation are so small, compared to the dose coefficients for the other organs, that they have no observed influence on the coefficients for effective dose equivalent.

The organ dose coefficients for isotropic plane sources at the six source depths were integrated over source depth to compute organ dose coefficients for uniformly distributed volume sources having thicknesses of 1, 5, and 15 cm, and for an effectively infinite source (4 mean free paths thick). If $\hat{h}_{T,P}(E,\tau)$ is the dose coefficient (Sv per Bq s m^{-2}) for tissue T for a plane isotropic source at energy E and depth τ (mean free paths), then the dose coefficient $\hat{h}_{T,L}(E)$ (Sv per Bq-s m^{-3}) for a volumetric source extending from the air-ground interface to depth L (cm) is just

$$\hat{h}_{T,L}(E) = \frac{1}{\mu}\int_0^{\mu L} d\tau \, \hat{h}_{T,P}(E,\tau) \quad , \qquad \textbf{(10)}$$

where μ is the linear attenuation coefficient for soil at energy E. The dose coefficients for each organ $\hat{h}_{T,P}(E,\tau)$ at the six source depths were interpolated on a fine grid using a log-linear Hermite cubic spline (Fritsch and Carlson, 1980). The interpolated data were then numerically integrated. The organ dose coefficients are presented in Tables II.6 through II.11 for plane sources at the six source depths, and in Tables II.12 through II.15 for the four volumetric sources. The coefficients for the plane sources do not need to be scaled for different soil densities, since depths are in mean free paths. Coefficients for a source with finite thickness expressed in cm cannot be scaled. Coefficients for a source with finite thickness expressed in mean free paths are inversely proportional to soil density, as shown by Chen (1991), as are those for an infinitely thick source.

Table II.4. Organ Dose (Gy per Bq s m^{-3}) from a Monoenergetic Semi-infinite Cloud Source

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	2.489E-22	7.606E-20	4.213E-18	1.086E-16	8.128E-16	1.746E-15	3.092E-15	7.205E-15	1.944E-14	4.044E-14	8.798E-14	2.491E-13
B SURFACE	1.034E-18	2.736E-17	1.619E-16	1.159E-15	5.622E-15	9.896E-15	1.432E-14	2.291E-14	4.155E-14	7.265E-14	1.385E-13	3.580E-13
BRAIN	9.062E-24	1.718E-20	3.469E-18	1.502E-16	1.138E-15	2.355E-15	4.060E-15	9.270E-15	2.475E-14	5.229E-14	1.109E-13	2.938E-13
BREASTS	5.061E-18	6.567E-17	2.325E-16	7.726E-16	2.105E-15	3.398E-15	5.188E-15	1.071E-14	2.678E-14	5.502E-14	1.141E-13	2.994E-13
ESOPHAGUS	1.054E-22	2.067E-20	8.300E-19	4.694E-17	6.130E-16	1.522E-15	2.866E-15	7.008E-15	1.906E-14	4.166E-14	9.079E-14	2.577E-13
ST WALL	4.492E-21	4.577E-19	1.168E-17	1.668E-16	1.024E-15	2.078E-15	3.531E-15	7.852E-15	2.067E-14	4.327E-14	9.491E-14	2.655E-13
SI WALL	3.176E-23	1.940E-20	1.751E-18	7.106E-17	7.021E-16	1.614E-15	2.932E-15	6.856E-15	1.834E-14	3.973E-14	8.820E-14	2.513E-13
ULI WALL	4.831E-23	3.145E-20	2.977E-18	9.688E-17	7.981E-16	1.758E-15	3.134E-15	7.214E-15	1.916E-14	4.083E-14	9.008E-14	2.549E-13
LLI WALL	4.951E-21	3.529E-20	1.522E-18	6.946E-17	7.149E-16	1.635E-15	2.960E-15	6.934E-15	1.869E-14	4.063E-14	8.867E-14	2.578E-13
G BLADDER	8.828E-22	6.684E-20	1.365E-18	8.421E-17	7.851E-16	1.731E-15	3.020E-15	7.011E-15	1.890E-14	4.027E-14	9.090E-14	2.619E-13
HEART	1.039E-21	6.051E-19	8.347E-18	1.301E-16	9.232E-16	1.967E-15	3.442E-15	7.778E-15	2.042E-14	4.319E-14	9.432E-14	2.679E-13
KIDNEYS	1.428E-20	1.129E-18	2.415E-17	2.464E-16	1.143E-15	2.193E-15	3.643E-15	7.973E-15	2.077E-14	4.362E-14	9.472E-14	2.633E-13
LIVER	2.564E-21	3.292E-19	9.880E-18	1.653E-16	1.039E-15	2.113E-15	3.610E-15	8.028E-15	2.089E-14	4.396E-14	9.592E-14	2.651E-13
LUNGS	3.499E-21	4.348E-19	1.275E-17	2.178E-16	1.266E-15	2.487E-15	4.147E-15	9.017E-15	2.324E-14	4.852E-14	1.037E-13	2.827E-13
MUSCLE	2.003E-18	2.477E-17	9.434E-17	3.927E-16	1.400E-15	2.507E-15	4.064E-15	8.801E-15	2.271E-14	4.734E-14	1.011E-13	2.727E-13
OVARIES	6.084E-23	9.552E-21	3.260E-19	4.080E-17	6.400E-16	1.483E-15	2.768E-15	6.708E-15	1.734E-14	4.155E-14	8.910E-14	2.596E-13
PANCREAS	4.182E-23	7.920E-21	3.084E-19	4.670E-17	6.430E-16	1.546E-15	2.865E-15	6.850E-15	1.821E-14	3.897E-14	8.804E-14	2.506E-13
R MARROW	1.939E-19	4.829E-18	2.644E-17	1.721E-16	9.331E-16	1.976E-15	3.538E-15	8.341E-15	2.238E-14	4.777E-14	1.038E-13	2.873E-13
SKIN	1.138E-16	3.038E-16	5.261E-16	1.035E-15	2.235E-15	3.514E-15	5.314E-15	1.101E-14	2.774E-14	5.621E-14	1.164E-13	3.030E-13
SPLEEN	2.533E-22	1.001E-19	6.667E-18	1.518E-16	1.023E-15	2.114E-15	3.603E-15	8.028E-15	2.103E-14	4.415E-14	9.590E-14	2.674E-13
TESTES	6.587E-19	2.666E-17	1.296E-16	5.509E-16	1.689E-15	2.857E-15	4.432E-15	9.354E-15	2.341E-14	4.859E-14	1.014E-13	2.818E-13
THYMUS	1.996E-20	1.366E-18	2.640E-17	2.527E-16	1.245E-15	2.368E-15	3.930E-15	8.529E-15	2.154E-14	4.519E-14	1.015E-13	2.689E-13
THYROID	4.389E-20	1.122E-17	8.478E-17	4.311E-16	1.532E-15	2.706E-15	4.374E-15	9.394E-15	2.384E-14	4.992E-14	1.052E-13	2.979E-13
U BLADDER	8.251E-21	6.043E-19	1.220E-17	1.616E-16	9.478E-16	1.947E-15	3.337E-15	7.432E-15	1.940E-14	3.973E-14	9.174E-14	2.530E-13
UTERUS	8.773E-22	5.780E-20	1.071E-18	5.706E-17	6.562E-16	1.548E-15	2.853E-15	6.730E-15	1.787E-14	3.849E-14	8.730E-14	2.494E-13
h_E	1.103E-18	2.001E-17	8.939E-17	4.229E-16	1.574E-15	2.829E-15	4.530E-15	9.561E-15	2.397E-14	4.961E-14	1.050E-13	2.858E-13
e	1.651E-18	1.436E-17	6.029E-17	3.052E-16	1.271E-15	2.395E-15	3.955E-15	8.635E-15	2.220E-14	4.651E-14	9.970E-14	2.765E-13
k_{AIR}	6.746E-16	9.912E-16	1.305E-15	1.886E-15	2.765E-15	3.890E-15	6.356E-15	1.880E-14	5.997E-14	1.228E-13	2.384E-13	5.825E-13

Table II.5. Organ Dose (Gy per Bq s m^{-3}) from a Monoenergetic Infinite Pool Source

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	5.746E-25	1.776E-22	9.862E-21	2.533E-19	1.858E-18	3.929E-18	6.871E-18	1.578E-17	4.221E-17	8.755E-17	1.903E-16	5.430E-16
B SURFACE	2.388E-21	6.397E-20	3.804E-19	2.718E-18	1.293E-17	2.247E-17	3.216E-17	5.080E-17	9.107E-17	1.582E-16	3.005E-16	7.810E-16
BRAIN	2.092E-26	4.008E-23	8.109E-21	3.497E-19	2.602E-18	5.307E-18	9.034E-18	2.031E-17	5.376E-17	1.132E-16	2.400E-16	6.405E-16
BREASTS	1.168E-20	1.536E-19	5.474E-19	1.820E-18	4.900E-18	7.784E-18	1.170E-17	2.365E-17	5.836E-17	1.194E-16	2.471E-16	6.529E-16
ESOPHAGUS	2.434E-25	4.827E-23	1.943E-21	1.090E-19	1.392E-18	3.406E-18	6.343E-18	1.531E-17	4.133E-17	9.016E-17	1.964E-16	5.618E-16
ST WALL	1.037E-23	1.069E-21	2.737E-20	3.898E-19	2.346E-18	4.690E-18	7.866E-18	1.722E-17	4.491E-17	9.372E-17	2.054E-16	5.789E-16
SI WALL	7.334E-26	4.527E-23	4.096E-21	1.654E-19	1.599E-18	3.622E-18	6.502E-18	1.500E-17	3.981E-17	8.599E-17	1.908E-16	5.480E-16
ULI WALL	1.116E-25	7.340E-23	6.963E-21	2.257E-19	1.822E-18	3.953E-18	6.960E-18	1.579E-17	4.159E-17	8.839E-17	1.949E-16	5.556E-16
LLI WALL	1.143E-23	8.252E-23	3.560E-21	1.615E-19	1.628E-18	3.670E-18	6.564E-18	1.517E-17	4.057E-17	8.794E-17	1.918E-16	5.620E-16
G BLADDER	2.038E-24	1.561E-22	3.198E-21	1.956E-19	1.790E-18	3.891E-18	6.708E-18	1.535E-17	4.103E-17	8.718E-17	1.967E-16	5.710E-16
HEART	2.399E-24	1.413E-21	1.958E-20	3.039E-19	2.111E-18	4.430E-18	7.653E-18	1.704E-17	4.435E-17	9.352E-17	2.041E-16	5.840E-16
KIDNEYS	3.297E-23	2.637E-21	5.663E-20	5.771E-19	2.631E-18	4.967E-18	8.138E-18	1.751E-17	4.516E-17	9.450E-17	2.050E-16	5.741E-16
LIVER	5.921E-24	7.687E-22	2.315E-20	3.861E-19	2.380E-18	4.768E-18	8.041E-18	1.761E-17	4.538E-17	9.522E-17	2.075E-16	5.780E-16
LUNGS	8.080E-24	1.015E-21	2.988E-20	5.088E-19	2.904E-18	5.621E-18	9.251E-18	1.980E-17	5.051E-17	1.051E-16	2.244E-16	6.164E-16
MUSCLE	4.624E-21	5.793E-20	2.220E-19	9.238E-19	3.237E-18	5.702E-18	9.107E-18	1.936E-17	4.941E-17	1.026E-16	2.188E-16	5.945E-16
OVARIES	1.405E-25	2.231E-23	7.630E-22	9.452E-20	1.452E-18	3.323E-18	6.130E-18	1.466E-17	3.762E-17	8.992E-17	1.927E-16	5.659E-16
PANCREAS	9.657E-26	1.849E-23	7.216E-22	1.082E-19	1.461E-18	3.463E-18	6.345E-18	1.497E-17	3.950E-17	8.434E-17	1.904E-16	5.463E-16
R MARROW	4.478E-22	1.129E-20	6.217E-20	4.035E-19	2.140E-18	4.455E-18	7.867E-18	1.826E-17	4.860E-17	1.034E-16	2.246E-16	6.263E-16
SKIN	2.627E-19	7.113E-19	1.241E-18	2.450E-18	5.226E-18	8.080E-18	1.202E-17	2.435E-17	6.049E-17	1.220E-16	2.521E-16	6.608E-16
SPLEEN	5.849E-25	2.337E-22	1.561E-20	3.543E-19	2.341E-18	4.766E-18	8.021E-18	1.760E-17	4.570E-17	9.562E-17	2.075E-16	5.830E-16
TESTES	1.521E-21	6.233E-20	3.050E-19	1.297E-18	3.919E-18	6.522E-18	9.968E-18	2.062E-17	5.099E-17	1.054E-16	2.195E-16	6.145E-16
THYMUS	4.608E-23	3.192E-21	6.192E-20	5.919E-19	2.863E-18	5.362E-18	8.777E-18	1.873E-17	4.683E-17	9.792E-17	2.197E-16	5.862E-16
THYROID	1.013E-22	2.621E-20	1.993E-19	1.013E-18	3.543E-18	6.158E-18	9.806E-18	2.067E-17	5.187E-17	1.082E-16	2.276E-16	6.495E-16
U BLADDER	1.905E-23	1.412E-21	2.861E-20	3.778E-19	2.173E-18	4.392E-18	7.432E-18	1.630E-17	4.215E-17	8.606E-17	1.985E-16	5.516E-16
UTERUS	2.026E-24	1.350E-22	2.508E-21	1.325E-19	1.492E-18	3.471E-18	6.321E-18	1.471E-17	3.878E-17	8.331E-17	1.888E-16	5.437E-16
h_E	2.546E-21	4.679E-20	2.103E-19	9.942E-19	3.636E-18	6.432E-18	1.015E-17	2.105E-17	5.216E-17	1.075E-16	2.273E-16	6.232E-16
e	3.812E-21	3.358E-20	1.418E-19	7.170E-19	2.930E-18	5.430E-18	8.841E-18	1.897E-17	4.828E-17	1.008E-16	2.158E-16	6.028E-16
k_{WATER}	1.615E-18	2.403E-18	3.194E-18	4.570E-18	6.589E-18	9.384E-18	1.573E-17	4.661E-17	1.464E-16	2.978E-16	5.739E-16	1.368E-15

Table II.6. Organ Dose (Gy per Bq s m^{-2}) from a Monoenergetic Plane Source at the Air-ground Interface

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	1.136E-20	1.378E-19	8.100E-19	9.829E-18	3.093E-17	4.905E-17	7.476E-17	1.634E-16	4.167E-16	8.407E-16	1.499E-15	3.416E-15
B SURFACE	1.888E-19	5.795E-18	2.454E-17	9.315E-17	2.074E-16	2.529E-16	2.826E-16	3.747E-16	7.253E-16	1.292E-15	2.270E-15	4.727E-15
BRAIN	9.716E-25	1.422E-21	2.505E-19	7.655E-18	3.319E-17	5.175E-17	7.818E-17	1.689E-16	4.442E-16	8.771E-16	1.627E-15	3.457E-15
BREASTS	1.066E-18	1.314E-17	3.022E-17	4.889E-17	5.724E-17	6.900E-17	9.393E-17	1.950E-16	4.989E-16	9.570E-16	1.747E-15	3.708E-15
ESOPHAGUS	4.655E-24	6.456E-22	2.137E-20	2.964E-18	2.335E-17	4.246E-17	6.982E-17	1.501E-16	4.016E-16	8.020E-16	1.506E-15	3.335E-15
ST WALL	1.567E-21	1.045E-19	2.057E-18	1.409E-17	3.927E-17	5.722E-17	8.321E-17	1.739E-16	4.433E-16	8.868E-16	1.645E-15	3.583E-15
SI WALL	1.029E-23	4.575E-21	3.460E-19	6.746E-18	3.023E-17	5.044E-17	7.647E-17	1.636E-16	4.321E-16	8.735E-16	1.663E-15	3.562E-15
ULI WALL	9.988E-24	5.829E-21	5.348E-19	8.882E-18	3.319E-17	5.334E-17	8.010E-17	1.687E-16	4.413E-16	8.786E-16	1.674E-15	3.588E-15
LLI WALL	7.305E-22	2.791E-20	3.701E-19	6.890E-18	3.184E-17	5.225E-17	7.958E-17	1.690E-16	4.479E-16	9.100E-16	1.700E-15	3.590E-15
G BLADDER	2.445E-21	4.739E-20	3.883E-19	7.527E-18	3.095E-17	4.853E-17	8.117E-17	1.583E-16	4.241E-16	8.253E-16	1.583E-15	3.335E-15
HEART	3.275E-21	1.132E-19	1.398E-18	1.086E-17	3.561E-17	5.463E-17	8.135E-17	1.673E-16	4.392E-16	8.748E-16	1.628E-15	3.478E-15
KIDNEYS	7.164E-21	3.061E-19	4.394E-18	2.060E-17	4.166E-17	5.769E-17	8.382E-17	1.726E-16	4.474E-16	8.966E-16	1.686E-15	3.562E-15
LIVER	9.768E-22	7.800E-20	1.745E-18	1.393E-17	3.926E-17	5.808E-17	8.366E-17	1.734E-16	4.457E-16	8.864E-16	1.664E-15	3.519E-15
LUNGS	1.387E-21	9.981E-20	2.074E-18	1.710E-17	4.455E-17	6.297E-17	8.968E-17	1.828E-16	4.732E-16	9.207E-16	1.725E-15	3.636E-15
MUSCLE	9.151E-19	7.986E-18	1.752E-17	3.289E-17	4.996E-17	6.588E-17	9.326E-17	1.962E-16	5.112E-16	9.988E-16	1.831E-15	3.780E-15
OVARIES	1.333E-19	5.101E-19	1.322E-18	5.058E-18	2.743E-17	5.160E-17	7.486E-17	1.656E-16	4.734E-16	8.337E-16	1.578E-15	3.673E-15
PANCREAS	4.673E-23	3.262E-21	6.633E-20	4.630E-18	2.761E-17	4.843E-17	7.402E-17	1.582E-16	4.087E-16	8.215E-16	1.595E-15	3.539E-15
R MARROW	3.072E-20	9.539E-19	3.647E-18	1.243E-17	3.312E-17	5.353E-17	8.327E-17	1.816E-16	4.776E-16	9.464E-16	1.777E-15	3.785E-15
SKIN	5.046E-17	8.798E-17	8.729E-17	7.545E-17	6.831E-17	7.862E-17	1.077E-16	2.278E-16	5.897E-16	1.133E-15	2.025E-15	4.090E-15
SPLEEN	6.389E-23	1.916E-20	1.096E-18	1.338E-17	3.978E-17	5.844E-17	8.483E-17	1.752E-16	4.462E-16	8.942E-16	1.641E-15	3.656E-15
TESTES	3.597E-19	9.241E-18	2.566E-17	4.481E-17	5.672E-17	6.917E-17	9.669E-17	1.996E-16	5.197E-16	1.004E-15	1.830E-15	3.965E-15
THYMUS	6.092E-21	2.602E-19	3.734E-18	1.885E-17	4.156E-17	6.113E-17	8.165E-17	1.659E-16	4.556E-16	8.417E-16	1.673E-15	3.513E-15
THYROID	7.423E-20	1.185E-18	8.460E-18	2.790E-17	4.663E-17	6.226E-17	9.072E-17	1.829E-16	4.944E-16	9.444E-16	1.597E-15	3.611E-15
U BLADDER	2.426E-21	1.360E-19	2.367E-18	1.479E-17	3.808E-17	5.672E-17	8.493E-17	1.715E-16	4.550E-16	8.783E-16	1.805E-15	4.038E-15
UTERUS	4.926E-22	1.579E-20	1.848E-19	5.923E-18	2.925E-17	4.974E-17	7.765E-17	1.649E-16	4.322E-16	8.633E-16	1.627E-15	3.705E-15
h_E	3.181E-19	5.147E-18	1.443E-17	3.179E-17	5.244E-17	6.915E-17	9.605E-17	1.931E-16	4.945E-16	9.610E-16	1.778E-15	3.814E-15
e	6.811E-19	4.017E-18	1.016E-17	2.367E-17	4.460E-17	6.192E-17	8.928E-17	1.841E-16	4.781E-16	9.376E-16	1.737E-15	3.731E-15
k_{AIR}	1.829E-16	2.323E-16	1.881E-16	1.256E-16	8.337E-17	8.515E-17	1.117E-16	2.415E-16	6.394E-16	1.211E-15	2.122E-15	4.194E-15

Table II.7. Organ Dose (Gy per Bq s m^{-2}) from a Monoenergetic Plane Source 0.04 Mean Free Paths Deep

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	8.084E-21	9.891E-20	5.847E-19	7.154E-18	2.352E-17	3.824E-17	5.934E-17	1.239E-16	3.085E-16	5.809E-16	9.712E-16	1.729E-15
B SURFACE	1.695E-19	4.681E-18	1.919E-17	6.739E-17	1.504E-16	1.900E-16	2.185E-16	2.876E-16	5.029E-16	8.174E-16	1.318E-15	2.461E-15
BRAIN	5.330E-25	9.947E-22	2.082E-19	6.001E-18	2.589E-17	4.162E-17	6.326E-17	1.346E-16	3.313E-16	6.097E-16	1.052E-15	1.949E-15
BREASTS	9.766E-19	1.112E-17	2.518E-17	3.864E-17	4.514E-17	5.564E-17	7.637E-17	1.538E-16	3.606E-16	6.446E-16	1.081E-15	1.987E-15
ESOPHAGUS	3.714E-23	2.198E-21	3.977E-20	2.354E-18	1.737E-17	3.394E-17	5.403E-17	1.125E-16	2.822E-16	5.139E-16	9.144E-16	1.802E-15
ST WALL	1.607E-21	9.244E-20	1.639E-18	1.077E-17	2.905E-17	4.427E-17	6.485E-17	1.292E-16	3.076E-16	5.671E-16	9.562E-16	1.843E-15
SI WALL	6.004E-24	3.038E-21	2.519E-19	4.857E-18	2.219E-17	3.771E-17	5.858E-17	1.208E-16	2.935E-16	5.459E-16	9.467E-16	1.815E-15
ULI WALL	3.032E-23	8.078E-21	4.249E-19	6.514E-18	2.446E-17	4.035E-17	6.128E-17	1.252E-16	3.014E-16	5.530E-16	9.377E-16	1.827E-15
LLI WALL	4.715E-21	2.783E-20	2.870E-19	5.215E-18	2.294E-17	3.904E-17	6.007E-17	1.233E-16	2.979E-16	5.540E-16	9.605E-16	1.871E-15
G BLADDER	9.335E-22	2.339E-20	2.299E-19	5.760E-18	2.312E-17	3.735E-17	5.780E-17	1.227E-16	2.635E-16	5.943E-16	8.875E-16	1.774E-15
HEART	3.335E-21	9.939E-20	1.105E-18	8.399E-18	2.676E-17	4.221E-17	6.337E-17	1.288E-16	3.144E-16	5.641E-16	9.948E-16	1.887E-15
KIDNEYS	5.090E-21	2.326E-19	3.502E-18	1.533E-17	3.124E-17	4.503E-17	6.504E-17	1.321E-16	3.154E-16	5.809E-16	9.705E-16	1.886E-15
LIVER	9.393E-22	6.670E-20	1.373E-18	1.041E-17	2.961E-17	4.490E-17	6.560E-17	1.324E-16	3.140E-16	5.679E-16	9.804E-16	1.872E-15
LUNGS	1.315E-21	8.644E-20	1.684E-18	1.302E-17	3.416E-17	4.969E-17	7.140E-17	1.418E-16	3.394E-16	6.136E-16	1.040E-15	1.983E-15
MUSCLE	7.791E-19	6.263E-18	1.339E-17	2.372E-17	3.644E-17	4.920E-17	7.034E-17	1.433E-16	3.411E-16	6.133E-16	1.035E-15	1.936E-15
OVARIES	8.755E-20	3.459E-19	9.167E-19	3.621E-18	2.044E-17	3.736E-17	5.553E-17	1.156E-16	2.957E-16	5.662E-16	9.786E-16	1.926E-15
PANCREAS	7.331E-23	3.859E-21	6.423E-20	3.381E-18	2.033E-17	3.680E-17	5.728E-17	1.181E-16	2.851E-16	5.338E-16	9.196E-16	1.799E-15
R MARROW	2.765E-20	7.948E-19	2.996E-18	9.552E-18	2.518E-17	4.134E-17	6.486E-17	1.387E-16	3.358E-16	6.139E-16	1.056E-15	2.017E-15
SKIN	4.385E-17	7.001E-17	6.792E-17	5.521E-17	5.020E-17	5.947E-17	8.131E-17	1.664E-16	3.940E-16	6.949E-16	1.148E-15	2.091E-15
SPLEEN	8.197E-23	1.954E-20	9.498E-19	9.898E-18	2.934E-17	4.546E-17	6.618E-17	1.346E-16	3.174E-16	5.573E-16	9.617E-16	1.891E-15
TESTES	3.982E-19	7.400E-18	2.042E-17	3.415E-17	4.247E-17	5.295E-17	7.541E-17	1.451E-16	3.482E-16	6.099E-16	1.062E-15	2.013E-15
THYMUS	3.028E-21	1.722E-19	3.028E-18	1.493E-17	3.287E-17	4.612E-17	6.793E-17	1.295E-16	3.281E-16	5.734E-16	9.865E-16	1.850E-15
THYROID	4.991E-20	8.844E-19	6.799E-18	1.955E-17	3.581E-17	4.793E-17	7.011E-17	1.403E-16	3.614E-16	6.500E-16	1.047E-15	2.055E-15
U BLADDER	2.126E-21	1.172E-19	2.016E-18	1.067E-17	2.803E-17	4.300E-17	6.279E-17	1.301E-16	2.973E-16	5.456E-16	9.274E-16	1.768E-15
UTERUS	2.677E-22	9.508E-21	1.197E-19	4.251E-18	2.119E-17	3.739E-17	5.864E-17	1.202E-16	2.881E-16	5.429E-16	9.122E-16	1.865E-15
h_E	3.041E-19	4.204E-18	1.164E-17	2.418E-17	3.967E-17	5.349E-17	7.542E-17	1.465E-16	3.461E-16	6.192E-16	1.053E-15	1.990E-15
e	6.108E-19	3.240E-18	8.127E-18	1.787E-17	3.343E-17	4.770E-17	6.934E-17	1.381E-16	3.300E-16	5.956E-16	1.018E-15	1.945E-15
k_{AIR}	1.687E-16	1.945E-16	1.552E-16	9.742E-17	6.543E-17	6.827E-17	8.971E-17	1.863E-16	4.508E-16	7.847E-16	1.255E-15	2.217E-15
μ_{SOIL} (cm^{-1})	3.201E+01	9.853E+00	4.309E+00	1.448E+00	5.094E-01	3.404E-01	2.665E-01	2.021E-01	1.419E-01	1.035E-01	7.261E-02	4.634E-02

Table II.8. Organ Dose (Gy per Bq s m⁻²) from a Monoenergetic Plane Source 0.2 Mean Free Paths Deep

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	4.126E-21	5.197E-20	3.136E-19	3.950E-18	1.259E-17	2.183E-17	3.726E-17	7.526E-17	1.737E-16	2.990E-16	5.299E-16	8.074E-16
B SURFACE	1.213E-19	2.863E-18	1.067E-17	3.546E-17	8.582E-17	1.181E-16	1.469E-16	1.988E-16	3.190E-16	4.805E-16	7.264E-16	1.274E-15
BRAIN	9.963E-26	3.483E-22	1.138E-19	3.189E-18	1.512E-17	2.634E-17	4.193E-17	8.835E-17	2.017E-16	3.470E-16	5.709E-16	1.034E-15
BREASTS	7.457E-19	7.447E-18	1.526E-17	2.230E-17	2.766E-17	3.612E-17	5.173E-17	1.030E-16	2.247E-16	3.761E-16	5.988E-16	1.046E-15
ESOPHAGUS	8.055E-24	6.479E-22	1.457E-20	1.172E-18	9.428E-18	1.966E-17	3.399E-17	7.296E-17	1.747E-16	2.923E-16	5.063E-16	8.989E-16
ST WALL	1.093E-21	5.458E-20	8.752E-19	5.545E-18	1.634E-17	2.689E-17	4.161E-17	8.283E-17	1.817E-16	3.209E-16	5.186E-16	9.798E-16
SI WALL	3.537E-24	1.615E-21	1.245E-19	2.384E-18	1.203E-17	2.221E-17	3.651E-17	7.560E-17	1.707E-16	2.996E-16	4.990E-16	9.265E-16
ULI WALL	8.502E-24	3.188E-21	2.137E-19	3.237E-18	1.334E-17	2.397E-17	3.795E-17	7.804E-17	1.760E-16	3.068E-16	5.060E-16	9.239E-16
LLI WALL	2.513E-21	1.933E-20	1.632E-19	2.544E-18	1.250E-17	2.302E-17	3.739E-17	7.775E-17	1.769E-16	3.050E-16	5.102E-16	9.591E-16
G BLADDER	6.813E-22	1.537E-20	1.403E-19	3.166E-18	1.303E-17	2.313E-17	3.717E-17	7.668E-17	1.694E-16	2.994E-16	4.721E-16	1.048E-15
HEART	2.161E-21	5.742E-20	5.884E-19	4.225E-18	1.515E-17	2.560E-17	4.017E-17	8.237E-17	1.811E-16	3.165E-16	5.091E-16	9.482E-16
KIDNEYS	2.863E-21	1.266E-19	1.862E-18	8.063E-18	1.764E-17	2.702E-17	4.160E-17	8.472E-17	1.886E-16	3.155E-16	5.373E-16	9.757E-16
LIVER	5.073E-22	3.548E-20	7.225E-19	5.424E-18	1.665E-17	2.718E-17	4.205E-17	8.446E-17	1.869E-16	3.179E-16	5.244E-16	9.497E-16
LUNGS	8.680E-22	4.956E-20	8.739E-19	6.806E-18	1.961E-17	3.064E-17	4.621E-17	9.168E-17	2.036E-16	3.457E-16	5.611E-16	1.015E-15
MUSCLE	4.901E-19	3.590E-18	7.187E-18	1.246E-17	2.085E-17	3.029E-17	4.534E-17	9.183E-17	2.043E-16	3.465E-16	5.586E-16	9.939E-16
OVARIES	1.686E-20	8.648E-20	2.759E-19	1.415E-18	1.110E-17	2.143E-17	3.522E-17	7.568E-17	1.631E-16	3.062E-16	5.173E-16	8.736E-16
PANCREAS	3.617E-23	1.930E-21	3.245E-20	1.732E-18	1.114E-17	2.167E-17	3.626E-17	7.482E-17	1.689E-16	2.840E-16	4.993E-16	8.836E-16
R MARROW	2.001E-20	4.961E-19	1.706E-18	5.122E-18	1.438E-17	2.511E-17	4.144E-17	8.856E-17	2.000E-16	3.451E-16	5.665E-16	1.025E-15
SKIN	2.927E-17	4.244E-17	3.850E-17	3.034E-17	2.991E-17	3.779E-17	5.404E-17	1.092E-16	2.403E-16	4.017E-16	6.312E-16	1.092E-15
SPLEEN	7.964E-23	1.291E-20	4.773E-19	5.115E-18	1.686E-17	2.724E-17	4.171E-17	8.518E-17	1.885E-16	3.260E-16	5.329E-16	9.699E-16
TESTES	2.727E-19	4.750E-18	1.219E-17	1.874E-17	2.513E-17	3.401E-17	5.008E-17	9.933E-17	2.187E-16	3.674E-16	5.820E-16	1.102E-15
THYMUS	2.635E-21	1.136E-19	1.641E-18	7.683E-18	1.820E-17	2.968E-17	4.327E-17	8.618E-17	1.944E-16	3.364E-16	5.471E-16	1.035E-15
THYROID	4.454E-20	5.475E-19	3.247E-18	9.721E-18	1.951E-17	2.948E-17	4.290E-17	8.572E-17	1.879E-16	3.098E-16	5.206E-16	1.043E-15
U BLADDER	1.994E-21	7.429E-20	9.675E-19	5.455E-18	1.531E-17	2.545E-17	3.972E-17	8.110E-17	1.787E-16	3.143E-16	5.291E-16	9.500E-16
UTERUS	1.963E-22	6.008E-21	6.806E-20	2.083E-18	1.140E-17	2.174E-17	3.601E-17	7.371E-17	1.697E-16	3.030E-16	4.812E-16	9.133E-16
h_E	2.176E-19	2.710E-18	6.816E-18	1.317E-17	2.308E-17	3.352E-17	4.935E-17	9.662E-17	2.107E-16	3.555E-16	5.729E-16	1.052E-15
e	4.132E-19	2.045E-18	4.701E-18	9.592E-18	1.916E-17	2.942E-17	4.479E-17	8.976E-17	1.986E-16	3.381E-16	5.506E-16	1.016E-15
k_{AIR}	1.244E-16	1.255E-16	9.185E-17	5.539E-17	4.049E-17	4.523E-17	6.137E-17	1.246E-16	2.800E-16	4.609E-16	7.029E-16	1.173E-15
μ_{SOIL} (cm^{-1})	3.201E+01	9.853E+00	4.309E+00	1.448E+00	5.094E-01	3.404E-01	2.665E-01	2.021E-01	1.419E-01	1.035E-01	7.261E-02	4.634E-02

Table II.9. Organ Dose (Gy per Bq s m⁻²) from a Monoenergetic Plane Source 1.0 Mean Free Paths Deep

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	4.639E-22	6.413E-21	4.134E-20	5.715E-19	2.984E-18	6.518E-18	1.175E-17	2.782E-17	5.501E-17	9.043E-17	1.248E-16	2.076E-16
B SURFACE	2.806E-20	5.271E-19	1.845E-18	6.504E-18	2.038E-17	3.512E-17	5.306E-17	8.323E-17	1.195E-16	1.539E-16	2.023E-16	3.052E-16
BRAIN	3.732E-26	7.488E-23	1.650E-20	5.517E-19	3.542E-18	7.571E-18	1.412E-17	3.198E-17	6.496E-17	9.944E-17	1.467E-16	2.321E-16
BREASTS	2.166E-19	1.694E-18	3.215E-18	4.831E-18	7.347E-18	1.143E-17	1.868E-17	3.972E-17	7.845E-17	1.134E-16	1.613E-16	2.500E-16
ESOPHAGUS	9.305E-25	8.385E-23	2.044E-21	1.842E-19	2.147E-18	5.387E-18	1.097E-17	2.585E-17	5.178E-17	8.325E-17	1.225E-16	1.964E-16
ST WALL	1.044E-22	6.787E-21	1.312E-19	9.611E-19	3.666E-18	7.563E-18	1.365E-17	2.982E-17	5.924E-17	8.885E-17	1.303E-16	2.193E-16
SI WALL	2.815E-25	1.779E-22	1.727E-20	3.787E-19	2.616E-18	6.003E-18	1.170E-17	2.674E-17	5.376E-17	8.387E-17	1.255E-16	2.086E-16
ULI WALL	2.411E-25	2.266E-22	2.915E-20	5.062E-19	2.966E-18	6.440E-18	1.218E-17	2.747E-17	5.515E-17	8.569E-17	1.275E-16	2.107E-16
LLI WALL	3.881E-22	3.532E-21	2.453E-20	4.228E-19	2.764E-18	6.324E-18	1.209E-17	2.777E-17	5.640E-17	8.654E-17	1.275E-16	2.120E-16
G BLADDER	9.214E-23	2.103E-21	1.934E-20	4.413E-19	2.844E-18	6.418E-18	1.128E-17	2.677E-17	5.292E-17	9.240E-17	1.320E-16	2.188E-16
HEART	4.875E-14	1.044E-12	9.181E-12	7.074E-11	3.415E-10	7.179E-10	1.329E-09	2.932E-09	5.786E-09	8.908E-09	1.298E-08	2.090E-08
KIDNEYS	4.289E-22	1.892E-20	2.778E-19	1.410E-18	4.171E-18	7.817E-18	1.405E-17	3.076E-17	6.224E-17	9.147E-17	1.351E-16	2.142E-16
LIVER	6.270E-23	4.821E-21	1.050E-19	9.300E-19	3.801E-18	7.689E-18	1.395E-17	3.057E-17	6.053E-17	9.184E-17	1.339E-16	2.176E-16
LUNGS	1.054E-22	6.875E-21	1.332E-19	1.167E-18	4.538E-18	8.745E-18	1.562E-17	3.353E-17	6.622E-17	1.000E-16	1.446E-16	2.291E-16
MUSCLE	9.629E-20	6.457E-19	1.269E-18	2.370E-18	5.067E-18	8.927E-18	1.552E-17	3.402E-17	6.788E-17	1.027E-16	1.486E-16	2.334E-16
OVARIES	1.528E-21	9.705E-21	3.603E-20	2.289E-19	2.351E-18	5.650E-18	1.131E-17	2.726E-17	5.308E-17	8.095E-17	1.174E-16	1.731E-16
PANCREAS	2.357E-24	1.708E-22	3.567E-21	2.585E-19	2.419E-18	5.766E-18	1.141E-17	2.636E-17	5.269E-17	8.152E-17	1.240E-16	2.064E-16
R MARROW	4.523E-21	9.205E-20	3.004E-19	9.501E-19	3.353E-18	7.129E-18	1.368E-17	3.199E-17	6.526E-17	9.974E-17	1.468E-16	2.392E-16
SKIN	6.885E-18	8.823E-18	7.717E-18	6.377E-18	7.825E-18	1.188E-17	1.942E-17	4.174E-17	8.288E-17	1.229E-16	1.729E-16	2.649E-16
SPLEEN	1.119E-24	6.945E-22	6.655E-20	8.524E-19	3.758E-18	7.783E-18	1.395E-17	3.071E-17	6.060E-17	9.151E-17	1.367E-16	2.219E-16
TESTES	7.712E-20	1.102E-18	2.603E-18	4.099E-18	6.548E-18	1.067E-17	1.767E-17	3.799E-17	7.649E-17	1.121E-16	1.671E-16	2.254E-16
THYMUS	2.626E-22	1.470E-20	2.556E-19	1.390E-18	4.419E-18	8.538E-18	1.473E-17	3.259E-17	6.287E-17	9.807E-17	1.292E-16	2.282E-16
THYROID	2.522E-21	4.544E-20	3.535E-19	1.432E-18	4.487E-18	8.053E-18	1.442E-17	3.107E-17	6.039E-17	9.222E-17	1.416E-16	1.919E-16
U BLADDER	3.012E-22	1.092E-20	1.395E-19	9.184E-19	3.539E-18	7.122E-18	1.330E-17	2.992E-17	5.822E-17	9.204E-17	1.278E-16	2.198E-16
UTERUS	3.039E-23	9.130E-22	1.021E-20	3.068E-19	2.474E-18	5.746E-18	1.125E-17	2.633E-17	5.309E-17	8.168E-17	1.270E-16	2.039E-16
h_E	5.913E-20	6.007E-19	1.375E-18	2.665E-18	5.705E-18	1.003E-17	1.710E-17	3.635E-17	7.118E-17	1.055E-16	1.533E-16	2.331E-16
e	1.005E-19	4.440E-19	9.353E-19	1.894E-18	4.621E-18	8.597E-18	1.520E-17	3.316E-17	6.580E-17	9.894E-17	1.448E-16	2.241E-16
k_{AIR}	3.447E-17	2.826E-17	1.940E-17	1.217E-17	1.117E-17	1.500E-17	2.315E-17	4.931E-17	9.966E-17	1.472E-16	2.019E-16	2.937E-16
μ_{SOIL} (cm^{-1})	3.201E+01	9.853E+00	4.309E+00	1.448E+00	5.094E-01	3.404E-01	2.665E-01	2.021E-01	1.419E-01	1.035E-01	7.261E-02	4.634E-02

Table II.10. Organ Dose (Gy per Bq s m^{-2}) from a Monoenergetic Plane Source 2.5 Mean Free Paths Deep

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	7.717E-24	2.193E-22	2.357E-21	6.698E-20	4.181E-19	1.138E-18	2.588E-18	6.634E-18	1.304E-17	1.676E-17	2.304E-17	2.991E-17
B SURFACE	2.878E-21	4.992E-20	1.797E-19	7.099E-19	2.929E-18	6.298E-18	1.163E-17	2.214E-17	2.988E-17	3.312E-17	3.680E-17	4.646E-17
BRAIN	4.277E-27	7.183E-24	1.395E-21	5.594E-20	5.051E-19	1.322E-18	2.979E-18	7.783E-18	1.473E-17	1.953E-17	2.497E-17	3.418E-17
BREASTS	2.880E-20	1.982E-19	3.785E-19	5.995E-19	1.130E-18	2.127E-18	4.091E-18	1.012E-17	1.853E-17	2.377E-17	2.914E-17	3.832E-17
ESOPHAGUS	6.409E-26	6.548E-24	1.745E-22	1.783E-20	2.796E-19	9.122E-19	2.213E-18	6.266E-18	1.145E-17	1.567E-17	2.115E-17	2.711E-17
ST WALL	8.501E-24	5.731E-22	1.137E-20	9.840E-20	5.231E-19	1.304E-18	2.855E-18	7.347E-18	1.334E-17	1.777E-17	2.263E-17	3.183E-17
SI WALL	2.203E-26	1.330E-23	1.250E-21	3.715E-20	3.525E-19	1.015E-18	2.405E-18	6.430E-18	1.199E-17	1.626E-17	2.096E-17	3.077E-17
ULI WALL	7.947E-24	2.020E-22	2.006E-21	5.099E-20	4.053E-19	1.106E-18	2.551E-18	6.748E-18	1.229E-17	1.698E-17	2.176E-17	3.212E-17
LLI WALL	9.592E-23	5.813E-22	2.521E-21	4.422E-20	3.920E-19	1.092E-18	2.488E-18	6.739E-18	1.271E-17	1.674E-17	2.231E-17	3.160E-17
G BLADDER	3.384E-24	1.120E-22	1.342E-21	4.443E-20	3.653E-19	1.081E-18	2.476E-18	6.363E-18	1.251E-17	1.533E-17	2.233E-17	3.224E-17
HEART	2.130E-23	6.564E-22	7.474E-21	7.360E-20	4.673E-19	1.226E-18	2.734E-18	7.131E-18	1.311E-17	1.714E-17	2.173E-17	3.203E-17
KIDNEYS	1.915E-23	1.256E-21	2.444E-20	1.518E-19	5.865E-19	1.373E-18	2.934E-18	7.467E-18	1.392E-17	1.837E-17	2.338E-17	3.260E-17
LIVER	3.307E-24	3.284E-22	8.575E-21	9.444E-20	5.328E-19	1.336E-18	2.906E-18	7.501E-18	1.365E-17	1.821E-17	2.312E-17	3.211E-17
LUNGS	6.907E-24	5.113E-22	1.084E-20	1.199E-19	6.370E-19	1.536E-18	3.286E-18	8.267E-18	1.492E-17	1.968E-17	2.514E-17	3.415E-17
MUSCLE	9.253E-21	6.363E-20	1.303E-19	2.700E-19	7.399E-19	1.598E-18	3.316E-18	8.425E-18	1.565E-17	2.081E-17	2.625E-17	3.580E-17
OVARIES	1.008E-22	7.597E-22	3.183E-21	2.398E-20	3.053E-19	9.616E-19	2.250E-18	6.296E-18	1.193E-17	1.824E-17	1.992E-17	3.214E-17
PANCREAS	5.134E-26	6.435E-24	1.982E-22	2.484E-20	3.219E-19	9.836E-19	2.360E-18	6.218E-18	1.159E-17	1.531E-17	2.065E-17	3.023E-17
R MARROW	4.368E-22	8.677E-21	2.948E-20	1.041E-19	4.752E-19	1.243E-18	2.857E-18	7.793E-18	1.477E-17	1.971E-17	2.537E-17	3.549E-17
SKIN	8.167E-19	1.013E-18	8.966E-19	7.929E-19	1.203E-18	2.214E-18	4.286E-18	1.057E-17	1.961E-17	2.589E-17	3.182E-17	4.137E-17
SPLEEN	1.884E-25	7.374E-23	5.096E-21	8.673E-20	5.367E-19	1.338E-18	2.942E-18	7.539E-18	1.352E-17	1.786E-17	2.333E-17	3.286E-17
TESTES	1.120E-20	1.338E-19	3.242E-19	5.284E-19	1.026E-18	2.053E-18	4.044E-18	9.760E-18	1.828E-17	2.257E-17	2.991E-17	3.916E-17
THYMUS	1.763E-23	1.091E-21	2.037E-20	1.464E-19	6.243E-19	1.479E-18	3.198E-18	8.076E-18	1.495E-17	2.007E-17	2.307E-17	3.142E-17
THYROID	1.873E-22	3.630E-21	2.974E-20	1.538E-19	6.265E-19	1.435E-18	3.026E-18	7.454E-18	1.344E-17	1.757E-17	2.301E-17	3.174E-17
U BLADDER	5.465E-24	4.844E-22	1.167E-20	9.632E-20	5.048E-19	1.231E-18	2.853E-18	7.361E-18	1.346E-17	1.779E-17	2.517E-17	3.396E-17
UTERUS	5.570E-25	3.129E-23	5.453E-22	3.063E-20	3.378E-19	9.897E-19	2.377E-18	6.210E-18	1.187E-17	1.627E-17	2.190E-17	3.062E-17
h_E	7.830E-21	6.992E-20	1.608E-19	3.206E-19	8.473E-19	1.825E-18	3.723E-18	9.132E-18	1.658E-17	2.128E-17	2.709E-17	3.640E-17
e	1.237E-20	5.164E-20	1.095E-19	2.253E-19	6.791E-19	1.547E-18	3.264E-18	8.247E-18	1.514E-17	1.965E-17	2.550E-17	3.462E-17
k_{AIR}	4.595E-18	3.456E-18	2.355E-18	1.564E-18	1.772E-18	2.875E-18	5.243E-18	1.271E-17	2.399E-17	3.159E-17	3.823E-17	4.785E-17
μ_{SOIL} (cm^{-1})	3.201E+01	9.853E+00	4.309E+00	1.448E+00	5.094E-01	3.404E-01	2.665E-01	2.021E-01	1.419E-01	1.035E-01	7.261E-02	4.634E-02

Table II.11. Organ Dose (Gy per Bq s m^{-2}) from a Monoenergetic Plane Source 4.0 Mean Free Paths Deep

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	6.527E-25	2.217E-23	2.704E-22	9.184E-21	6.958E-20	2.119E-19	5.700E-19	1.668E-18	3.144E-18	4.094E-18	4.412E-18	5.594E-18
B SURFACE	3.792E-22	6.509E-21	2.436E-20	1.050E-19	5.207E-19	1.304E-18	2.783E-18	6.144E-18	7.958E-18	7.881E-18	7.798E-18	8.780E-18
BRAIN	2.545E-25	1.174E-23	1.779E-22	8.205E-21	8.814E-20	2.709E-19	6.958E-19	2.096E-18	3.743E-18	4.487E-18	5.128E-18	6.179E-18
BREASTS	4.595E-21	3.053E-20	5.796E-20	9.526E-20	2.067E-19	4.450E-19	9.894E-19	2.699E-18	4.733E-18	5.567E-18	6.227E-18	7.350E-18
ESOPHAGUS	2.796E-26	1.917E-24	3.849E-23	2.639E-21	5.104E-20	1.852E-19	5.165E-19	1.703E-18	2.858E-18	3.363E-18	4.059E-18	5.228E-18
ST WALL	6.130E-25	5.375E-23	1.285E-21	1.408E-20	9.262E-20	2.649E-19	6.661E-19	1.974E-18	3.388E-18	4.018E-18	4.719E-18	5.787E-18
SI WALL	1.115E-27	1.097E-24	1.458E-22	5.191E-21	6.172E-20	2.082E-19	5.609E-19	1.714E-18	3.050E-18	3.708E-18	4.350E-18	5.630E-18
ULI WALL	9.136E-25	2.489E-23	2.596E-22	7.072E-21	7.018E-20	2.252E-19	5.965E-19	1.807E-18	3.172E-18	3.752E-18	4.389E-18	5.812E-18
LLI WALL	1.737E-23	6.034E-23	3.691E-22	6.120E-21	6.708E-20	2.229E-19	5.878E-19	1.805E-18	3.251E-18	3.868E-18	4.528E-18	5.867E-18
G BLADDER	3.614E-25	1.260E-23	1.565E-22	5.455E-21	6.803E-20	2.102E-19	5.770E-19	1.775E-18	3.064E-18	3.980E-18	5.004E-18	5.944E-18
HEART	2.172E-24	7.574E-23	9.413E-22	1.041E-20	8.324E-20	2.533E-19	6.391E-19	1.906E-18	3.364E-18	3.965E-18	4.587E-18	5.674E-18
KIDNEYS	1.754E-24	1.330E-22	2.868E-21	2.183E-20	1.036E-19	2.847E-19	7.000E-19	2.014E-18	3.531E-18	4.242E-18	4.806E-18	6.140E-18
LIVER	2.869E-25	3.516E-23	1.066E-21	1.344E-20	9.335E-20	2.723E-19	6.842E-19	1.991E-18	3.476E-18	4.157E-18	4.748E-18	6.023E-18
LUNGS	6.744E-25	5.638E-23	1.303E-21	1.717E-20	1.123E-19	3.166E-19	7.705E-19	2.220E-18	3.845E-18	4.530E-18	5.142E-18	6.420E-18
MUSCLE	1.201E-21	8.621E-21	1.833E-20	4.092E-20	1.325E-19	3.311E-19	7.851E-19	2.265E-18	4.010E-18	4.822E-18	5.481E-18	6.749E-18
OVARIES	7.942E-24	7.258E-23	3.488E-22	3.187E-21	5.175E-20	1.827E-19	5.390E-19	1.702E-18	3.069E-18	3.769E-18	4.988E-18	5.802E-18
PANCREAS	9.672E-27	1.060E-24	2.969E-23	3.254E-21	5.617E-20	1.962E-19	5.426E-19	1.644E-18	2.991E-18	3.506E-18	4.249E-18	5.514E-18
R MARROW	5.447E-23	1.121E-21	4.002E-21	1.543E-20	8.424E-20	2.544E-19	6.692E-19	2.077E-18	3.765E-18	4.549E-18	5.254E-18	6.605E-18
SKIN	1.223E-19	1.519E-19	1.366E-19	1.264E-19	2.215E-19	4.665E-19	1.027E-18	2.873E-18	5.091E-18	6.077E-18	6.738E-18	7.975E-18
SPLEEN	2.412E-26	8.916E-24	5.916E-22	1.192E-20	9.381E-20	2.724E-19	6.898E-19	1.994E-18	3.479E-18	4.056E-18	4.790E-18	6.321E-18
TESTES	1.958E-21	2.207E-20	5.004E-20	8.711E-20	1.929E-19	4.282E-19	9.262E-19	2.613E-18	4.628E-18	5.916E-18	6.400E-18	7.654E-18
THYMUS	2.494E-24	1.393E-22	2.418E-21	2.114E-20	1.099E-19	3.038E-19	7.500E-19	2.151E-18	3.616E-18	4.255E-18	4.887E-18	6.610E-18
THYROID	1.801E-23	4.068E-22	3.715E-21	2.249E-20	1.123E-19	3.064E-19	7.343E-19	2.003E-18	3.406E-18	4.038E-18	4.318E-18	5.556E-18
U BLADDER	3.916E-25	4.663E-23	1.385E-21	1.361E-20	9.084E-20	2.564E-19	6.538E-19	1.944E-18	3.421E-18	4.156E-18	4.970E-18	6.272E-18
UTERUS	1.265E-25	5.808E-24	8.773E-23	4.027E-21	5.990E-20	2.021E-19	5.459E-19	1.684E-18	3.089E-18	3.721E-18	4.407E-18	5.825E-18
h_E	1.271E-21	1.099E-20	2.426E-20	5.050E-20	1.538E-19	3.785E-19	8.755E-19	2.449E-18	4.224E-18	5.079E-18	5.673E-18	6.937E-18
e	1.912E-21	8.094E-21	1.649E-20	3.534E-20	1.228E-19	3.198E-19	7.641E-19	2.211E-18	3.858E-18	4.661E-18	5.269E-18	6.515E-18
k_{AIR}	7.372E-19	5.391E-19	3.686E-19	2.539E-19	3.297E-19	6.126E-19	1.271E-18	3.473E-18	6.246E-18	7.520E-18	8.276E-18	9.390E-18
μ_{SOIL} (cm^{-1})	3.201E+01	9.853E+00	4.309E+00	1.448E+00	5.094E-01	3.404E-01	2.665E-01	2.021E-01	1.419E-01	1.035E-01	7.261E-02	4.634E-02

Table II.12. Organ Dose (Gy per Bq s m^{-3}) from a Monoenergetic Source Uniformly Distributed to a Depth of 1 cm

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	8.506E-25	3.554E-23	5.007E-22	1.824E-20	1.284E-19	2.616E-19	4.636E-19	1.033E-18	2.782E-18	5.679E-18	1.055E-17	2.295E-17
B SURFACE	3.060E-23	2.189E-21	1.859E-20	1.758E-19	8.597E-19	1.367E-18	1.768E-18	2.513E-18	4.676E-18	8.222E-18	1.475E-17	3.220E-17
BRAIN	6.026E-29	3.216E-25	1.874E-22	1.551E-20	1.500E-19	3.019E-19	5.074E-19	1.152E-18	3.034E-18	6.016E-18	1.143E-17	2.465E-17
BREASTS	2.099E-22	6.149E-21	2.834E-20	1.137E-19	2.729E-19	4.104E-19	6.191E-19	1.327E-18	3.327E-18	6.409E-18	1.189E-17	2.568E-17
ESOPHAGUS	2.133E-27	5.209E-25	2.602E-23	5.643E-21	9.559E-20	2.336E-19	4.229E-19	9.622E-19	2.610E-18	5.141E-18	1.011E-17	2.323E-17
ST WALL	2.114E-25	3.719E-23	1.464E-21	2.717E-20	1.636E-19	3.136E-19	5.124E-19	1.101E-18	2.819E-18	5.673E-18	1.069E-17	2.422E-17
SI WALL	6.754E-28	1.090E-24	2.062E-22	1.157E-20	1.217E-19	2.625E-19	4.566E-19	1.020E-18	2.687E-18	5.465E-18	1.064E-17	2.398E-17
ULI WALL	5.139E-27	2.426E-24	3.500E-22	1.559E-20	1.348E-19	2.822E-19	4.761E-19	1.056E-18	2.761E-18	5.536E-18	1.059E-17	2.415E-17
LLI WALL	5.872E-25	1.507E-23	2.718E-22	1.249E-20	1.264E-19	2.720E-19	4.682E-19	1.045E-18	2.746E-18	5.575E-18	1.082E-17	2.448E-17
G BLADDER	1.446E-25	1.065E-23	2.243E-22	1.450E-20	1.302E-19	2.676E-19	4.594E-19	1.033E-18	2.495E-18	5.762E-18	1.002E-17	2.293E-17
HEART	5.276E-25	4.340E-23	9.939E-22	2.062E-20	1.514E-19	2.987E-19	4.977E-19	1.094E-18	2.857E-18	5.629E-18	1.095E-17	2.428E-17
KIDNEYS	6.279E-25	9.143E-23	3.114E-21	3.944E-20	1.770E-19	3.168E-19	5.132E-19	1.123E-18	2.892E-18	5.771E-18	1.089E-17	2.450E-17
LIVER	1.074E-25	2.509E-23	1.199E-21	2.645E-20	1.669E-19	3.175E-19	5.179E-19	1.124E-18	2.877E-18	5.671E-18	1.092E-17	2.428E-17
LUNGS	1.771E-25	3.482E-23	1.474E-21	3.315E-20	1.954E-19	3.550E-19	5.661E-19	1.209E-18	3.110E-18	6.090E-18	1.151E-17	2.545E-17
MUSCLE	1.175E-22	2.757E-21	1.272E-20	6.240E-20	2.090E-19	3.520E-19	5.579E-19	1.222E-18	3.148E-18	6.178E-18	1.166E-17	2.551E-17
OVARIES	4.943E-24	7.537E-23	5.274E-22	7.337E-21	1.120E-19	2.564E-19	4.373E-19	9.973E-19	2.704E-18	5.580E-18	1.074E-17	2.520E-17
PANCREAS	6.734E-27	1.246E-24	5.045E-23	8.193E-21	1.123E-19	2.559E-19	4.497E-19	1.001E-18	2.613E-18	5.290E-18	1.031E-17	2.381E-17
R MARROW	4.982E-24	3.791E-22	2.977E-21	2.534E-20	1.436E-19	2.929E-19	5.114E-19	1.178E-18	3.078E-18	6.120E-18	1.173E-17	2.615E-17
SKIN	7.546E-21	3.426E-20	7.091E-20	1.549E-19	2.977E-19	4.339E-19	6.549E-19	1.431E-18	3.650E-18	7.018E-18	1.293E-17	2.757E-17
SPLEEN	1.129E-26	7.296E-24	7.895E-22	2.481E-20	1.677E-19	3.195E-19	5.182E-19	1.139E-18	2.904E-18	5.621E-18	1.073E-17	2.482E-17
TESTES	7.714E-23	3.982E-21	2.289E-20	9.674E-20	2.503E-19	3.886E-19	6.062E-19	1.269E-18	3.245E-18	6.200E-18	1.188E-17	2.659E-17
THYMUS	5.176E-25	7.710E-23	2.759E-21	3.807E-20	1.839E-19	3.386E-19	5.338E-19	1.115E-18	2.997E-18	5.694E-18	1.099E-17	2.405E-17
THYROID	7.722E-24	3.363E-22	5.117E-21	4.618E-20	1.975E-19	3.419E-19	5.413E-19	1.172E-18	3.211E-18	6.313E-18	1.131E-17	2.592E-17
U BLADDER	4.235E-25	5.153E-23	1.637E-21	2.660E-20	1.551E-19	3.002E-19	4.938E-19	1.095E-18	2.754E-18	5.496E-18	1.076E-17	2.491E-17
UTERUS	4.186E-26	4.219E-24	1.114E-22	9.927E-21	1.156E-19	2.582E-19	4.540E-19	1.008E-18	2.651E-18	5.439E-18	1.030E-17	2.479E-17
h_E	5.975E-23	2.224E-21	1.252E-20	6.654E-20	2.302E-19	3.864E-19	6.015E-19	1.259E-18	3.188E-18	6.178E-18	1.168E-17	2.591E-17
e	1.081E-22	1.670E-21	8.609E-21	4.827E-20	1.917E-19	3.413E-19	5.498E-19	1.182E-18	3.038E-18	5.966E-18	1.135E-17	2.542E-17
k_{AIR}	3.437E-20	1.039E-19	1.717E-19	2.844E-19	3.995E-19	5.102E-19	7.313E-19	1.608E-18	4.166E-18	7.859E-18	1.398E-17	2.881E-17

Table II.13. Organ Dose (Gy per Bq s m^{-3}) from a Monoenergetic Source Uniformly Distributed to a Depth of 5 cm

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	8.506E-25	3.554E-23	5.007E-22	1.959E-20	2.084E-19	5.513E-19	1.123E-18	2.816E-18	7.613E-18	1.564E-17	3.165E-17	6.471E-17
B SURFACE	3.060E-23	2.189E-21	1.859E-20	1.906E-19	1.409E-18	2.944E-18	4.616E-18	7.568E-18	1.404E-17	2.433E-17	4.370E-17	9.566E-17
BRAIN	6.026E-29	3.216E-25	1.874E-22	1.670E-20	2.458E-19	6.455E-19	1.285E-18	3.244E-18	8.717E-18	1.751E-17	3.425E-17	7.588E-17
BREASTS	2.099E-22	6.149E-21	2.834E-20	1.259E-19	4.713E-19	9.178E-19	1.623E-18	3.840E-18	9.800E-18	1.893E-17	3.575E-17	7.751E-17
ESOPHAGUS	2.133E-27	5.209E-25	2.602E-23	6.026E-21	1.528E-19	4.788E-19	1.034E-18	2.670E-18	7.444E-18	1.480E-17	3.020E-17	6.876E-17
ST WALL	2.114E-25	3.719E-23	1.464E-21	2.926E-20	2.631E-19	6.572E-19	1.269E-18	3.050E-18	7.936E-18	1.624E-17	3.133E-17	7.255E-17
SI WALL	6.754E-28	1.090E-24	2.062E-22	1.236E-20	1.921E-19	5.373E-19	1.109E-18	2.781E-18	7.446E-18	1.533E-17	3.056E-17	7.036E-17
ULI WALL	5.139E-27	2.426E-24	3.500E-22	1.667E-20	2.147E-19	5.779E-19	1.154E-18	2.867E-18	7.663E-18	1.564E-17	3.073E-17	7.056E-17
LLI WALL	5.872E-25	1.507E-23	2.718E-22	1.342E-20	2.013E-19	5.604E-19	1.140E-18	2.865E-18	7.703E-18	1.563E-17	3.116E-17	7.247E-17
G BLADDER	1.446E-25	1.065E-23	2.243E-22	1.544E-20	2.064E-19	5.609E-19	1.105E-18	2.809E-18	7.258E-18	1.578E-17	2.891E-17	7.274E-17
HEART	5.276E-25	4.340E-23	9.939E-22	2.217E-20	2.435E-19	6.250E-19	1.231E-18	3.023E-18	7.919E-18	1.607E-17	3.142E-17	7.218E-17
KIDNEYS	6.279E-25	9.143E-23	3.114E-21	4.261E-20	2.892E-19	6.688E-19	1.283E-18	3.126E-18	8.229E-18	1.621E-17	3.221E-17	7.319E-17
LIVER	1.074E-25	2.509E-23	1.199E-21	2.846E-20	2.695E-19	6.662E-19	1.288E-18	3.115E-18	8.137E-18	1.619E-17	3.184E-17	7.202E-17
LUNGS	1.771E-25	3.482E-23	1.474E-21	3.569E-20	3.179E-19	7.516E-19	1.423E-18	3.384E-18	8.851E-18	1.754E-17	3.390E-17	7.636E-17
MUSCLE	1.175E-22	2.757E-21	1.272E-20	6.798E-20	3.456E-19	7.534E-19	1.404E-18	3.411E-18	8.936E-18	1.767E-17	3.393E-17	7.515E-17
OVARIES	4.943E-24	7.537E-23	5.274E-22	7.841E-21	1.753E-19	5.163E-19	1.069E-18	2.786E-18	7.264E-18	1.560E-17	3.137E-17	7.113E-17
PANCREAS	6.734E-27	1.246E-24	5.045E-23	8.726E-21	1.774E-19	5.212E-19	1.092E-18	2.744E-18	7.322E-18	1.468E-17	3.016E-17	6.868E-17
R MARROW	4.982E-24	3.791E-22	2.977E-21	2.751E-20	2.341E-19	6.161E-19	1.268E-18	3.265E-18	8.717E-18	1.754E-17	3.435E-17	7.763E-17
SKIN	7.546E-21	3.426E-20	7.091E-20	1.709E-19	5.089E-19	9.610E-19	1.698E-18	4.079E-18	1.053E-17	2.040E-17	3.806E-17	8.173E-17
SPLEEN	1.129E-26	7.296E-24	7.895E-22	2.665E-20	2.699E-19	6.710E-19	1.284E-18	3.142E-18	8.199E-18	1.638E-17	3.190E-17	7.331E-17
TESTES	7.714E-23	3.982E-21	2.289E-20	1.074E-19	4.276E-19	8.634E-19	1.562E-18	3.691E-18	9.551E-18	1.845E-17	3.512E-17	8.037E-17
THYMUS	5.176E-25	7.710E-23	2.759E-21	4.116E-20	3.022E-19	7.267E-19	1.338E-18	3.199E-18	8.459E-18	1.686E-17	3.267E-17	7.419E-17
THYROID	7.722E-24	3.363E-22	5.117E-21	4.937E-20	3.181E-19	7.117E-19	1.329E-18	3.185E-18	8.428E-18	1.662E-17	3.244E-17	7.861E-17
U BLADDER	4.235E-25	5.153E-23	1.637E-21	2.863E-20	2.504E-19	6.233E-19	1.224E-18	3.019E-18	7.792E-18	1.591E-17	3.160E-17	7.134E-17
UTERUS	4.186E-26	4.219E-24	1.114E-22	1.058E-20	1.823E-19	5.227E-19	1.087E-18	2.729E-18	7.380E-18	1.538E-17	2.953E-17	7.123E-17
h_E	5.975E-23	2.224E-21	1.252E-20	7.309E-20	3.842E-19	8.365E-19	1.531E-18	3.586E-18	9.192E-18	1.797E-17	3.451E-17	7.773E-17
e	1.081E-22	1.670E-21	8.609E-21	5.288E-20	3.165E-19	7.289E-19	1.382E-18	3.323E-18	8.664E-18	1.717E-17	3.331E-17	7.589E-17
k_{AIR}	3.437E-20	1.039E-19	1.717E-19	3.159E-19	7.014E-19	1.170E-18	1.956E-18	4.683E-18	1.227E-17	2.331E-17	4.197E-17	8.676E-17

Table II.14. Organ Dose (Gy per Bq s m^{-3}) from a Monoenergetic Source Uniformly Distributed to a Depth of 15 cm

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	8.506E-25	3.554E-23	5.007E-22	1.959E-20	2.137E-19	6.185E-19	1.408E-18	4.013E-18	1.153E-17	2.485E-17	5.172E-17	1.120E-16
B SURFACE	3.060E-23	2.189E-21	1.859E-20	1.906E-19	1.447E-18	3.317E-18	5.913E-18	1.136E-17	2.265E-17	4.008E-17	7.427E-17	1.696E-16
BRAIN	6.026E-29	3.216E-25	1.874E-22	1.670E-20	2.522E-19	7.239E-19	1.620E-18	4.629E-18	1.331E-17	2.779E-17	5.710E-17	1.350E-16
BREASTS	2.099E-22	6.149E-21	2.834E-20	1.259E-19	4.861E-19	1.044E-18	2.079E-18	5.606E-18	1.539E-17	3.062E-17	6.046E-17	1.383E-16
ESOPHAGUS	2.133E-27	5.209E-25	2.602E-23	6.026E-21	1.564E-19	5.331E-19	1.285E-18	3.786E-18	1.109E-17	2.341E-17	4.978E-17	1.193E-16
ST WALL	2.114E-25	3.719E-23	1.464E-21	2.926E-20	2.698E-19	7.347E-19	1.590E-18	4.349E-18	1.211E-17	2.547E-17	5.179E-17	1.285E-16
SI WALL	6.754E-28	1.090E-24	2.062E-22	1.236E-20	1.966E-19	5.977E-19	1.380E-18	3.931E-18	1.123E-17	2.401E-17	5.022E-17	1.230E-16
ULI WALL	5.139E-27	2.426E-24	3.500E-22	1.667E-20	2.199E-19	6.435E-19	1.440E-18	4.061E-18	1.154E-17	2.452E-17	5.072E-17	1.232E-16
LLI WALL	5.872E-25	1.507E-23	2.718E-22	1.342E-20	2.063E-19	6.252E-19	1.421E-18	4.066E-18	1.168E-17	2.457E-17	5.117E-17	1.267E-16
G BLADDER	1.446E-25	1.065E-23	2.243E-22	1.544E-20	2.112E-19	6.251E-19	1.378E-18	3.952E-18	1.103E-17	2.513E-17	4.879E-17	1.326E-16
HEART	5.276E-25	4.340E-23	9.939E-22	2.217E-20	2.495E-19	6.980E-19	1.540E-18	4.291E-18	1.200E-17	2.529E-17	5.157E-17	1.255E-16
KIDNEYS	6.279E-25	9.143E-23	3.114E-21	4.261E-20	2.967E-19	7.503E-19	1.614E-18	4.457E-18	1.261E-17	2.563E-17	5.348E-17	1.283E-16
LIVER	1.074E-25	2.509E-23	1.199E-21	2.846E-20	2.763E-19	7.455E-19	1.615E-18	4.445E-18	1.241E-17	2.567E-17	5.271E-17	1.262E-16
LUNGS	1.771E-25	3.482E-23	1.474E-21	3.569E-20	3.261E-19	8.427E-19	1.792E-18	4.847E-18	1.352E-17	2.786E-17	5.637E-17	1.341E-16
MUSCLE	1.175E-22	2.757E-21	1.272E-20	6.798E-20	3.552E-19	8.480E-19	1.776E-18	4.899E-18	1.374E-17	2.825E-17	5.674E-17	1.324E-16
OVARIES	4.943E-24	7.537E-23	5.274E-22	7.841E-21	1.791E-19	5.731E-19	1.326E-18	3.938E-18	1.100E-17	2.408E-17	5.050E-17	1.177E-16
PANCREAS	6.734E-27	1.246E-24	5.045E-23	8.726E-21	1.815E-19	5.795E-19	1.357E-18	3.868E-18	1.102E-17	2.306E-17	4.975E-17	1.192E-16
R MARROW	4.982E-24	3.791E-22	2.977E-21	2.751E-20	2.402E-19	6.898E-19	1.589E-18	4.651E-18	1.332E-17	2.784E-17	5.711E-17	1.365E-16
SKIN	7.546E-21	3.426E-20	7.091E-20	1.709E-19	5.247E-19	1.092E-18	2.174E-18	5.927E-18	1.643E-17	3.303E-17	6.434E-17	1.454E-16
SPLEEN	1.129E-26	7.296E-24	7.895E-22	2.665E-20	2.768E-19	7.505E-19	1.614E-18	4.478E-18	1.246E-17	2.589E-17	5.327E-17	1.287E-16
TESTES	7.714E-23	3.982E-21	2.289E-20	1.074E-19	4.411E-19	9.841E-19	2.005E-18	5.386E-18	1.501E-17	2.999E-17	6.009E-17	1.417E-16
THYMUS	5.176E-25	7.710E-23	2.759E-21	4.116E-20	3.103E-19	8.146E-19	1.694E-18	4.627E-18	1.294E-17	2.701E-17	5.349E-17	1.337E-16
THYROID	7.722E-24	3.363E-22	5.117E-21	4.937E-20	3.262E-19	7.968E-19	1.669E-18	4.522E-18	1.267E-17	2.601E-17	5.386E-17	1.342E-16
U BLADDER	4.235E-25	5.153E-23	1.637E-21	2.863E-20	2.570E-19	6.965E-19	1.542E-18	4.324E-18	1.192E-17	2.541E-17	5.203E-17	1.262E-16
UTERUS	4.186E-26	4.219E-24	1.114E-22	1.058E-20	1.867E-19	5.814E-19	1.352E-18	3.852E-18	1.112E-17	2.389E-17	4.904E-17	1.226E-16
h_E	5.975E-23	2.224E-21	1.252E-20	7.309E-20	3.953E-19	9.444E-19	1.945E-18	5.189E-18	1.425E-17	2.883E-17	5.800E-17	1.375E-16
e	1.081E-22	1.670E-21	8.609E-21	5.288E-20	3.253E-19	8.204E-19	1.746E-18	4.776E-18	1.332E-17	2.738E-17	5.564E-17	1.334E-16
k_{AIR}	3.437E-20	1.039E-19	1.717E-19	3.159E-19	7.247E-19	1.340E-18	2.536E-18	6.891E-18	1.939E-17	3.837E-17	7.217E-17	1.559E-16

Table II.15. Organ Dose (Gy per Bq s m^{-3}) from a Monoenergetic Source Uniformly Distributed to an Infinite Depth

	Emitted photon energy (MeV)											
Organ/Tissue	1.0E-02	1.5E-02	2.0E-02	3.0E-02	5.0E-02	7.0E-02	1.0E-01	2.0E-01	5.0E-01	1.0E+00	2.0E+00	5.0E+00
ADRENALS	8.506E-25	3.554E-23	5.007E-22	1.959E-20	2.137E-19	6.185E-19	1.408E-18	4.141E-18	1.267E-17	2.876E-17	6.452E-17	1.622E-16
B SURFACE	3.060E-23	2.189E-21	1.859E-20	1.906E-19	1.447E-18	3.317E-18	5.913E-18	1.182E-17	2.531E-17	4.757E-17	9.511E-17	2.447E-16
BRAIN	6.026E-29	3.216E-25	1.874E-22	1.670E-20	2.522E-19	7.239E-19	1.620E-18	4.786E-18	1.461E-17	3.226E-17	7.161E-17	1.916E-16
BREASTS	2.099E-22	6.149E-21	2.834E-20	1.259E-19	4.861E-19	1.044E-18	2.079E-18	5.809E-18	1.703E-17	3.601E-17	7.698E-17	2.000E-16
ESOPHAGUS	2.133E-27	5.209E-25	2.602E-23	6.026E-21	1.564E-19	5.331E-19	1.285E-18	3.913E-18	1.209E-17	2.702E-17	6.193E-17	1.663E-16
ST WALL	2.114E-25	3.719E-23	1.464E-21	2.926E-20	2.698E-19	7.347E-19	1.590E-18	4.497E-18	1.329E-17	2.952E-17	6.480E-17	1.818E-16
SI WALL	6.754E-28	1.090E-24	2.062E-22	1.236E-20	1.966E-19	5.977E-19	1.380E-18	4.060E-18	1.229E-17	2.774E-17	6.249E-17	1.739E-16
ULI WALL	5.139E-27	2.426E-24	3.500E-22	1.667E-20	2.199E-19	6.435E-19	1.441E-18	4.196E-18	1.263E-17	2.839E-17	6.333E-17	1.750E-16
LLI WALL	5.872E-25	1.507E-23	2.718E-22	1.342E-20	2.063E-19	6.252E-19	1.421E-18	4.201E-18	1.280E-17	2.842E-17	6.393E-17	1.786E-16
G BLADDER	1.446E-25	1.065E-23	2.243E-22	1.544E-20	2.112E-19	6.251E-19	1.378E-18	4.082E-18	1.213E-17	2.880E-17	6.189E-17	1.862E-16
HEART	5.276E-25	4.340E-23	9.939E-22	2.217E-20	2.495E-19	6.980E-19	1.540E-18	4.434E-18	1.316E-17	2.923E-17	6.430E-17	1.771E-16
KIDNEYS	6.279E-25	9.143E-23	3.114E-21	4.261E-20	2.967E-19	7.503E-19	1.614E-18	4.607E-18	1.384E-17	2.982E-17	6.694E-17	1.811E-16
LIVER	1.074E-25	2.509E-23	1.199E-21	2.846E-20	2.763E-19	7.455E-19	1.615E-18	4.595E-18	1.361E-17	2.983E-17	6.604E-17	1.793E-16
LUNGS	1.771E-25	3.482E-23	1.474E-21	3.569E-20	3.261E-19	8.427E-19	1.792E-18	5.013E-18	1.484E-17	3.237E-17	7.083E-17	1.902E-16
MUSCLE	1.175E-22	2.757E-21	1.272E-20	6.798E-20	3.552E-19	8.480E-19	1.776E-18	5.068E-18	1.513E-17	3.299E-17	7.176E-17	1.900E-16
OVARIES	4.943E-24	7.537E-23	5.274E-22	7.841E-21	1.791E-19	5.731E-19	1.326E-18	4.064E-18	1.206E-17	2.811E-17	6.205E-17	1.630E-16
PANCREAS	6.734E-27	1.246E-24	5.045E-23	8.726E-21	1.815E-19	5.795E-19	1.357E-18	3.991E-18	1.204E-17	2.660E-17	6.184E-17	1.694E-16
R MARROW	4.982E-24	3.791E-22	2.977E-21	2.751E-20	2.402E-19	6.898E-19	1.589E-18	4.807E-18	1.463E-17	3.235E-17	7.175E-17	1.949E-16
SKIN	7.546E-21	3.426E-20	7.091E-20	1.709E-19	5.247E-19	1.092E-18	2.175E-18	6.141E-18	1.817E-17	3.890E-17	8.224E-17	2.111E-16
SPLEEN	1.129E-26	7.296E-24	7.895E-22	2.665E-20	2.768E-19	7.505E-19	1.614E-18	4.628E-18	1.366E-17	2.998E-17	6.681E-17	1.830E-16
TESTES	7.714E-23	3.982E-21	2.289E-20	1.074E-19	4.411E-19	9.841E-19	2.005E-18	5.582E-18	1.663E-17	3.518E-17	7.718E-17	1.997E-16
THYMUS	5.176E-25	7.710E-23	2.759E-21	4.116E-20	3.103E-19	8.146E-19	1.694E-18	4.789E-18	1.425E-17	3.155E-17	6.654E-17	1.884E-16
THYROID	7.722E-24	3.363E-22	5.117E-21	4.937E-20	3.262E-19	7.968E-19	1.669E-18	4.672E-18	1.385E-17	3.006E-17	6.755E-17	1.827E-16
U BLADDER	4.235E-25	5.153E-23	1.637E-21	2.863E-20	2.570E-19	6.965E-19	1.542E-18	4.470E-18	1.311E-17	2.950E-17	6.564E-17	1.806E-16
UTERUS	4.186E-26	4.219E-24	1.114E-22	1.058E-20	1.867E-19	5.814E-19	1.352E-18	3.977E-18	1.217E-17	2.760E-17	6.170E-17	1.726E-16
h_E	5.975E-23	2.224E-21	1.252E-20	7.309E-20	3.953E-19	9.444E-19	1.946E-18	5.373E-18	1.571E-17	3.369E-17	7.345E-17	1.953E-16
e	1.081E-22	1.670E-21	8.609E-21	5.288E-20	3.253E-19	8.204E-19	1.746E-18	4.942E-18	1.466E-17	3.188E-17	7.024E-17	1.889E-16
k_{AIR}	3.437E-20	1.039E-19	1.717E-19	3.159E-19	7.247E-19	1.340E-18	2.536E-18	7.149E-18	2.152E-17	4.553E-17	9.346E-17	2.297E-16

Discussion

In this section we compare our results for effective dose equivalent to published results of other researchers. Unless specifically stated otherwise, all values of effective dose equivalent discussed in this section are normalized to air kerma free in air, at a distance of one meter above the air-ground interface, or to water kerma free in water within an infinite pool.

Effective dose equivalent, as a function of energy, is shown in Fig. II.9 for an isotropic plane source at the air-ground interface, for submersion in a semi-infinite cloud source, and for immersion in an infinite water pool, as calculated for this report. In previous calculations performed at ORNL (DOE, 1988; Kocher, 1981, 1983; Kocher and Sjoreen, 1985), normalized organ doses for a plane surface source and for water immersion were assumed to be those for submersion in a semi-infinite cloud. Values of effective dose equivalent for a plane isotropic surface source and for water immersion are compared to those for submersion in Fig. II.10. For water immersion, the differences are small (less than 10 percent), and are due solely to differences in the photon spectra in water and air (see Figs. II.3 and II.4). However, the differences for a plane surface source can be as large as 33 percent, and illustrate one of the primary reasons that new calculations were performed.

Effective dose equivalent for submersion in a semi-infinite cloud source, from Table II.4, is compared to that from Zankl et al. (1992) at the Gesellschaft für Strahlen- und Umweltforschung (GSF), in Figs. II.11 and II.12. Comparisons for an infinite plane isotropic source at an effective depth of 0.5 g cm^{-2} are shown in Figs. II.13 and II.14. The values for the upper curve were derived by interpolation, using a log-linear Hermite cubic spline fit to the data of Tables II.6 to II.11. The different values are traceable to differences in the adult hermaphrodite phantom used in this work and the gender-specific phantoms used at GSF, and will be explained in detail later.

Effective dose equivalent for an infinite plane isotropic source at the air-ground interface is shown in Fig. II.15, as derived by two different procedures. The lower curve in Fig. II.15 shows values from Table II.6. The upper curve represents values derived using fluence-to-dose equivalent conversion factors for rotational normal beam exposure (ROT) computed for the adult hermaphrodite phantom of Cristy (Cristy and Eckerman, 1987), which was used throughout this work. The two curves illustrate the difference due to assuming all photons are normally incident (upper curve), as compared to using the actual angular distribution of photons on the body (lower curve). The differences in effective dose equivalent for plane isotropic sources at the surface and at depths of one and four mean free paths are shown in Fig. II.16. It can be seen that the differences between the values for rotational exposure and those for the actual field are significant, and increase with increasing source depth.

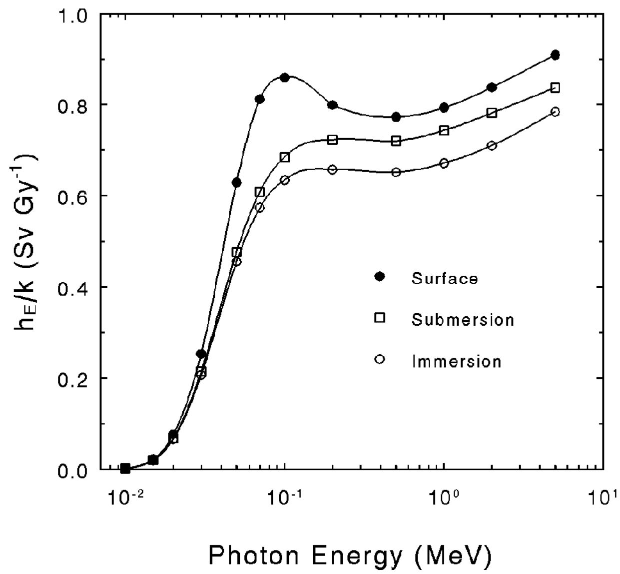

Fig. II.9. Normalized effective dose equivalent for an isotropic plane surface source, submersion in a semi-infinite cloud, and immersion in an infinite water pool (this work).

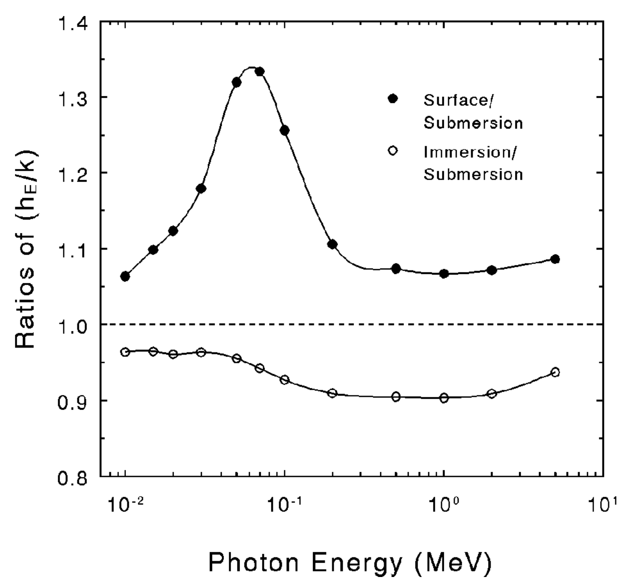

Fig. II.10. Comparison of normalized effective dose equivalent for an isotropic plane surface source and for water immersion to that for submersion (this work).

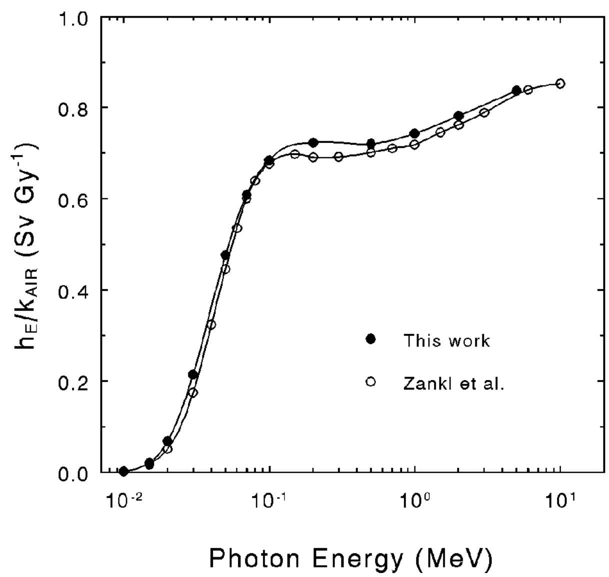

Fig. II.11. Effective dose equivalent for submersion normalized to air kerma 1 m above the air-ground interface.

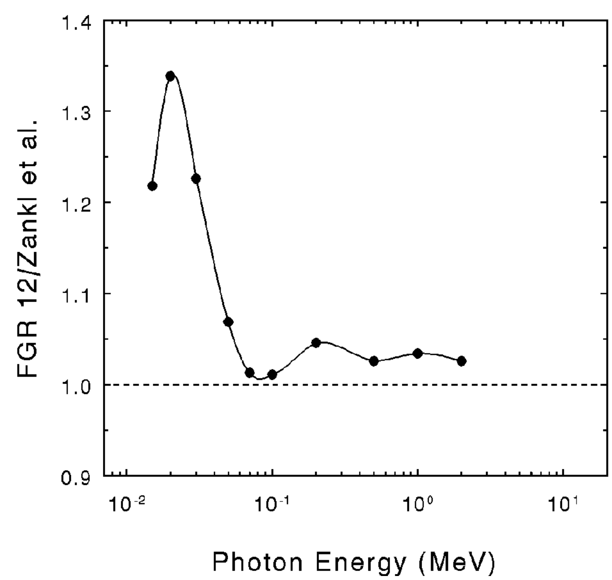

Fig. II.12. Comparison of normalized effective dose equivalent for submersion from this work (FGR 12) to that of Zankl et al. (1992).

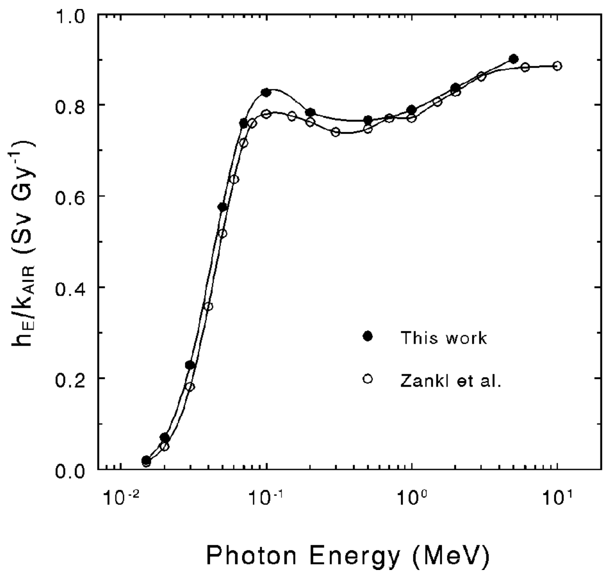

Fig. II.13. Effective dose equivalent normalized to air kerma 1 m above the air-ground interface for an infinite plane source 0.5 g cm^{-2} deep.

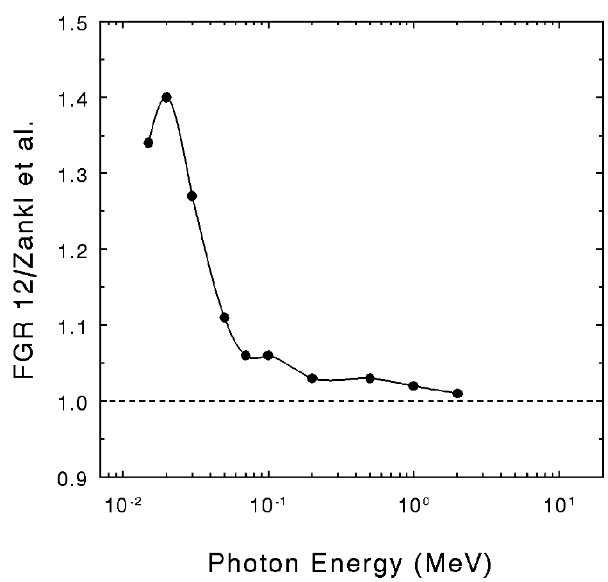

Fig. II.14. Comparison of normalized effective dose equivalent from this work to that of Zankl et al. (1992) for an infinite plane source 0.5 g cm^{-2} deep.

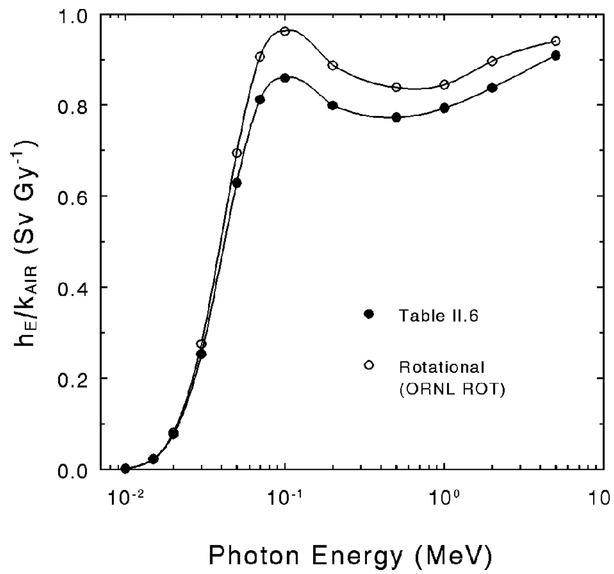

Fig. II.15. Effective dose equivalent normalized to air kerma 1 m above the air-ground interface for an infinite plane source at the interface.

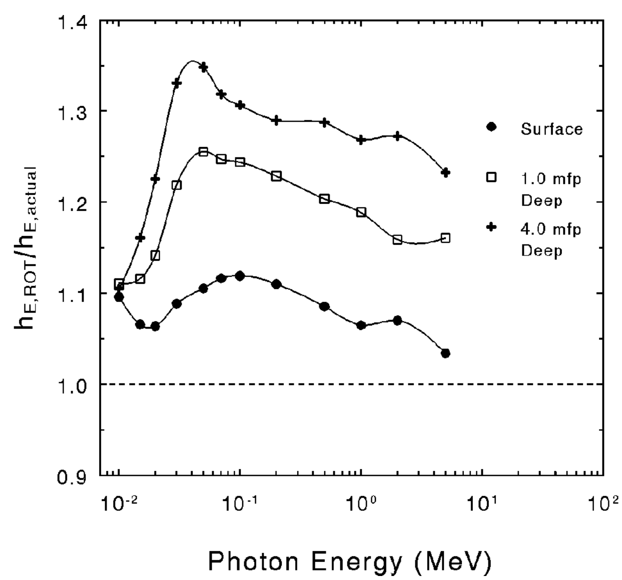

Fig. II.16. Ratio of effective dose equivalent for rotational exposure to that for the actual field.

Effective dose equivalent for a plane isotropic source at the air-ground interface is compared to Chen (1991) in Fig. II.17. Chen used the rotational fluence-to-effective dose equivalent conversion factors from ICRP Publication 51 (ICRP, 1987) to compute dose equivalent for exposure to contaminated soil. Effective dose equivalent computed from the photon spectra of this work, using the same ICRP 51 rotational conversion factors as Chen, is seen to be in excellent agreement with his values. Figure II.18 shows the difference between the values from Table II.6 and the values based on rotational exposure of Fig. II.15, as compared to Chen's values. Effective dose equivalent for the adult Cristy phantom is compared to the ICRP Publication 51 data (ICRP, 1987) in Figs. II.19 and II.20. The ICRP 51 data were computed at GSF (Williams et al., 1985). A comparison of individual organ dose equivalent conversion factors which contribute to the effective dose equivalent differences are shown in Table II.16.

The differences seen in Figs. II.19 and II.20 are due to the same factors that contribute to the differences seen in Figs. II.11 to II.14. The organ dose coefficients computed here use the 73 kg hermaphrodite phantom of Cristy (Cristy and Eckerman, 1987). At GSF, organ dose coefficients were computed separately for adult male and female phantoms (Williams et al., 1985; Zankl et al., 1992). Prior to calculating effective dose equivalent coefficients, the organ dose coefficients for the male and female phantoms were averaged, and the ICRP 26 weighting factors were applied to the arithmetic mean of the male and female organ dose coefficients. The GSF 59 kg female phantom is smaller than the 70 kg male phantom. The female has a height of 160 cm, a body width of 37.6 cm, and a body depth of 18.7 cm, as compared to 170 cm, 40 cm, and 20 cm, respectively, for the male phantom (Saito et al., 1990). Therefore, organ dose coefficients will tend to be greater for internal organs of the female phantom, since there is less shielding from photons incident on the body surface, and the gender-averaged coefficients used in computing the effective dose equivalent will be higher than those derived from the hermaphrodite phantom, all other factors being equal. The dose equivalent for remainder in the male and female from Williams et al. (1985) in Table II.16 illustrate the tendency for female organ doses to be higher for deeply-seated internal organs. The differences in doses to other organs do not always exhibit this tendency because they are more directly affected by gender differences (e.g., ovaries versus testes) or are more distributed in nature (e.g., red marrow and bone surfaces). Comparison of organ doses between the hermaphrodite phantom of this work and the GSF phantoms shows that competing factors contribute to the differences in effective dose equivalents. The doses to red marrow, bone surface, and thyroid are consistently higher in the hermaphrodite phantom. The differences in red marrow and bone surface doses are due to different methods of estimating those doses. In the hermaphrodite phantom,

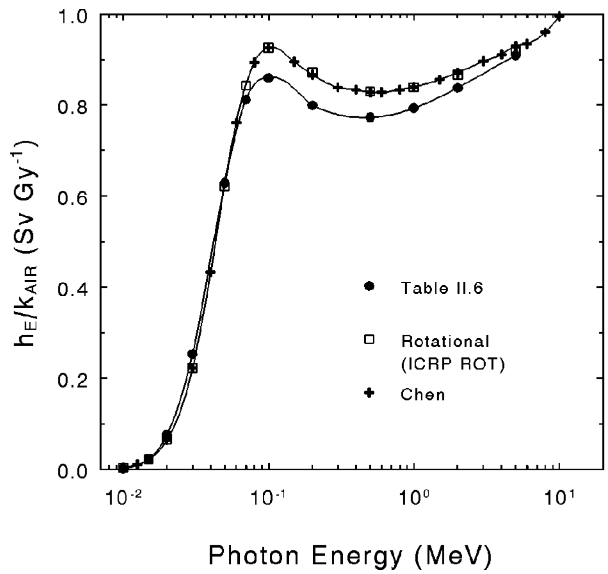

Fig. II.17. Effective dose equivalent, normalized to air kerma 1 m above the air-ground interface, for an infinite plane source at the interface, compared to Chen (1991).

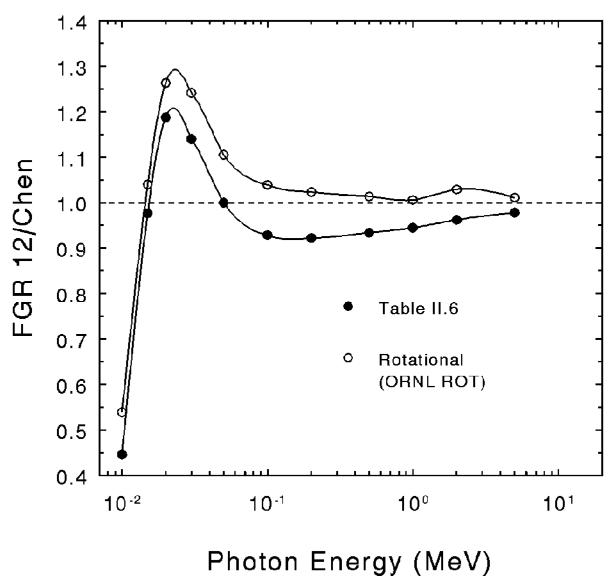

Fig. II.18. Ratio of normalized effective dose equivalent from Fig. II.15 to that of Chen (1991) from Fig. II.17 for an infinite plane source at the air-ground interface.

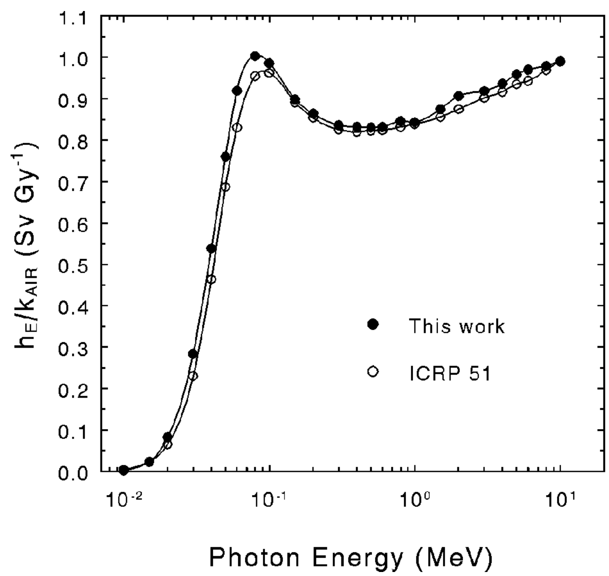

Fig. II.19. Effective dose equivalent normalized to air kerma for rotational normal beam exposure.

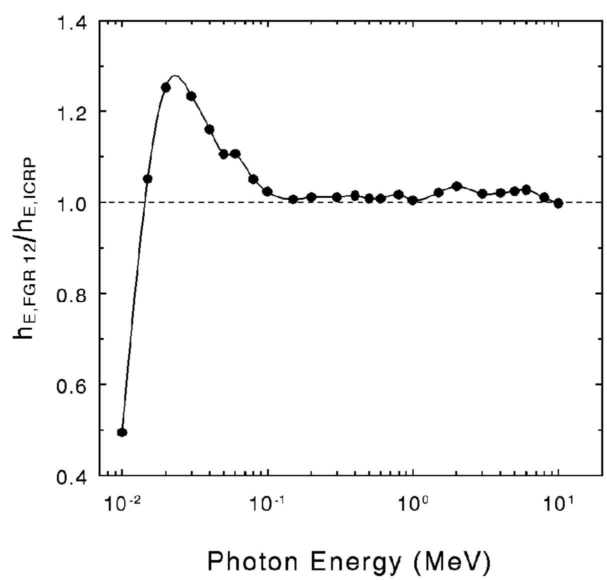

Fig. II.20. Ratio of effective dose equivalent for rotational exposure from this report (FGR 12) to that from ICRP Publication 51.

Table II.16. Organ Dose Equivalent Conversion Factors for Rotational Exposure (pSv cm^2)

Organ	E_{photon} (MeV)	This Work Hermaphrodite	Williams et al. (1985) Male	Female	Average
Gonads	0.015	0.105	0.140	0.000	0.070
	0.05	0.226	0.207	0.174	0.191
	0.1	0.335	0.341	0.335	0.338
	0.5	1.866	1.913	1.812	1.862
	1.0	3.431	3.733	3.518	3.626
Breasts	0.015	0.214	-	0.287	0.287
	0.05	0.255	-	0.243	0.243
	0.1	0.345	-	0.344	0.344
	0.5	1.981	-	1.940	1.940
	1.0	3.837	-	3.718	3.718
R Marrow	0.015	0.021	0.011	0.011	0.011
	0.05	0.170	0.151	0.151	0.151
	0.1	0.341	0.324	0.336	0.330
	0.5	1.971	1.907	1.916	1.911
	1.0	3.838	3.682	3.682	3.682
Lungs	0.015	0.003	0.007	0.007	0.007
	0.05	0.236	0.238	0.248	0.243
	0.1	0.365	0.375	0.368	0.372
	0.5	2.003	2.057	1.995	2.026
	1.0	3.863	3.928	3.856	3.892
Thyroid	0.015	0.086	0.072	0.072	0.072
	0.05	0.323	0.281	0.281	0.281
	0.1	0.465	0.443	0.443	0.443
	0.5	2.485	2.251	2.251	2.251
	1.0	4.924	4.282	4.282	4.282
B Surface	0.015	0.117	0.090	0.090	0.090
	0.05	0.952	0.562	0.601	0.582
	0.1	0.935	0.580	0.607	0.594
	0.5	2.550	2.019	2.019	2.019
	1.0	4.676	3.764	3.764	3.764
Remainder	0.015	0.025	0.011	0.011	0.011
	0.05	0.212	0.211	0.224	0.217
	0.1	0.344	0.350	0.357	0.353
	0.5	1.952	1.967	2.016	1.992
	0.1	3.750	3.754	3.831	3.792
h_E	0.015	0.075			0.071
	0.05	0.245			0.222
	0.1	0.366			0.357
	0.5	1.977			1.955
	1.0	3.771			3.752

fluence-to-dose conversion factors (Cristy and Eckerman, 1987) which take into account the heterogeneity of the marrow and endosteal tissue structures are used to estimate doses. In the GSF calculations, the marrow dose is estimated by a mass-weighted partitioning of the dose to skeleton, with a correction for the difference in energy absorption coefficients between skeleton and marrow, and the skeletal dose is taken as a surrogate for bone surface dose. The thyroid doses in the hermaphrodite phantom are higher because the neck region, modified for this work, provides less shielding than the neck region of the GSF phantoms. There are also differences in doses to the remainder organs. The reasons for these differences are difficult to quantify, since data for all the organs which contribute to the remainder have not been published by GSF. However, one difference may be that in this work, "remaining tissue" was used as a surrogate for muscle, and was included in the list of organs which can contribute to the remainder. It appears that muscle was not included in the list for the GSF calculations. In using the hermaphrodite phantom for internal emitters, it has been the practice to assign the gonadal tissue the higher dose of either the testes or the ovaries. We have continued that practice here; which, for external radiation, means the dose to testes is used, since it is always higher than the dose to ovaries. Since the gonadal dose has a high weighting factor (0.25), it has a large influence on effective dose equivalent. The combination of the competing effects is clearly illustrated in Fig. II.20. At higher photon energies (above 100 keV), photons are relatively penetrating, so the dose to the ovaries, in the female, is not much lower than the dose to the testes, in the male, and the lower gonadal average dose is compensated for by the increase in average dose to other organs. In the energy range from 100 keV down to 15 keV, the ovaries receive significantly more shielding than the testes, and the lower gonadal dose more than compensates for the increase in average dose to other organs, resulting in a noticeably lower effective dose equivalent than is computed for the hermaphrodite phantom. Finally, at the lowest energy (10 keV), the shielding of the testes in the male phantom increases significantly, and the difference in dose between the male and female phantoms is again not as large. At 10 keV, the average doses to other organs of the male and female phantoms now dominate the effective dose equivalent, and are larger than those for the hermaphrodite phantom. Therefore, the effective dose equivalent for the hermaphrodite phantom at 10 keV is lower than that for the average of the GSF phantoms.

The effective dose equivalent for exposure to an infinite volume source in the soil is compared to the work of Chen (1991) in Fig. II.21. Since Chen used the ICRP 51 rotational fluence-to-dose equivalent conversion factors, the differences in the phantoms discussed above also explain part of the differences shown in this figure. In addition, there is some difference attributable to the use of rotational exposure factors instead of the actual angular distributions

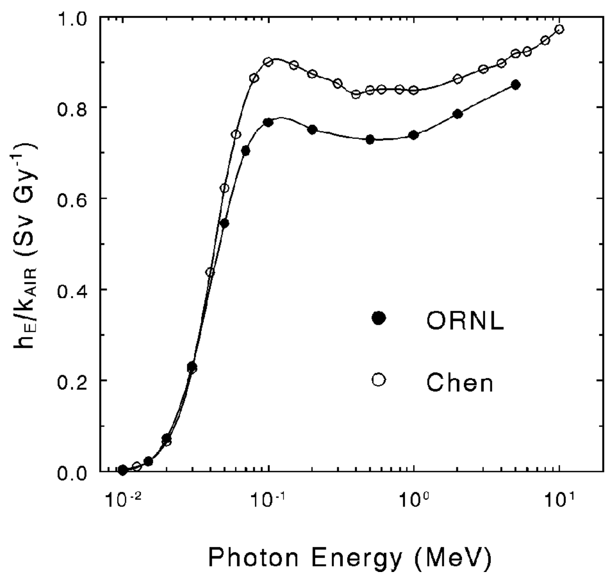

Fig. II.21. Effective dose equivalent normalized to air kerma 1 m above the air-ground interface, from an infinitely thick uniformly distributed soil source.

used in this work, as shown in Fig. II.15. However, when the dose equivalent is not normalized to air kerma, there remain significant differences between the results of this work and those of Chen. It has been determined that these differences, which are present for all volumetric sources in the soil, are due to use of different soil compositions. The effect of soil composition was investigated by computing air kerma 1 m above the air-ground interface for a series of uniformly distributed, isotropic, 10 cm thick volume sources at the air-ground interface, for slabs of varying soil compositions. The calculations were performed for the 12 source energies used for the monoenergetic environmental photon sources, using a one-dimensional Monte Carlo transport code based on the ALGAMP transport routines (Ryman and Eckerman, 1993). The soils used in the calculations were (a) a dry sandy soil similar in composition to Nevada Test Site soil (Garrett, 1968), (b) the typical silty soil used in this work, (c) a soil composed of the average components of the earth's crust (Chen, 1991), and (c) Nipe clay soil, a ferruginous laterite soil with a high concentration of iron (Lawton, 1955). The volume fractions of air and water in the Nipe clay were assumed to be 0.2 and 0.3, respectively. All soils were assumed to have a density of 1.6×10^3 kg m^{-3}. The compositions of the soils are given in Table II.17. The air composition is given in Table II.2, and is the same used throughout this work.

Table II.17. Soil Compositions

Element	Mass Fraction			
	Dry Sandy Soil	Earth's Crust	Nipe Clay	Silty Soil
H	0.0124		0.02109	0.021
C			0.001628	0.016
N			0.0002483	
O	0.5236	0.4658	0.4510	0.577
Na		0.0275	0.0002013	
Mg		0.0208	0.001472	
Al	0.0782	0.0806	0.07037	0.050
Si	0.3858	0.2925	0.03382	0.271
P			0.0001579	
S			0.0008694	
Ar			0.000001922	
K		0.0258		0.013
Ca		0.0364	0.002650	0.041
Ti			0.003958	
Mn			0.007636	
Fe		0.0506	0.4049	0.011
Total	1.0000	1.0000	1.00000	1.000

In the Monte Carlo calculations, the thickness of the air above the interface was three mean free paths (at the source energy). The soil depth was the greater of one mean free path beneath the 10 cm slab source or three mean free paths plus 5 cm.

The effect of soil composition is shown in Fig. II.22, which shows air kerma 1 m above the 10 cm slab source, normalized to the air kerma 1 m above typical silty soil. It is seen that the air kerma at low energies is strongly influenced by the composition, with lighter soil (in terms of average atomic number) producing a greater kerma, and heavier soils resulting in a lower kerma. The curve for earth's crust explains the remaining differences between the

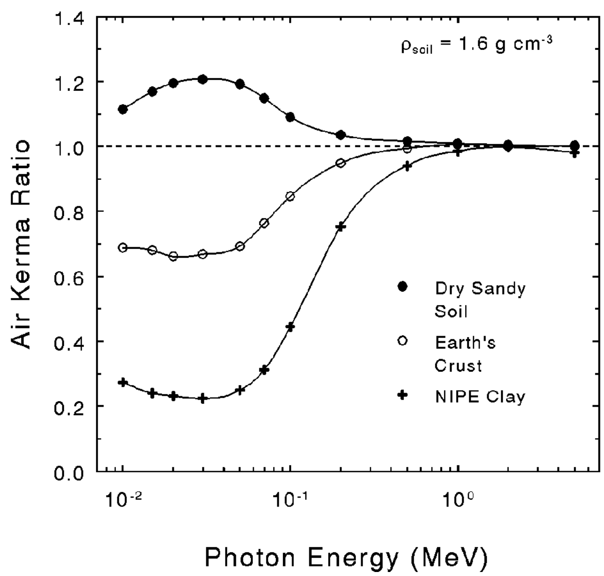

Fig. II.22. Ratio of air kerma 1 m above 10 cm thick sources in soils of varying composition to that above the typical silty soil used in this report.

results of this work and those of Chen (1991). The shape of the curves is explained by Fig. II.23, which gives the ratio of the linear attenuation coefficient for silty soil to that of the other soils. Although not shown, the ratios of the uncollided contribution to the kermas of Fig. II.22 lie exactly on the curves of Fig. II.23.

In summary, the discussion above illustrates the sensitivity of the dose coefficients to certain features of the computational models. For example, the coefficients at lower photon energies are sensitive to the elemental composition of the soil. Differences in the treatment of energy deposition in red marrow and bone surface are evident in the coefficients for those radiosensitive tissues of the skeleton. The effective dose equivalent coefficient is sensitive, again at the lower photon energies, to the choice of an anatomical model; i.e., to the use of a hermaphrodite phantom versus the averaging of doses from gender-specific phantoms. For the purpose of establishing dose coefficients for use in radiation protection, the choice of an anatomical model appears to be more of a public policy than a technical issue. We have continued the traditional use of a hermaphrodite phantom, as specified in current Federal guidance for workers (EPA, 1987).

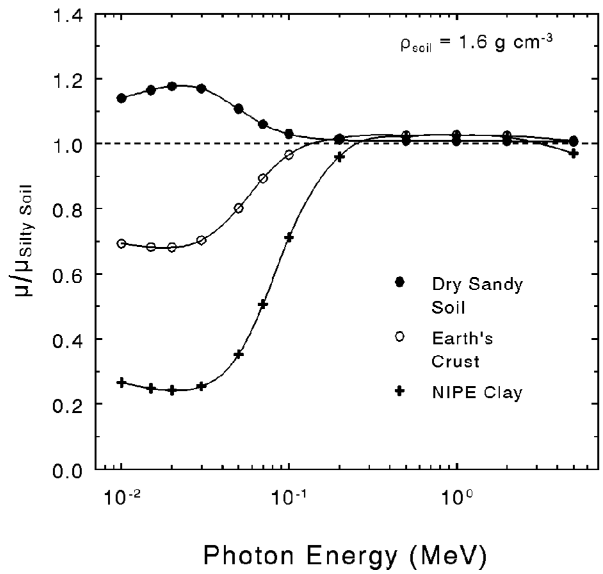

Fig. II.23. Ratio of linear attenuation coefficient for the typical silty soil used in this report to that of other soils.

Many of the features of the computational models interact in a complex manner, making an *a priori* assessment of their contributions to the dose coefficients difficult to assess. The analyses of the computational models used to produce this report have been sufficiently detailed to account, we believe, for the dependence of the dose coefficients on all significant features of the models. The resulting tabulations of coefficients reflect the current state of the art in environmental dosimetric calculations.

Skin doses from monoenergetic environmental electron sources

In this section we discuss the calculation of the skin dose from electrons for air submersion, water immersion, and ground-surface and volume exposures. The contribution of electrons to dose to organs and tissues of the body other than skin need not be considered, due to the short range in tissue of electrons emitted by radionuclides. However, bremsstrahlung produced by electrons slowing down in environmental media are sufficiently penetrating to contribute to the dose to underlying tissues. Bremsstrahlung production is discussed in Appendix C. The DOSFACTER code developed by Kocher (DOE, 1988) was used to calculate skin dose coefficients for a series of monoenergetic electron emissions, that were convoluted to the spectra of the various radionuclides, using the energy and intensity of beta and electron emissions of radionuclides tabulated in ICRP Publication 38 (ICRP, 1983; Eckerman et al., 1993). The discussion of the computational details, presented below, is taken from that of Kocher (DOE, 1988).

Immersion in contaminated water

For immersion in an infinite, uniformly contaminated water medium, the skin dose coefficient at a depth of 70 μm, for a unit concentration of a monoenergetic electron emitter of energy E, can be expressed as

$$h_{skin}(E) = \frac{E}{\rho_w} R^{w}(E)\; q(E)\; G_{skin}(E) \quad , \tag{11}$$

where ρ_w is the density of water, R^w is the ratio of the energy absorption in tissue to energy absorption in water at energy E, q is a leakage correction factor, and G_{skin} is a geometrical reduction factor defined as the ratio of the absorbed dose at the depth of interest into a semi-infinite tissue medium to the absorbed dose in the contaminated water for the energy E. The energy-absorption ratio R^w is obtained from the mass stopping powers, $\frac{1}{\rho}\frac{dE}{dx}$ in tissue (t) and water (w) as

$$R^{w} = \left(\frac{1}{\rho}\frac{dE}{dx}\right)_t \Big/ \left(\frac{1}{\rho}\frac{dE}{dx}\right)_w \quad . \tag{12}$$

Since the stopping powers in tissue and water are nearly independent of energy, the ratio in Eq. (12) is evaluated at the emitted energy. The mass stopping powers in tissue and water used in the DOSFACTER code were those reported in National Academy of Sciences-National Research Council Publication 113 (NAS, 1964).

The geometrical reduction factor G_{skin} relates the dose to skin (at a depth of 70 μm) to the dose in water. This factor is obtained from electron specific absorbed fractions in water calculated using Monte Carlo methods, as described by Berger (1974). In calculations of the geometrical reduction factors it is assumed that a half-space occupied by water (as a surrogate for tissue) is in contact with a uniformly-contaminated half-space containing water (the source). Thus, G_{skin} has a value of one-half at the interface (i.e., the body surface) and decreases with increasing depth into the body. The geometrical reduction factors used in the present calculations were derived by Berger (1974).

The leakage correction factor q accounts for the finite lateral extent of the body surface and is given by the empirical formula (Berger, 1974)

$$q(x,E) = 1 - q_1(E)\ q_2(x/a) \quad , \tag{13}$$

where x is the depth of interest, here taken as 70 µm, and the parameter a depends only on the emitted energy E. Values of q_1, a, and q_2 used in the DOSFACTER code were those given by Berger (1974). The DOSFACTER code was used to tabulate the dose coefficient for the skin, h_{skin} (dose per unit volume source), in water. The results are shown graphically in Fig. II.24.

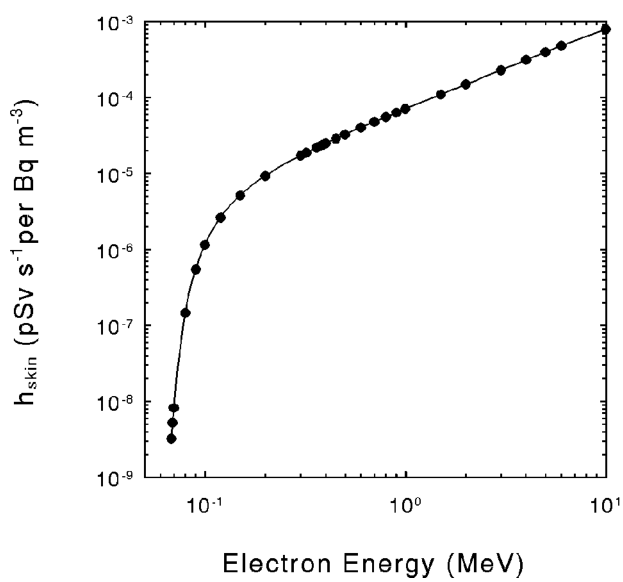

Fig. II.24. Electron skin dose coefficient for immersion in contaminated water.

Submersion in contaminated air.

For an exposed individual standing at the boundary of a semi-infinite, uniformly contaminated atmospheric cloud, we assume that the electron range in air is less than the average height of the body, which is taken to be 1 m. Therefore, the source region is assumed to be effectively infinite in extent, and the electron dose coefficient at the depth of interest into tissue (70 µm) is given in terms of the geometrical reduction factor G_{skin} for immersion in contaminated water, noted above, as (Berger, 1974)

$$h_{skin}(E) = \frac{E}{\rho_a} \frac{R^a}{\alpha} q(x,E) \; G_{skin}(E) \quad , \tag{14}$$

where ρ_a is the density of air, R^a/α is the ratio of energy absorption in tissue to that in air at the emitted energy E, and the leakage correction factor q and the geometrical reduction factor G_{skin} are as discussed above.

The energy-absorption rate R^a/α consists of two factors. The first factor is the ratio of the mass stopping powers in tissue and air (NAS, 1964):

$$R^a = \left(\frac{1}{\rho} \frac{dE}{dx} \right)_t / \left(\frac{1}{\rho} \frac{dE}{dx} \right)_a \quad , \tag{15}$$

which is evaluated at the emitted energy E. The second factor, α, also depends on the emitted energy and accounts for the variations in mass stopping powers in tissue and air over the continuous energy spectrum of electrons incident on the body for a monoenergetic source of energy E in an infinite, uniformly-contaminated atmospheric cloud (Berger, 1974). Dose coefficients for skin calculated using the DOSFACTER code for submersion are shown in Fig. II.25.

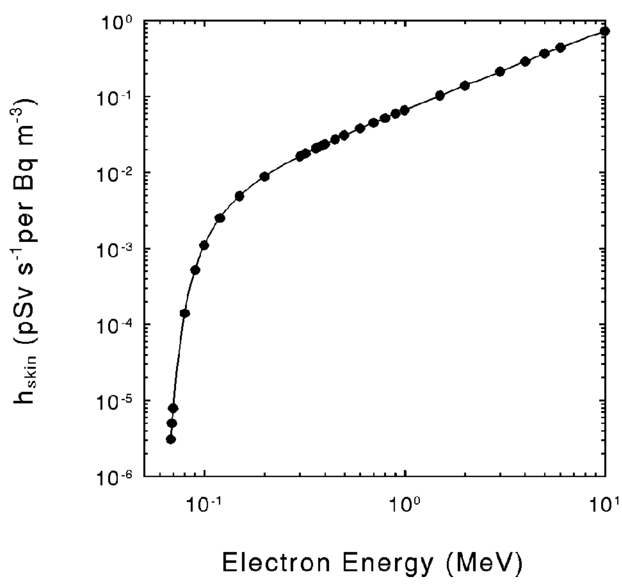

Fig. II.25. Electron skin dose coefficient for submersion in contaminated air.

Exposure to contaminated soil

The geometrical reduction factor G_{skin} identified above cannot be used to calculate skin dose coefficients for exposure to contaminated soil, since it applies only to the situation where the source region occupies one half-space and tissue the other. Therefore, the coefficients for exposure to contaminated ground must be obtained by explicit consideration of the radiation transport.

In the calculations performed by DOSFACTER, the transport of energy through air and into the body was reduced to consideration of an equivalent thickness in air alone. Thus, for a height z of the body surface above the ground and depth x into the body, the effective height $z^{/}$ in air above the ground is given by

$$z^{/} = z + 1.14 \frac{\rho_t}{\rho_a} x \quad , \qquad \textbf{(16)}$$

where ρ_t and ρ_a are the densities of tissue and air, respectively, and the factor 1.14 approximates the ratio of mass stopping powers in tissue and air for any electron energy (NAS, 1964).

The electron dose coefficient for skin at the height $z^{/}$ in air above ground defined by Eq. (16) then is given by

$$h_{skin}(E) = \frac{1}{2} E R^{a} \int_{\sigma} \Phi^{a}(r,E)\, d\sigma \quad , \qquad \textbf{(17)}$$

where R^a is the ratio of mass stopping powers in tissue and air evaluated at the emitted energy E, σ denotes the ground surface, Φ^a is the specific absorbed fraction for electrons in air, and r is the distance from any point on the ground surface to the receptor located at height $z^{/}$ in air above the ground. The factor 1/2 accounts for the impenetrability of the body by electrons, so that any point on the body surface is irradiated by only half of the source region.

The DOSFACTER code evaluates Eq. (17) numerically using the electron scaled point kernel, F, developed by Berger (1974). The scaled point kernel is defined in terms of the specific absorbed fraction Φ as

$$F(r/r_o, E)\, d(r/r_o) = 4\pi\rho\Phi(r,E)\, r^2\, dr \quad , \qquad \textbf{(18)}$$

where r_0 is the electron range for energy E in a medium of density ρ. Thus, the scaling of the specific absorbed fraction is accomplished by expressing distances in units of electron range.

The DOSFACTER code uses the scaled point kernels in water, F^w, given by Berger

(1973). The scaled point kernels in air, F^a, are obtained from those for water according to Berger (1974) as

$$F^{a}(r/r_o^{a}, E) = \alpha^{\prime} F^{w}(\alpha^{\prime} r/r_o^{a}, E) \quad , \qquad \textbf{(19)}$$

where $\alpha^{\prime}$ is a scaling parameter that depends on the energy E. By expressing Eq. (17) in terms of the scaled point kernel in air, the electron dose coefficient for skin is

$$h_{skin}(E) = \frac{1}{4r_o^{a}} \frac{E}{\rho_a} R^{a} \int_{z^{\prime}/r_o^{a}}^{\infty} \frac{1}{u} F^{a}(u, E)\, du \quad , \qquad \textbf{(20)}$$

where u is the scaled distance r/r_0^a.

The above formulations, as implemented in the DOSFACTER code, are not directly applicable to the situation where the source is uniformly distributed within the soil. To approximate this situation, an additional term was added to Eq. (16) to convert the depth of a planar source into its equivalent air thickness. Because of the limited range of electrons in the soil, the source may be regarded as infinitely thick. Calculations were performed for a series of planar sources ranging from the surface to a depth beyond the range of the electrons and the results for a source distributed in the volume was then approximated by superposition of the results for the planar sources. The resulting coefficients for monoenergetic electron emitters on the surface and in the volume are seen in Fig. II.26.

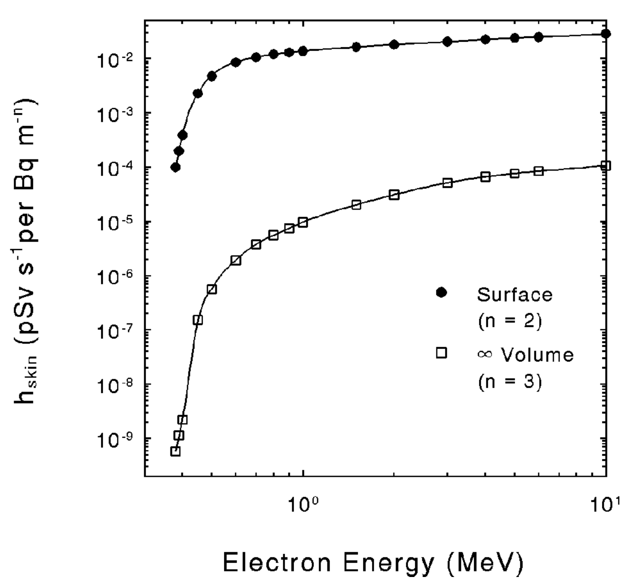

Fig. II.26. Electron skin dose coefficients for exposure to contaminated soil.

Dose coefficient formulation for radionuclides

The energies and intensities of the radiations emitted in spontaneous nuclear transformations of radionuclides have been reported in Publication 38 of the International Commission on Radiological Protection (ICRP, 1983). That publication, a report of the Task Group on Dose Calculations of ICRP Committee 2, was assembled at ORNL during the preparation of ICRP Publication 30 (ICRP, 1979). The nuclear decay data of Publication 38 are based on the Evaluated Nuclear Structure Data Files (ENSDF) (Ewbank and Schmorak, 1978) of the Department of Energy's Nuclear Data Project as processed by the EDISTR code (Dillman, 1980). The processed data files retained in the ICRP/ORNL dosimetric data base (Eckerman et al., 1993) include not only the full tabulations of the energies (average or unique) and intensities of the radiations, but also the beta spectra. The dose coefficients presented here are based on these data.

When electrons slow down in a medium, a small fraction of their initial kinetic energy is converted into energy in the form of photons called bremsstrahlung (from the German word for braking radiation). Bremsstrahlung energy is distributed from zero up to the initial electron energy. Although the bremsstrahlung yield is rather small (only about 0.2% for a 1.0 MeV electron in air), for pure beta emitters it can be the only source of radiations that are sufficiently penetrating to irradiate deeper-lying radiosensitive tissues. Appendix C discusses the manner in which the bremsstrahlung spectra were evaluated in this work.

Only photons, including bremsstrahlung, and electrons emitted by the radionuclides are sufficiently penetrating to contribute to the dose to tissues and organs of the body. The energy spectra of emitted radiations are either (1) discrete, as in the case of gamma emissions, or (2) continuous, as in the case of beta particles and bremsstrahlung. The beta spectra, from the ICRP/ORNL dosimetric data file, are used here to evaluate the contribution of the beta particles to the skin dose and to determine the yield of bremsstrahlung.

The dose coefficient h_T^S for tissue T for any exposure mode S can be expressed as

$$h_T^S = \sum_{j=e,\gamma} \left[\sum_i y_j(E_i)\, \hat{h}_{T,j}^S(E_i) + \int_o^\infty y_j(E)\, \hat{h}_{T,j}^S(E)\, dE \right] \qquad \textbf{(21)}$$

where $y_j(E_i)$ is the yield of discrete radiations of type j and energy E_i, and $y_j(E)$ denotes the yield of continuous radiations per nuclear transformation with energy between E and $E + dE$. The other summation is over all electron and photon radiations. Note that each radiation potentially has two components: (1) the discrete energy emissions, and (2) the continuous emissions. The contribution of the radiations to the dose in tissue or organ T is defined by the quantity $\hat{h}_T^S(E)$ which is tabulated as a function of energy for tissue and organ T for each exposure mode. In the case of the discrete emissions, a value appropriate to the energy of the discrete radiation being evaluated is obtained by interpolation. For photons, these data are tabulated for 25 target tissues of the body at each of 12 monoenergetic photon energies, while for electrons, values are tabulated only for the skin.

Relationship to Federal Guidance Report No. 11

Federal Guidance Report No. 11 (Eckerman, et al., 1988) contains dose coefficients for submersion exposure to noble gas radionuclides and elemental tritium. Those data, given in Table 2.3 of that report, were based on the dosimetric analysis of ICRP Publication 30 and are now replaced by the values in Table III.1 of this report. Below, we briefly discuss some of the differences between these two tabulations of dose coefficients.

The submersion coefficients for elemental tritium (^{3}H) and ^{37}Ar present in Table III.1 are taken from Table 2.3 of Federal Guidance Report No. 11. The coefficient for elemental tritium is based on the dose equivalent received by the lung due to elemental tritium within the airways of the lung after equilibration with the atmosphere. In a similar manner, the coefficient for ^{37}Ar is based on the activity in the airways. The elemental form of tritium and the noble gas ^{37}Ar do not deposit on the airways and thus do not represent an intake by inhalation. They also do not emit radiations sufficiently penetrating to irradiate the body as an external source. Note that the coefficient in Table III.1 is only for elemental tritium. For tritiated water vapor, the inhalation intake should be evaluated using the inhalation coefficients of Table 2.1 of Federal Guidance Report No. 11.

The methods used to compute the submersion coefficients of Table III.1 are an improvement upon those used to derive the values in Table 2.3 of Federal Guidance Report 11, although the numerical differences in the coefficients, particularly for the effective dose, are rather minor. We note the following differences in the computational methods:

Breast Tissue: In the earlier analysis, breast tissue was not represented in the anatomical model used to derive the submersion dose coefficients. The dose coefficient for muscle was used as a surrogate for breast tissue. This appears to have slightly underestimated the breast dose. The presence of breast tissue does increase the body's shielding of the lungs and therefore lowers the dose to the lung at low photon energies.

Skeletal Tissues: The dose coefficients for the skeletal tissues (red marrow and bone surfaces) in this work explicitly consider the deposition of energy in the skeletal tissues of interest by the secondary electrons liberated by photon interactions in the skeleton. In contrast, the earlier calculations assumed that the energy given to secondary electrons was partitioned among the various tissues of the skeleton according to their mass fractions. Consideration of energy deposition by secondary electrons results in lower dose estimates for the red marrow at low photon energies since the electrons are largely liberated by photoelectric interactions in the bone mineral and deposit much of their energy in this region rather than in the marrow spaces. For example, the ^{133}Xe coefficient for the active marrow in this report is more than a factor of three lower than the value in Federal Guidance Report No. 11.

Thyroid: The anatomical model has been modified to include a neck region and the thyroid has been moved to an appropriate position for external dosimetry. These changes obviously alter the amount of overlaying tissues shielding the thyroid. See Appendix B for further details.

Radiation Transport: The present coefficients are based on Monte Carlo radiation transport calculations with many more histories than the calculations for Federal Guidance Report No. 11. The new calculations have substantially reduced the statistical errors that were present in the earlier data for some organs of the body.

III. TABLES OF DOSE COEFFICIENTS

TABLE III.1

Dose Coefficients for Air Submersion*

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units. The coefficients are for air at a density of 1.2 kg m^{-3}.

h_T: The tissue dose equivalent coefficient for organ or tissue T (Sv per Bq s m^{-3}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-3}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

To convert to a source per unit mass basis (Sv per Bq s kg^{-1}), multiply table entries by 1.2 (kg m^{-3}).

To convert to conventional units (mrem per µCi y cm^{-3}), multiply table entries by 1.168×10^{23}.

To convert to conventional units for a source per unit mass basis (mrem per µCi y g^{-1}), multiply table entries by 1.401×10^{20}.

To derive coefficients for an air density other than 1.2 kg m^{-3}, multiply coefficients (in any units) by (1.2/ρ), where ρ is the air density in kg m^{-3}.

*These coefficients replace those presented in Table 2.3 of Federal Guidance Report No. 11 (Eckerman et al., 1988).

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3[1,2]	0.0	0.0	2.75E-18	0.0	0.0	0.0	0.0	3.31E-19	0.0
Beryllium									
Be-7	2.31E-15	2.64E-15	2.29E-15	2.20E-15	4.16E-15	2.35E-15	2.19E-15	2.36E-15	2.74E-15
Be-10	1.16E-17	1.40E-17	9.69E-18	8.24E-18	3.37E-17	1.10E-17	9.19E-18	1.12E-17	1.29E-14
Carbon									
C-11	4.78E-14	5.47E-14	4.75E-14	4.57E-14	8.43E-14	4.87E-14	4.53E-14	4.89E-14	7.91E-14
C-14	2.59E-19	3.52E-19	1.53E-19	1.21E-19	7.06E-19	2.19E-19	1.54E-19	2.24E-19	2.43E-16
Nitrogen									
N-13	4.78E-14	5.47E-14	4.75E-14	4.58E-14	8.44E-14	4.87E-14	4.54E-14	4.90E-14	8.68E-14
Oxygen									
O-15	4.79E-14	5.48E-14	4.76E-14	4.59E-14	8.46E-14	4.88E-14	4.54E-14	4.91E-14	1.04E-13
Fluorine									
F-18	4.79E-14	5.48E-14	4.76E-14	4.58E-14	8.45E-14	4.88E-14	4.54E-14	4.90E-14	6.94E-14
Neon									
Ne-19	4.81E-14	5.50E-14	4.77E-14	4.60E-14	8.49E-14	4.90E-14	4.56E-14	4.92E-14	1.21E-13
Sodium									
Na-22	1.06E-13	1.20E-13	1.06E-13	1.04E-13	1.66E-13	1.08E-13	1.02E-13	1.08E-13	1.33E-13
Na-24	2.12E-13	2.36E-13	2.16E-13	2.16E-13	2.87E-13	2.20E-13	2.10E-13	2.18E-13	2.75E-13
Magnesium									
Mg-28	6.64E-14	7.53E-14	6.64E-14	6.55E-14	9.97E-14	6.82E-14	6.40E-14	6.79E-14	8.33E-14
Aluminum									
Al-26	1.32E-13	1.49E-13	1.33E-13	1.32E-13	1.97E-13	1.36E-13	1.29E-13	1.36E-13	1.81E-13
Al-28	8.97E-14	1.01E-13	9.15E-14	9.13E-14	1.24E-13	9.28E-14	8.90E-14	9.28E-14	1.88E-13
Silicon									
Si-31	1.16E-16	1.35E-16	1.10E-16	1.03E-16	2.50E-16	1.16E-16	1.05E-16	1.17E-16	3.78E-14
Si-32	5.84E-19	7.66E-19	3.88E-19	3.10E-19	1.68E-18	5.11E-19	3.80E-19	5.24E-19	8.27E-16
Phosphorus									
P-30	4.83E-14	5.53E-14	4.80E-14	4.62E-14	8.53E-14	4.92E-14	4.58E-14	4.94E-14	1.56E-13
P-32	9.89E-17	1.16E-16	9.08E-17	8.19E-17	2.48E-16	9.73E-17	8.60E-17	9.90E-17	4.49E-14
P-33	9.02E-19	1.17E-18	6.30E-19	5.06E-19	2.64E-18	8.01E-19	6.11E-19	8.23E-19	1.38E-15
Sulphur									
S-35	2.78E-19	3.76E-19	1.68E-19	1.34E-19	7.67E-19	2.37E-19	1.68E-19	2.43E-19	2.92E-16
Chlorine									
Cl-36	2.24E-17	2.66E-17	2.02E-17	1.81E-17	5.63E-17	2.19E-17	1.92E-17	2.23E-17	1.47E-14
Cl-38	7.61E-14	8.56E-14	7.77E-14	7.77E-14	1.05E-13	7.89E-14	7.56E-14	7.87E-14	1.94E-13
Cl-39	7.09E-14	8.03E-14	7.14E-14	7.06E-14	1.06E-13	7.30E-14	6.90E-14	7.29E-14	1.36E-13
Argon									
Ar-37[2]	0.0	0.0	1.06E-18	0.0	0.0	0.0	0.0	1.27E-19	0.0
Ar-39	9.38E-18	1.14E-17	7.82E-18	6.63E-18	2.74E-17	8.87E-18	7.42E-18	9.10E-18	1.07E-14
Ar-41	6.33E-14	7.16E-14	6.38E-14	6.32E-14	9.08E-14	6.52E-14	6.16E-14	6.50E-14	1.01E-13
Potassium									
K-38	1.59E-13	1.79E-13	1.61E-13	1.60E-13	2.35E-13	1.64E-13	1.56E-13	1.64E-13	2.66E-13
K-40	7.81E-15	8.84E-15	7.91E-15	7.86E-15	1.11E-14	8.07E-15	7.66E-15	8.05E-15	4.20E-14
K-42	1.42E-14	1.60E-14	1.44E-14	1.43E-14	2.03E-14	1.46E-14	1.39E-14	1.46E-14	1.15E-13
K-43	4.57E-14	5.22E-14	4.53E-14	4.36E-14	8.13E-14	4.65E-14	4.32E-14	4.67E-14	7.11E-14
K-44	1.16E-13	1.30E-13	1.17E-13	1.17E-13	1.61E-13	1.20E-13	1.14E-13	1.19E-13	2.35E-13
K-45	9.37E-14	1.06E-13	9.51E-14	9.45E-14	1.37E-13	9.68E-14	9.23E-14	9.67E-14	1.74E-13
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	9.44E-19	1.22E-18	6.64E-19	5.34E-19	2.77E-18	8.40E-19	6.43E-19	8.63E-19	1.46E-15
Ca-47	5.22E-14	5.91E-14	5.26E-14	5.21E-14	7.59E-14	5.38E-14	5.07E-14	5.36E-14	8.02E-14
Ca-49	1.68E-13	1.85E-13	1.71E-13	1.73E-13	2.20E-13	1.76E-13	1.67E-13	1.73E-13	2.46E-13
Scandium									
Sc-43	5.13E-14	5.87E-14	5.09E-14	4.89E-14	9.30E-14	5.23E-14	4.86E-14	5.26E-14	7.91E-14
Sc-44m	1.32E-14	1.51E-14	1.30E-14	1.23E-14	2.73E-14	1.34E-14	1.23E-14	1.35E-14	1.72E-14
Sc-44	1.03E-13	1.17E-13	1.03E-13	1.00E-13	1.64E-13	1.05E-13	9.84E-14	1.05E-13	1.58E-13
Sc-46	9.77E-14	1.11E-13	9.76E-14	9.62E-14	1.46E-13	1.00E-13	9.38E-14	9.98E-14	1.17E-13
Sc-47	5.03E-15	5.78E-15	4.82E-15	4.36E-15	1.35E-14	5.03E-15	4.53E-15	5.14E-15	1.28E-14
Sc-48	1.64E-13	1.85E-13	1.64E-13	1.62E-13	2.41E-13	1.68E-13	1.58E-13	1.68E-13	2.01E-13
Sc-49	1.91E-16	2.21E-16	1.82E-16	1.70E-16	4.10E-16	1.91E-16	1.74E-16	1.93E-16	5.43E-14

[1] Elemental form of tritium

[2] Taken from Table 2.3, Federal Guidance Report No. 11 (Eckerman et al., 1988)

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	5.55E-15	6.58E-15	4.89E-15	3.93E-15	1.91E-14	5.29E-15	4.54E-15	5.53E-15	6.79E-15
Ti-45	4.08E-14	4.67E-14	4.05E-14	3.91E-14	7.20E-14	4.16E-14	3.87E-14	4.18E-14	7.07E-14
Vanadium									
V-47	4.68E-14	5.35E-14	4.65E-14	4.48E-14	8.24E-14	4.77E-14	4.44E-14	4.79E-14	1.08E-13
V-48	1.42E-13	1.61E-13	1.42E-13	1.40E-13	2.14E-13	1.46E-13	1.37E-13	1.45E-13	1.72E-13
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	2.02E-14	2.32E-14	1.96E-14	1.82E-14	4.70E-14	2.03E-14	1.86E-14	2.06E-14	2.40E-14
Cr-49	4.92E-14	5.64E-14	4.86E-14	4.64E-14	9.30E-14	5.00E-14	4.63E-14	5.03E-14	9.65E-14
Cr-51	1.47E-15	1.69E-15	1.45E-15	1.37E-15	3.04E-15	1.49E-15	1.38E-15	1.51E-15	1.75E-15
Manganese									
Mn-51	4.69E-14	5.37E-14	4.66E-14	4.49E-14	8.28E-14	4.78E-14	4.45E-14	4.80E-14	1.18E-13
Mn-52m	1.17E-13	1.33E-13	1.17E-13	1.15E-13	1.82E-13	1.20E-13	1.13E-13	1.20E-13	2.13E-13
Mn-52	1.68E-13	1.91E-13	1.69E-13	1.66E-13	2.53E-13	1.73E-13	1.62E-13	1.72E-13	1.99E-13
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	4.01E-14	4.55E-14	4.00E-14	3.91E-14	6.23E-14	4.11E-14	3.83E-14	4.09E-14	4.67E-14
Mn-56	8.37E-14	9.46E-14	8.45E-14	8.37E-14	1.22E-13	8.64E-14	8.17E-14	8.61E-14	1.51E-13
Iron									
Fe-52	3.46E-14	3.96E-14	3.41E-14	3.25E-14	6.77E-14	3.51E-14	3.25E-14	3.54E-14	5.17E-14
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-59	5.83E-14	6.59E-14	5.85E-14	5.79E-14	8.51E-14	6.00E-14	5.64E-14	5.97E-14	7.13E-14
Fe-60	2.28E-19	3.13E-19	1.29E-19	1.02E-19	6.07E-19	1.90E-19	1.31E-19	1.95E-19	1.64E-16
Cobalt									
Co-55	9.56E-14	1.09E-13	9.54E-14	9.31E-14	1.54E-13	9.79E-14	9.15E-14	9.78E-14	1.39E-13
Co-56	1.78E-13	2.01E-13	1.80E-13	1.79E-13	2.57E-13	1.84E-13	1.74E-13	1.83E-13	2.13E-13
Co-57	5.47E-15	6.36E-15	5.21E-15	4.59E-15	1.63E-14	5.46E-15	4.87E-15	5.61E-15	6.63E-15
Co-58m	1.22E-19	1.88E-19	2.91E-20	3.10E-20	2.03E-19	9.01E-20	4.30E-20	8.77E-20	3.05E-19
Co-58	4.66E-14	5.30E-14	4.64E-14	4.53E-14	7.41E-14	4.77E-14	4.44E-14	4.76E-14	5.58E-14
Co-60m	2.14E-16	2.46E-16	2.07E-16	1.97E-16	3.99E-16	2.16E-16	1.98E-16	2.17E-16	3.46E-16
Co-60	1.23E-13	1.39E-13	1.24E-13	1.23E-13	1.78E-13	1.27E-13	1.20E-13	1.26E-13	1.45E-13
Co-61	3.94E-15	4.61E-15	3.60E-15	3.14E-15	1.06E-14	3.84E-15	3.39E-15	3.94E-15	3.24E-14
Co-62m	1.34E-13	1.51E-13	1.35E-13	1.34E-13	1.92E-13	1.38E-13	1.30E-13	1.37E-13	2.25E-13
Nickel									
Ni-56	8.22E-14	9.35E-14	8.17E-14	7.92E-14	1.40E-13	8.40E-14	7.82E-14	8.41E-14	9.61E-14
Ni-57	9.42E-14	1.07E-13	9.51E-14	9.39E-14	1.41E-13	9.70E-14	9.18E-14	9.69E-14	1.17E-13
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	2.72E-14	3.07E-14	2.74E-14	2.72E-14	3.93E-14	2.80E-14	2.65E-14	2.79E-14	7.18E-14
Ni-66	6.80E-19	8.86E-19	4.64E-19	3.71E-19	1.98E-18	6.00E-19	4.52E-19	6.16E-19	1.01E-15
Copper									
Cu-60	1.92E-13	2.17E-13	1.94E-13	1.92E-13	2.86E-13	1.98E-13	1.87E-13	1.98E-13	2.82E-13
Cu-61	3.90E-14	4.45E-14	3.87E-14	3.73E-14	6.82E-14	3.97E-14	3.70E-14	3.99E-14	6.50E-14
Cu-62	4.75E-14	5.44E-14	4.72E-14	4.55E-14	8.38E-14	4.84E-14	4.51E-14	4.86E-14	1.44E-13
Cu-64	8.89E-15	1.02E-14	8.84E-15	8.52E-15	1.56E-14	9.06E-15	8.44E-15	9.10E-15	1.64E-14
Cu-66	4.37E-15	4.95E-15	4.35E-15	4.27E-15	6.68E-15	4.48E-15	4.18E-15	4.46E-15	7.69E-14
Cu-67	5.30E-15	6.10E-15	5.06E-15	4.59E-15	1.40E-14	5.29E-15	4.77E-15	5.41E-15	1.18E-14
Zinc									
Zn-62	2.03E-14	2.32E-14	2.00E-14	1.93E-14	3.58E-14	2.06E-14	1.91E-14	2.07E-14	2.52E-14
Zn-63	5.19E-14	5.93E-14	5.16E-14	4.99E-14	9.00E-14	5.30E-14	4.93E-14	5.32E-14	1.23E-13
Zn-65	2.84E-14	3.21E-14	2.84E-14	2.80E-14	4.18E-14	2.92E-14	2.73E-14	2.90E-14	3.29E-14
Zn-69m	1.95E-14	2.23E-14	1.93E-14	1.85E-14	3.60E-14	1.98E-14	1.84E-14	1.99E-14	2.44E-14
Zn-69	2.19E-17	2.62E-17	1.91E-17	1.66E-17	6.09E-17	2.11E-17	1.81E-17	2.16E-17	1.81E-14
Zn-71m	7.33E-14	8.36E-14	7.27E-14	7.03E-14	1.28E-13	7.47E-14	6.95E-14	7.50E-14	1.21E-13
Zn-72	6.74E-15	7.79E-15	6.44E-15	5.78E-15	1.88E-14	6.74E-15	6.05E-15	6.90E-15	1.00E-14
Gallium									
Ga-65	5.52E-14	6.32E-14	5.47E-14	5.25E-14	1.01E-13	5.62E-14	5.22E-14	5.65E-14	1.19E-13
Ga-66	1.26E-13	1.40E-13	1.27E-13	1.26E-13	1.82E-13	1.30E-13	1.23E-13	1.29E-13	2.11E-13
Ga-67	7.05E-15	8.12E-15	6.79E-15	6.22E-15	1.75E-14	7.06E-15	6.41E-15	7.20E-15	8.50E-15
Ga-68	4.47E-14	5.11E-14	4.44E-14	4.29E-14	7.84E-14	4.56E-14	4.24E-14	4.58E-14	1.01E-13
Ga-70	4.55E-16	5.19E-16	4.46E-16	4.31E-16	7.93E-16	4.63E-16	4.27E-16	4.62E-16	4.17E-14
Ga-72	1.35E-13	1.52E-13	1.36E-13	1.35E-13	1.95E-13	1.39E-13	1.32E-13	1.39E-13	1.86E-13
Ga-73	1.45E-14	1.66E-14	1.42E-14	1.35E-14	3.01E-14	1.47E-14	1.35E-14	1.48E-14	4.37E-14

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	3.18E-14	3.64E-14	3.13E-14	3.00E-14	5.98E-14	3.23E-14	2.99E-14	3.25E-14	4.26E-14
Ge-67	6.70E-14	7.64E-14	6.65E-14	6.42E-14	1.19E-13	6.83E-14	6.36E-14	6.86E-14	1.68E-13
Ge-68	4.77E-20	3.33E-19	2.59E-22	1.33E-20	7.11E-20	3.74E-21	2.68E-20	7.37E-20	6.62E-18
Ge-69	4.17E-14	4.74E-14	4.16E-14	4.06E-14	6.72E-14	4.27E-14	3.99E-14	4.27E-14	5.96E-14
Ge-71	4.83E-20	3.37E-19	2.62E-22	1.35E-20	7.20E-20	3.78E-21	2.71E-20	7.47E-20	6.71E-18
Ge-75	1.64E-15	1.88E-15	1.60E-15	1.50E-15	3.60E-15	1.65E-15	1.52E-15	1.68E-15	2.71E-14
Ge-77	5.20E-14	5.92E-14	5.16E-14	4.99E-14	9.28E-14	5.31E-14	4.94E-14	5.32E-14	1.02E-13
Ge-78	1.31E-14	1.49E-14	1.27E-14	1.20E-14	2.83E-14	1.32E-14	1.21E-14	1.34E-14	2.75E-14
Arsenic									
As-69	4.77E-14	5.46E-14	4.74E-14	4.56E-14	8.51E-14	4.86E-14	4.52E-14	4.89E-14	1.43E-13
As-70	1.99E-13	2.26E-13	2.00E-13	1.97E-13	3.06E-13	2.05E-13	1.92E-13	2.04E-13	2.89E-13
As-71	2.68E-14	3.06E-14	2.64E-14	2.52E-14	5.24E-14	2.72E-14	2.51E-14	2.74E-14	3.78E-14
As-72	8.58E-14	9.77E-14	8.55E-14	8.33E-14	1.41E-13	8.78E-14	8.19E-14	8.78E-14	1.70E-13
As-73	2.00E-16	2.48E-16	1.56E-16	1.17E-16	6.79E-16	1.83E-16	1.46E-16	1.90E-16	2.78E-16
As-74	3.56E-14	4.07E-14	3.54E-14	3.43E-14	6.10E-14	3.64E-14	3.39E-14	3.65E-14	5.80E-14
As-76	2.08E-14	2.37E-14	2.08E-14	2.03E-14	3.39E-14	2.13E-14	1.99E-14	2.13E-14	9.61E-14
As-77	4.22E-16	4.84E-16	4.11E-16	3.88E-16	9.01E-16	4.26E-16	3.91E-16	4.31E-16	1.20E-14
As-78	6.16E-14	6.97E-14	6.19E-14	6.09E-14	9.35E-14	6.33E-14	5.96E-14	6.32E-14	1.65E-13
Selenium									
Se-70	4.63E-14	5.30E-14	4.57E-14	4.38E-14	8.50E-14	4.70E-14	4.36E-14	4.73E-14	8.36E-14
Se-73m	1.14E-14	1.30E-14	1.13E-14	1.09E-14	2.02E-14	1.16E-14	1.08E-14	1.17E-14	2.39E-14
Se-73	5.05E-14	5.78E-14	4.97E-14	4.74E-14	9.59E-14	5.12E-14	4.74E-14	5.16E-14	8.31E-14
Se-75	1.81E-14	2.08E-14	1.75E-14	1.63E-14	4.26E-14	1.82E-14	1.66E-14	1.85E-14	2.16E-14
Se-77m	3.94E-15	4.53E-15	3.77E-15	3.43E-15	1.05E-14	3.94E-15	3.55E-15	4.03E-15	6.99E-15
Se-79	3.47E-19	4.67E-19	2.11E-19	1.67E-19	9.60E-19	2.96E-19	2.10E-19	3.03E-19	3.71E-16
Se-81m	6.05E-16	7.10E-16	5.67E-16	4.88E-16	1.91E-15	5.97E-16	5.29E-16	6.18E-16	1.40E-15
Se-81	5.15E-16	5.90E-16	5.02E-16	4.77E-16	1.02E-15	5.21E-16	4.78E-16	5.24E-16	3.94E-14
Se-83	1.18E-13	1.34E-13	1.18E-13	1.16E-13	1.86E-13	1.21E-13	1.14E-13	1.21E-13	1.69E-13
Bromine									
Br-74m	2.02E-13	2.28E-13	2.03E-13	2.01E-13	3.07E-13	2.09E-13	1.96E-13	2.08E-13	3.31E-13
Br-74	2.32E-13	2.58E-13	2.34E-13	2.33E-13	3.36E-13	2.41E-13	2.27E-13	2.38E-13	3.40E-13
Br-75	5.71E-14	6.53E-14	5.65E-14	5.42E-14	1.05E-13	5.81E-14	5.39E-14	5.84E-14	1.01E-13
Br-76	1.30E-13	1.47E-13	1.31E-13	1.29E-13	1.97E-13	1.34E-13	1.26E-13	1.34E-13	1.97E-13
Br-77	1.48E-14	1.69E-14	1.46E-14	1.40E-14	2.78E-14	1.51E-14	1.39E-14	1.51E-14	1.77E-14
Br-80m	3.71E-16	5.00E-16	2.06E-16	1.49E-16	9.82E-16	3.10E-16	2.07E-16	3.11E-16	7.13E-16
Br-80	3.76E-15	4.30E-15	3.74E-15	3.62E-15	6.40E-15	3.84E-15	3.58E-15	3.85E-15	2.02E-14
Br-82	1.27E-13	1.44E-13	1.27E-13	1.24E-13	1.99E-13	1.30E-13	1.22E-13	1.30E-13	1.54E-13
Br-83	3.74E-16	4.29E-16	3.69E-16	3.54E-16	6.75E-16	3.80E-16	3.52E-16	3.82E-16	1.85E-14
Br-84	9.16E-14	1.02E-13	9.27E-14	9.26E-14	1.28E-13	9.50E-14	8.99E-14	9.41E-14	1.88E-13
Krypton									
Kr-74	5.46E-14	6.26E-14	5.39E-14	5.15E-14	1.04E-13	5.55E-14	5.14E-14	5.59E-14	1.16E-13
Kr-76	1.99E-14	2.28E-14	1.95E-14	1.85E-14	4.04E-14	2.01E-14	1.85E-14	2.03E-14	2.37E-14
Kr-77	4.74E-14	5.44E-14	4.68E-14	4.46E-14	9.25E-14	4.82E-14	4.46E-14	4.86E-14	9.74E-14
Kr-79	1.18E-14	1.35E-14	1.17E-14	1.12E-14	2.18E-14	1.20E-14	1.12E-14	1.21E-14	1.50E-14
Kr-81m	6.01E-15	6.89E-15	5.78E-15	5.32E-15	1.50E-14	6.03E-15	5.46E-15	6.14E-15	9.42E-15
Kr-81	2.62E-16	3.06E-16	2.53E-16	2.39E-16	5.66E-16	2.62E-16	2.41E-16	2.67E-16	4.04E-16
Kr-83m	1.71E-18	5.05E-18	1.64E-19	3.83E-19	2.25E-18	6.43E-19	5.30E-19	1.50E-18	3.56E-17
Kr-85m	7.31E-15	8.41E-15	7.04E-15	6.43E-15	1.88E-14	7.33E-15	6.64E-15	7.48E-15	2.24E-14
Kr-85	1.17E-16	1.34E-16	1.14E-16	1.09E-16	2.20E-16	1.18E-16	1.09E-16	1.19E-16	1.32E-14
Kr-87	4.00E-14	4.50E-14	4.04E-14	4.00E-14	6.02E-14	4.13E-14	3.91E-14	4.12E-14	1.37E-13
Kr-88	9.90E-14	1.11E-13	1.01E-13	1.00E-13	1.39E-13	1.03E-13	9.79E-14	1.02E-13	1.35E-13
Rubidium									
Rb-79	6.36E-14	7.28E-14	6.31E-14	6.06E-14	1.15E-13	6.48E-14	6.02E-14	6.51E-14	1.28E-13
Rb-80	5.93E-14	6.78E-14	5.89E-14	5.68E-14	1.04E-13	6.05E-14	5.63E-14	6.07E-14	2.11E-13
Rb-81m	1.87E-16	2.30E-16	1.66E-16	1.38E-16	6.17E-16	1.78E-16	1.55E-16	1.88E-16	4.01E-16
Rb-81	2.89E-14	3.31E-14	2.85E-14	2.72E-14	5.53E-14	2.93E-14	2.72E-14	2.96E-14	4.46E-14
Rb-82m	1.40E-13	1.59E-13	1.40E-13	1.37E-13	2.19E-13	1.43E-13	1.34E-13	1.43E-13	1.68E-13
Rb-82	5.18E-14	5.92E-14	5.14E-14	4.96E-14	9.03E-14	5.28E-14	4.91E-14	5.30E-14	1.58E-13
Rb-83	2.33E-14	2.67E-14	2.32E-14	2.24E-14	4.06E-14	2.38E-14	2.21E-14	2.39E-14	2.77E-14
Rb-84	4.37E-14	4.97E-14	4.36E-14	4.25E-14	6.99E-14	4.48E-14	4.17E-14	4.47E-14	5.71E-14
Rb-86	4.71E-15	5.34E-15	4.71E-15	4.64E-15	7.05E-15	4.84E-15	4.52E-15	4.81E-15	4.85E-14
Rb-87	1.96E-18	2.48E-18	1.45E-18	1.18E-18	5.84E-18	1.77E-18	1.39E-18	1.82E-18	3.15E-15

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	3.26E-14	3.67E-14	3.31E-14	3.30E-14	4.62E-14	3.37E-14	3.21E-14	3.36E-14	1.83E-13
Rb-89	1.03E-13	1.17E-13	1.04E-13	1.04E-13	1.48E-13	1.07E-13	1.01E-13	1.06E-13	1.87E-13
Strontium									
Sr-80	7.92E-18	2.31E-17	9.28E-20	1.48E-18	8.27E-18	2.63E-18	1.90E-18	6.53E-18	1.44E-16
Sr-81	6.53E-14	7.46E-14	6.46E-14	6.20E-14	1.20E-13	6.64E-14	6.16E-14	6.68E-14	1.44E-13
Sr-82	7.79E-18	2.27E-17	9.13E-20	1.46E-18	8.13E-18	2.58E-18	1.87E-18	6.43E-18	1.42E-16
Sr-83	3.77E-14	4.29E-14	3.75E-14	3.65E-14	6.25E-14	3.85E-14	3.60E-14	3.86E-14	5.20E-14
Sr-85m	1.02E-14	1.17E-14	9.91E-15	9.24E-15	2.41E-14	1.03E-14	9.39E-15	1.05E-14	1.23E-14
Sr-85	2.36E-14	2.70E-14	2.34E-14	2.26E-14	4.16E-14	2.41E-14	2.24E-14	2.42E-14	2.83E-14
Sr-87m	1.49E-14	1.71E-14	1.47E-14	1.40E-14	2.87E-14	1.51E-14	1.40E-14	1.52E-14	2.15E-14
Sr-89	7.73E-17	9.08E-17	7.08E-17	6.39E-17	1.94E-16	7.60E-17	6.71E-17	7.73E-17	3.69E-14
Sr-90	7.78E-18	9.49E-18	6.44E-18	5.44E-18	2.28E-17	7.33E-18	6.11E-18	7.53E-18	9.20E-15
Sr-91	3.38E-14	3.83E-14	3.37E-14	3.31E-14	5.20E-14	3.47E-14	3.24E-14	3.45E-14	8.14E-14
Sr-92	6.61E-14	7.48E-14	6.67E-14	6.62E-14	9.49E-14	6.82E-14	6.45E-14	6.79E-14	8.56E-14
Yttrium									
Y-86m	1.03E-14	1.18E-14	1.00E-14	9.35E-15	2.39E-14	1.04E-14	9.50E-15	1.06E-14	1.28E-14
Y-86	1.75E-13	1.98E-13	1.76E-13	1.73E-13	2.65E-13	1.80E-13	1.69E-13	1.79E-13	2.17E-13
Y-87	2.10E-14	2.40E-14	2.08E-14	2.00E-14	3.76E-14	2.14E-14	1.99E-14	2.15E-14	2.51E-14
Y-88	1.33E-13	1.51E-13	1.35E-13	1.34E-13	1.90E-13	1.38E-13	1.31E-13	1.37E-13	1.54E-13
Y-90m	2.94E-14	3.36E-14	2.89E-14	2.75E-14	5.86E-14	2.98E-14	2.75E-14	3.01E-14	3.75E-14
Y-90	1.89E-16	2.20E-16	1.77E-16	1.62E-16	4.44E-16	1.87E-16	1.68E-16	1.90E-16	6.24E-14
Y-91m	2.49E-14	2.85E-14	2.48E-14	2.39E-14	4.28E-14	2.54E-14	2.37E-14	2.55E-14	3.11E-14
Y-91	2.56E-16	2.93E-16	2.50E-16	2.41E-16	4.56E-16	2.60E-16	2.39E-16	2.60E-16	3.85E-14
Y-92	1.27E-14	1.44E-14	1.27E-14	1.25E-14	1.95E-14	1.30E-14	1.22E-14	1.30E-14	1.14E-13
Y-93	4.67E-15	5.30E-15	4.68E-15	4.58E-15	7.58E-15	4.79E-15	4.51E-15	4.80E-15	8.50E-14
Y-94	5.49E-14	6.21E-14	5.50E-14	5.42E-14	8.22E-14	5.65E-14	5.30E-14	5.62E-14	1.80E-13
Y-95	4.65E-14	5.19E-14	4.72E-14	4.73E-14	6.41E-14	4.84E-14	4.59E-14	4.79E-14	1.59E-13
Zirconium									
Zr-86	1.26E-14	1.44E-14	1.22E-14	1.14E-14	2.76E-14	1.26E-14	1.16E-14	1.28E-14	1.56E-14
Zr-88	1.84E-14	2.11E-14	1.81E-14	1.73E-14	3.52E-14	1.86E-14	1.73E-14	1.88E-14	2.26E-14
Zr-89	5.56E-14	6.32E-14	5.54E-14	5.43E-14	8.73E-14	5.70E-14	5.31E-14	5.68E-14	7.07E-14
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	3.53E-14	4.01E-14	3.51E-14	3.43E-14	5.62E-14	3.61E-14	3.36E-14	3.60E-14	4.50E-14
Zr-97	8.80E-15	9.99E-15	8.81E-15	8.64E-15	1.38E-14	9.03E-15	8.48E-15	9.02E-15	5.55E-14
Niobium									
Nb-88	1.98E-13	2.25E-13	1.97E-13	1.92E-13	3.20E-13	2.02E-13	1.88E-13	2.02E-13	3.12E-13
Nb-89b[1]	6.80E-14	7.70E-14	6.82E-14	6.69E-14	1.08E-13	6.99E-14	6.57E-14	6.98E-14	1.56E-13
Nb-89a[2]	9.05E-14	1.03E-13	8.99E-14	8.69E-14	1.57E-13	9.23E-14	8.59E-14	9.26E-14	1.63E-13
Nb-90	2.11E-13	2.37E-13	2.13E-13	2.12E-13	3.08E-13	2.18E-13	2.07E-13	2.17E-13	2.66E-13
Nb-93m	6.33E-18	1.31E-17	2.55E-19	1.18E-18	6.92E-18	3.43E-18	1.36E-18	4.44E-18	4.28E-17
Nb-94	7.54E-14	8.57E-14	7.51E-14	7.34E-14	1.19E-13	7.72E-14	7.19E-14	7.70E-14	9.52E-14
Nb-95m	2.88E-15	3.31E-15	2.77E-15	2.59E-15	6.60E-15	2.89E-15	2.63E-15	2.93E-15	1.12E-14
Nb-95	3.66E-14	4.16E-14	3.65E-14	3.56E-14	5.79E-14	3.75E-14	3.49E-14	3.74E-14	4.30E-14
Nb-96	1.19E-13	1.35E-13	1.19E-13	1.16E-13	1.87E-13	1.22E-13	1.14E-13	1.21E-13	1.52E-13
Nb-97m	3.47E-14	3.95E-14	3.46E-14	3.38E-14	5.54E-14	3.56E-14	3.31E-14	3.55E-14	4.16E-14
Nb-97	3.11E-14	3.55E-14	3.10E-14	3.01E-14	5.11E-14	3.18E-14	2.96E-14	3.18E-14	6.51E-14
Nb-98	1.18E-13	1.34E-13	1.18E-13	1.16E-13	1.81E-13	1.21E-13	1.13E-13	1.21E-13	1.96E-13
Molybdenum									
Mo-90	3.85E-14	4.40E-14	3.79E-14	3.61E-14	7.50E-14	3.91E-14	3.61E-14	3.93E-14	5.52E-14
Mo-93m	1.10E-13	1.24E-13	1.10E-13	1.09E-13	1.67E-13	1.13E-13	1.07E-13	1.13E-13	1.32E-13
Mo-93	3.59E-17	7.46E-17	1.44E-18	6.69E-18	3.93E-17	1.95E-17	7.74E-18	2.52E-17	2.43E-16
Mo-99	7.13E-15	8.13E-15	7.06E-15	6.82E-15	1.24E-14	7.27E-15	6.74E-15	7.28E-15	3.14E-14
Mo-101	6.69E-14	7.58E-14	6.72E-14	6.62E-14	1.02E-13	6.88E-14	6.48E-14	6.87E-14	1.14E-13
Technetium									
Tc-93m	3.62E-14	4.07E-14	3.66E-14	3.63E-14	5.47E-14	3.75E-14	3.55E-14	3.73E-14	4.62E-14
Tc-93	7.17E-14	8.12E-14	7.25E-14	7.21E-14	1.02E-13	7.40E-14	7.02E-14	7.38E-14	8.30E-14
Tc-94m	8.96E-14	1.02E-13	8.96E-14	8.77E-14	1.42E-13	9.19E-14	8.60E-14	9.18E-14	1.55E-13
Tc-94	1.28E-13	1.45E-13	1.27E-13	1.24E-13	2.00E-13	1.31E-13	1.22E-13	1.30E-13	1.51E-13
Tc-95m	3.16E-14	3.60E-14	3.12E-14	3.02E-14	5.55E-14	3.22E-14	2.98E-14	3.23E-14	3.76E-14

[1] $T_{½}$ = 122 m

[2] $T_{½}$ = 66 m

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Technetium, cont'd									
Tc-95	3.76E-14	4.28E-14	3.74E-14	3.66E-14	5.93E-14	3.85E-14	3.58E-14	3.84E-14	4.42E-14
Tc-96m	2.20E-15	2.52E-15	2.17E-15	2.13E-15	3.36E-15	2.24E-15	2.08E-15	2.24E-15	2.68E-15
Tc-96	1.20E-13	1.36E-13	1.19E-13	1.17E-13	1.87E-13	1.23E-13	1.14E-13	1.22E-13	1.40E-13
Tc-97m	6.10E-17	1.05E-16	1.60E-17	1.99E-17	1.00E-16	4.26E-17	2.26E-17	4.64E-17	5.55E-16
Tc-97	4.79E-17	9.44E-17	2.66E-18	9.13E-18	5.43E-17	2.79E-17	1.08E-17	3.33E-17	2.71E-16
Tc-98	6.72E-14	7.65E-14	6.69E-14	6.52E-14	1.09E-13	6.87E-14	6.40E-14	6.86E-14	8.53E-14
Tc-99m	5.75E-15	6.65E-15	5.49E-15	4.91E-15	1.63E-14	5.75E-15	5.15E-15	5.89E-15	7.14E-15
Tc-99	1.74E-18	2.20E-18	1.29E-18	1.05E-18	5.17E-18	1.57E-18	1.24E-18	1.62E-18	2.74E-15
Tc-101	1.57E-14	1.80E-14	1.54E-14	1.46E-14	3.21E-14	1.59E-14	1.47E-14	1.61E-14	4.77E-14
Tc-104	9.83E-14	1.11E-13	9.90E-14	9.76E-14	1.51E-13	1.01E-13	9.55E-14	1.01E-13	2.25E-13
Ruthenium									
Ru-94	2.49E-14	2.84E-14	2.46E-14	2.38E-14	4.33E-14	2.53E-14	2.35E-14	2.54E-14	2.95E-14
Ru-97	1.07E-14	1.23E-14	1.03E-14	9.65E-15	2.46E-14	1.08E-14	9.79E-15	1.09E-14	1.32E-14
Ru-103	2.19E-14	2.51E-14	2.18E-14	2.10E-14	3.89E-14	2.24E-14	2.08E-14	2.25E-14	2.77E-14
Ru-105	3.72E-14	4.24E-14	3.70E-14	3.59E-14	6.28E-14	3.80E-14	3.54E-14	3.81E-14	6.73E-14
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	3.22E-14	3.67E-14	3.19E-14	3.10E-14	5.52E-14	3.28E-14	3.06E-14	3.29E-14	3.94E-14
Rh-99	2.79E-14	3.19E-14	2.74E-14	2.62E-14	5.24E-14	2.83E-14	2.62E-14	2.85E-14	3.42E-14
Rh-100	1.37E-13	1.54E-13	1.38E-13	1.37E-13	2.00E-13	1.41E-13	1.34E-13	1.41E-13	1.63E-13
Rh-101m	1.38E-14	1.59E-14	1.35E-14	1.28E-14	2.85E-14	1.40E-14	1.28E-14	1.41E-14	1.71E-14
Rh-101	1.18E-14	1.37E-14	1.13E-14	1.04E-14	3.00E-14	1.18E-14	1.07E-14	1.21E-14	1.49E-14
Rh-102m	2.26E-14	2.58E-14	2.24E-14	2.16E-14	3.92E-14	2.30E-14	2.14E-14	2.31E-14	3.68E-14
Rh-102	1.02E-13	1.16E-13	1.01E-13	9.85E-14	1.65E-13	1.04E-13	9.67E-14	1.04E-13	1.19E-13
Rh-103m	1.25E-17	2.15E-17	1.87E-18	2.82E-18	1.76E-17	8.55E-18	3.68E-18	8.80E-18	4.49E-17
Rh-105	3.64E-15	4.16E-15	3.57E-15	3.38E-15	7.53E-15	3.68E-15	3.39E-15	3.72E-15	1.07E-14
Rh-106m	1.41E-13	1.60E-13	1.41E-13	1.38E-13	2.22E-13	1.44E-13	1.35E-13	1.44E-13	1.81E-13
Rh-106	1.01E-14	1.16E-14	1.01E-14	9.75E-15	1.72E-14	1.03E-14	9.63E-15	1.04E-14	1.09E-13
Rh-107	1.47E-14	1.68E-14	1.44E-14	1.37E-14	2.99E-14	1.49E-14	1.37E-14	1.50E-14	4.42E-14
Palladium									
Pd-100	4.67E-15	5.60E-15	4.09E-15	3.40E-15	1.53E-14	4.47E-15	3.83E-15	4.65E-15	6.11E-15
Pd-101	1.50E-14	1.72E-14	1.47E-14	1.42E-14	2.61E-14	1.52E-14	1.41E-14	1.53E-14	1.94E-14
Pd-103	1.08E-16	1.86E-16	1.74E-17	2.66E-17	1.46E-16	7.45E-17	3.30E-17	7.68E-17	3.90E-16
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	2.71E-16	3.52E-16	1.94E-16	1.74E-16	7.02E-16	2.46E-16	1.92E-16	2.51E-16	2.15E-14
Silver									
Ag-102	1.63E-13	1.85E-13	1.64E-13	1.61E-13	2.54E-13	1.67E-13	1.57E-13	1.67E-13	2.45E-13
Ag-103	3.59E-14	4.10E-14	3.56E-14	3.44E-14	6.35E-14	3.66E-14	3.41E-14	3.68E-14	5.84E-14
Ag-104m	5.67E-14	6.43E-14	5.68E-14	5.56E-14	9.14E-14	5.82E-14	5.46E-14	5.82E-14	1.00E-13
Ag-104	1.29E-13	1.46E-13	1.29E-13	1.26E-13	2.02E-13	1.32E-13	1.23E-13	1.32E-13	1.56E-13
Ag-105	2.40E-14	2.75E-14	2.36E-14	2.26E-14	4.54E-14	2.44E-14	2.25E-14	2.45E-14	2.90E-14
Ag-106m	1.35E-13	1.54E-13	1.35E-13	1.32E-13	2.14E-13	1.38E-13	1.30E-13	1.38E-13	1.58E-13
Ag-106	3.32E-14	3.80E-14	3.29E-14	3.17E-14	5.84E-14	3.38E-14	3.14E-14	3.39E-14	7.27E-14
Ag-108m	7.63E-14	8.71E-14	7.57E-14	7.34E-14	1.29E-13	7.78E-14	7.24E-14	7.80E-14	9.05E-14
Ag-108	9.10E-16	1.04E-15	8.96E-16	8.63E-16	1.61E-15	9.25E-16	8.56E-16	9.28E-16	4.00E-14
Ag-109m	2.13E-16	2.85E-16	1.40E-16	1.23E-16	5.72E-16	1.88E-16	1.40E-16	1.92E-16	5.59E-16
Ag-110m	1.33E-13	1.51E-13	1.33E-13	1.30E-13	2.05E-13	1.36E-13	1.27E-13	1.36E-13	1.57E-13
Ag-110	1.75E-15	2.00E-15	1.73E-15	1.67E-15	3.05E-15	1.78E-15	1.65E-15	1.78E-15	8.22E-14
Ag-111	1.26E-15	1.44E-15	1.23E-15	1.17E-15	2.59E-15	1.27E-15	1.17E-15	1.29E-15	2.19E-14
Ag-112	3.25E-14	3.68E-14	3.27E-14	3.22E-14	4.98E-14	3.34E-14	3.15E-14	3.34E-14	1.33E-13
Ag-115	3.51E-14	3.97E-14	3.53E-14	3.47E-14	5.57E-14	3.61E-14	3.41E-14	3.61E-14	1.11E-13
Cadmium									
Cd-104	1.12E-14	1.30E-14	1.09E-14	1.03E-14	2.15E-14	1.13E-14	1.03E-14	1.14E-14	1.38E-14
Cd-107	6.64E-16	8.78E-16	4.56E-16	4.35E-16	1.37E-15	5.98E-16	4.61E-16	6.02E-16	1.50E-15
Cd-109	3.58E-16	5.21E-16	1.65E-16	1.57E-16	7.87E-16	2.91E-16	1.83E-16	2.94E-16	9.95E-16
Cd-113m	7.17E-18	8.76E-18	5.93E-18	5.01E-18	2.10E-17	6.76E-18	5.63E-18	6.94E-18	8.48E-15
Cd-113	1.56E-18	1.98E-18	1.16E-18	9.42E-19	4.63E-18	1.41E-18	1.11E-18	1.45E-18	2.41E-15
Cd-115m	1.15E-15	1.30E-15	1.14E-15	1.12E-15	1.80E-15	1.18E-15	1.10E-15	1.17E-15	3.99E-14
Cd-115	1.09E-14	1.25E-14	1.08E-14	1.04E-14	1.93E-14	1.11E-14	1.03E-14	1.12E-14	2.97E-14
Cd-117m	1.02E-13	1.15E-13	1.03E-13	1.02E-13	1.46E-13	1.05E-13	9.95E-14	1.05E-13	1.29E-13
Cd-117	5.31E-14	6.02E-14	5.33E-14	5.24E-14	8.23E-14	5.46E-14	5.14E-14	5.45E-14	8.79E-14

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	3.15E-14	3.59E-14	3.10E-14	3.00E-14	5.63E-14	3.20E-14	2.97E-14	3.21E-14	3.91E-14
In-110b[1]	1.46E-13	1.66E-13	1.45E-13	1.42E-13	2.28E-13	1.49E-13	1.39E-13	1.49E-13	1.71E-13
In-110a[2]	7.44E-14	8.46E-14	7.43E-14	7.24E-14	1.22E-13	7.62E-14	7.12E-14	7.62E-14	1.29E-13
In-111	1.82E-14	2.10E-14	1.75E-14	1.62E-14	4.37E-14	1.83E-14	1.66E-14	1.86E-14	2.29E-14
In-112	1.24E-14	1.42E-14	1.22E-14	1.18E-14	2.16E-14	1.26E-14	1.17E-14	1.26E-14	2.88E-14
In-113m	1.18E-14	1.36E-14	1.16E-14	1.11E-14	2.27E-14	1.20E-14	1.11E-14	1.21E-14	2.18E-14
In-114m	4.13E-15	4.76E-15	3.98E-15	3.80E-15	7.98E-15	4.16E-15	3.80E-15	4.18E-15	1.05E-14
In-114	1.36E-16	1.55E-16	1.36E-16	1.34E-16	2.00E-16	1.40E-16	1.31E-16	1.39E-16	2.95E-15
In-115m	7.25E-15	8.34E-15	7.05E-15	6.70E-15	1.46E-14	7.32E-15	6.72E-15	7.39E-15	1.81E-14
In-115	4.69E-18	5.78E-18	3.78E-18	3.16E-18	1.39E-17	4.38E-18	3.59E-18	4.50E-18	6.18E-15
In-116m	1.22E-13	1.38E-13	1.23E-13	1.21E-13	1.78E-13	1.25E-13	1.18E-13	1.25E-13	1.58E-13
In-117m	4.12E-15	4.74E-15	3.96E-15	3.71E-15	9.24E-15	4.14E-15	3.76E-15	4.19E-15	3.17E-14
In-117	3.23E-14	3.70E-14	3.19E-14	3.05E-14	6.19E-14	3.29E-14	3.04E-14	3.31E-14	5.16E-14
In-119m	6.18E-16	7.28E-16	5.66E-16	5.40E-16	1.20E-15	6.12E-16	5.45E-16	6.14E-16	7.11E-14
In-119	3.67E-14	4.17E-14	3.65E-14	3.56E-14	5.82E-14	3.75E-14	3.49E-14	3.74E-14	8.20E-14
Tin									
Sn-110	1.35E-14	1.55E-14	1.30E-14	1.23E-14	2.90E-14	1.36E-14	1.24E-14	1.37E-14	1.66E-14
Sn-111	2.39E-14	2.73E-14	2.38E-14	2.32E-14	3.95E-14	2.45E-14	2.29E-14	2.45E-14	4.22E-14
Sn-113	4.40E-16	5.90E-16	2.68E-16	2.58E-16	8.59E-16	3.84E-16	2.78E-16	3.82E-16	8.20E-16
Sn-117m	6.73E-15	7.83E-15	6.29E-15	5.70E-15	1.79E-14	6.68E-15	5.94E-15	6.82E-15	1.25E-14
Sn-119m	1.40E-16	2.14E-16	3.58E-17	3.65E-17	2.40E-16	1.04E-16	5.07E-17	1.01E-16	3.42E-16
Sn-121m	7.92E-17	1.14E-16	2.91E-17	2.45E-17	1.62E-16	6.15E-17	3.41E-17	6.02E-17	1.07E-15
Sn-121	2.51E-18	3.14E-18	1.93E-18	1.59E-18	7.46E-18	2.30E-18	1.85E-18	2.37E-18	3.71E-15
Sn-123m	6.42E-15	7.40E-15	6.12E-15	5.55E-15	1.71E-14	6.41E-15	5.77E-15	6.55E-15	3.58E-14
Sn-123	3.96E-16	4.51E-16	3.91E-16	3.80E-16	6.50E-16	4.04E-16	3.75E-16	4.03E-16	3.28E-14
Sn-125	1.55E-14	1.75E-14	1.55E-14	1.53E-14	2.31E-14	1.59E-14	1.49E-14	1.58E-14	7.13E-14
Sn-126	2.13E-15	2.55E-15	1.85E-15	1.53E-15	6.94E-15	2.03E-15	1.73E-15	2.11E-15	6.65E-15
Sn-127	9.35E-14	1.06E-13	9.39E-14	9.25E-14	1.41E-13	9.62E-14	9.04E-14	9.59E-14	1.41E-13
Sn-128	2.96E-14	3.41E-14	2.87E-14	2.74E-14	5.46E-14	2.98E-14	2.74E-14	3.00E-14	4.50E-14
Antimony									
Sb-115	4.23E-14	4.84E-14	4.19E-14	4.04E-14	7.42E-14	4.30E-14	4.00E-14	4.32E-14	6.52E-14
Sb-116m	1.51E-13	1.72E-13	1.51E-13	1.48E-13	2.37E-13	1.55E-13	1.45E-13	1.55E-13	1.82E-13
Sb-116	1.05E-13	1.19E-13	1.06E-13	1.05E-13	1.58E-13	1.08E-13	1.02E-13	1.08E-13	1.50E-13
Sb-117	7.88E-15	9.16E-15	7.40E-15	6.79E-15	1.96E-14	7.84E-15	7.01E-15	7.97E-15	1.03E-14
Sb-118m	1.25E-13	1.41E-13	1.24E-13	1.22E-13	1.92E-13	1.28E-13	1.19E-13	1.27E-13	1.46E-13
Sb-119	2.98E-16	4.50E-16	7.87E-17	7.82E-17	5.17E-16	2.22E-16	1.09E-16	2.16E-16	7.09E-16
Sb-120b[3]	1.19E-13	1.35E-13	1.18E-13	1.16E-13	1.89E-13	1.22E-13	1.14E-13	1.22E-13	1.39E-13
Sb-120a[4]	2.09E-14	2.39E-14	2.06E-14	1.99E-14	3.65E-14	2.12E-14	1.97E-14	2.13E-14	4.46E-14
Sb-122	2.09E-14	2.38E-14	2.07E-14	2.01E-14	3.54E-14	2.13E-14	1.98E-14	2.13E-14	6.03E-14
Sb-124n[5]	9.41E-19	1.44E-18	2.27E-19	2.39E-19	1.57E-18	6.94E-19	3.33E-19	6.75E-19	2.33E-18
Sb-124m[6]	1.66E-14	1.89E-14	1.65E-14	1.60E-14	2.81E-14	1.69E-14	1.58E-14	1.70E-14	2.46E-14
Sb-124	8.89E-14	1.01E-13	8.97E-14	8.85E-14	1.34E-13	9.15E-14	8.66E-14	9.15E-14	1.26E-13
Sb-125	1.98E-14	2.27E-14	1.95E-14	1.87E-14	3.53E-14	2.01E-14	1.86E-14	2.02E-14	2.65E-14
Sb-126m	7.33E-14	8.36E-14	7.29E-14	7.07E-14	1.24E-13	7.49E-14	6.97E-14	7.50E-14	1.24E-13
Sb-126	1.35E-13	1.53E-13	1.34E-13	1.30E-13	2.22E-13	1.37E-13	1.28E-13	1.37E-13	1.73E-13
Sb-127	3.26E-14	3.72E-14	3.24E-14	3.14E-14	5.52E-14	3.33E-14	3.09E-14	3.33E-14	5.58E-14
Sb-128b[7]	1.47E-13	1.68E-13	1.47E-13	1.43E-13	2.42E-13	1.51E-13	1.40E-13	1.51E-13	1.99E-13
Sb-128a[8]	9.49E-14	1.08E-13	9.42E-14	9.17E-14	1.57E-13	9.70E-14	9.02E-14	9.69E-14	1.73E-13
Sb-129	6.97E-14	7.91E-14	6.98E-14	6.86E-14	1.07E-13	7.16E-14	6.71E-14	7.14E-14	1.05E-13
Sb-130	1.57E-13	1.78E-13	1.56E-13	1.52E-13	2.55E-13	1.61E-13	1.50E-13	1.60E-13	2.29E-13
Sb-131	9.14E-14	1.03E-13	9.18E-14	9.06E-14	1.36E-13	9.40E-14	8.85E-14	9.37E-14	1.40E-13
Tellurium									
Te-116	2.37E-15	2.89E-15	1.97E-15	1.75E-15	6.20E-15	2.26E-15	1.89E-15	2.29E-15	3.37E-15
Te-121m	9.76E-15	1.12E-14	9.33E-15	8.74E-15	2.20E-14	9.79E-15	8.87E-15	9.90E-15	1.23E-14

[1] $T_{½}$ = 4.9 h
[2] $T_{½}$ = 69.1 m
[3] $T_{½}$ = 5.76 d
[4] $T_{½}$ = 15.89 m
[5] $T_{½}$ = 20.2 m
[6] $T_{½}$ = 93 s
[7] $T_{½}$ = 9.01 h
[8] $T_{½}$ = 10.4 m

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	2.65E-14	3.04E-14	2.61E-14	2.53E-14	4.55E-14	2.69E-14	2.50E-14	2.70E-14	3.18E-14
Te-123m	6.43E-15	7.46E-15	6.02E-15	5.45E-15	1.71E-14	6.38E-15	5.68E-15	6.51E-15	8.48E-15
Te-123	2.91E-16	4.27E-16	9.01E-17	8.12E-17	5.42E-16	2.20E-16	1.14E-16	2.15E-16	6.32E-16
Te-125m	5.96E-16	8.48E-16	2.23E-16	1.86E-16	1.22E-15	4.64E-16	2.59E-16	4.53E-16	1.94E-15
Te-127m	1.90E-16	2.69E-16	7.62E-17	6.43E-17	3.94E-16	1.50E-16	8.64E-17	1.47E-16	8.49E-16
Te-127	2.37E-16	2.73E-16	2.32E-16	2.21E-16	4.65E-16	2.40E-16	2.21E-16	2.42E-16	1.14E-14
Te-129m	1.56E-15	1.81E-15	1.46E-15	1.42E-15	2.60E-15	1.56E-15	1.41E-15	1.55E-15	1.49E-14
Te-129	2.71E-15	3.12E-15	2.64E-15	2.54E-15	4.88E-15	2.74E-15	2.52E-15	2.75E-15	3.57E-14
Te-131m	6.85E-14	7.78E-14	6.83E-14	6.68E-14	1.09E-13	7.02E-14	6.55E-14	7.01E-14	8.85E-14
Te-131	1.99E-14	2.28E-14	1.96E-14	1.88E-14	3.80E-14	2.03E-14	1.87E-14	2.04E-14	6.89E-14
Te-132	1.02E-14	1.18E-14	9.65E-15	8.95E-15	2.42E-14	1.02E-14	9.16E-15	1.03E-14	1.39E-14
Te-133m	1.12E-13	1.27E-13	1.12E-13	1.09E-13	1.75E-13	1.15E-13	1.07E-13	1.14E-13	1.74E-13
Te-133	4.49E-14	5.10E-14	4.47E-14	4.36E-14	7.50E-14	4.59E-14	4.29E-14	4.60E-14	1.06E-13
Te-134	4.16E-14	4.75E-14	4.10E-14	3.94E-14	7.56E-14	4.23E-14	3.91E-14	4.24E-14	6.35E-14
Iodine									
I-120m	2.58E-13	2.93E-13	2.59E-13	2.55E-13	3.99E-13	2.66E-13	2.50E-13	2.65E-13	3.86E-13
I-120	1.34E-13	1.52E-13	1.35E-13	1.33E-13	2.08E-13	1.38E-13	1.30E-13	1.38E-13	2.55E-13
I-121	1.91E-14	2.19E-14	1.85E-14	1.76E-14	3.87E-14	1.92E-14	1.76E-14	1.94E-14	2.72E-14
I-122	4.46E-14	5.10E-14	4.43E-14	4.28E-14	7.78E-14	4.55E-14	4.23E-14	4.56E-14	1.25E-13
I-123	7.22E-15	8.42E-15	6.70E-15	6.11E-15	1.85E-14	7.15E-15	6.35E-15	7.28E-15	9.40E-15
I-124	5.25E-14	5.97E-14	5.25E-14	5.14E-14	8.31E-14	5.38E-14	5.05E-14	5.38E-14	7.39E-14
I-125	6.92E-16	9.90E-16	2.48E-16	2.07E-16	1.39E-15	5.34E-16	2.93E-16	5.22E-16	1.39E-15
I-126	2.11E-14	2.42E-14	2.09E-14	2.02E-14	3.66E-14	2.15E-14	1.99E-14	2.15E-14	3.37E-14
I-128	4.07E-15	4.67E-15	4.01E-15	3.85E-15	7.47E-15	4.13E-15	3.83E-15	4.16E-15	5.38E-14
I-129	4.83E-16	6.66E-16	2.14E-16	1.64E-16	1.10E-15	3.86E-16	2.30E-16	3.80E-16	1.10E-15
I-130	1.01E-13	1.16E-13	1.01E-13	9.82E-14	1.68E-13	1.04E-13	9.66E-14	1.04E-13	1.36E-13
I-131	1.78E-14	2.04E-14	1.76E-14	1.68E-14	3.45E-14	1.81E-14	1.67E-14	1.82E-14	2.98E-14
I-132m	1.50E-14	1.71E-14	1.48E-14	1.43E-14	2.54E-14	1.52E-14	1.41E-14	1.53E-14	2.22E-14
I-132	1.09E-13	1.24E-13	1.09E-13	1.07E-13	1.73E-13	1.12E-13	1.05E-13	1.12E-13	1.58E-13
I-133	2.87E-14	3.28E-14	2.86E-14	2.77E-14	4.87E-14	2.93E-14	2.73E-14	2.94E-14	5.83E-14
I-134	1.27E-13	1.44E-13	1.27E-13	1.25E-13	1.96E-13	1.30E-13	1.22E-13	1.30E-13	1.87E-13
I-135	7.77E-14	8.79E-14	7.84E-14	7.76E-14	1.13E-13	8.01E-14	7.57E-14	7.98E-14	1.11E-13
Xenon									
Xe-120	1.92E-14	2.21E-14	1.85E-14	1.78E-14	3.49E-14	1.94E-14	1.77E-14	1.94E-14	2.40E-14
Xe-121	8.90E-14	1.01E-13	8.93E-14	8.79E-14	1.39E-13	9.15E-14	8.62E-14	9.14E-14	1.40E-13
Xe-122	2.51E-15	2.99E-15	2.22E-15	2.07E-15	5.31E-15	2.45E-15	2.13E-15	2.46E-15	3.36E-15
Xe-123	2.97E-14	3.39E-14	2.93E-14	2.83E-14	5.30E-14	3.02E-14	2.80E-14	3.03E-14	4.52E-14
Xe-125	1.18E-14	1.37E-14	1.12E-14	1.05E-14	2.62E-14	1.18E-14	1.06E-14	1.19E-14	1.50E-14
Xe-127	1.23E-14	1.42E-14	1.17E-14	1.08E-14	2.88E-14	1.23E-14	1.11E-14	1.25E-14	1.57E-14
Xe-129m	1.23E-15	1.60E-15	7.55E-16	6.45E-16	2.84E-15	1.07E-15	7.60E-16	1.06E-15	8.29E-15
Xe-131m	4.57E-16	6.02E-16	2.67E-16	2.27E-16	1.06E-15	3.91E-16	2.71E-16	3.89E-16	4.82E-15
Xe-133m	1.42E-15	1.70E-15	1.19E-15	1.10E-15	3.23E-15	1.36E-15	1.15E-15	1.37E-15	1.04E-14
Xe-133	1.61E-15	1.96E-15	1.32E-15	1.07E-15	5.13E-15	1.51E-15	1.24E-15	1.56E-15	4.97E-15
Xe-135m	2.00E-14	2.29E-14	1.98E-14	1.91E-14	3.50E-14	2.04E-14	1.89E-14	2.04E-14	2.97E-14
Xe-135	1.17E-14	1.33E-14	1.13E-14	1.07E-14	2.57E-14	1.18E-14	1.08E-14	1.19E-14	3.12E-14
Xe-138	5.59E-14	6.32E-14	5.66E-14	5.60E-14	8.46E-14	5.77E-14	5.49E-14	5.77E-14	1.07E-13
Cesium									
Cs-125	3.15E-14	3.61E-14	3.12E-14	3.01E-14	5.54E-14	3.21E-14	2.98E-14	3.22E-14	5.97E-14
Cs-126	5.13E-14	5.87E-14	5.08E-14	4.89E-14	9.18E-14	5.22E-14	4.85E-14	5.24E-14	1.62E-13
Cs-127	1.90E-14	2.19E-14	1.85E-14	1.77E-14	3.59E-14	1.92E-14	1.77E-14	1.93E-14	2.38E-14
Cs-128	4.23E-14	4.83E-14	4.19E-14	4.04E-14	7.46E-14	4.30E-14	4.00E-14	4.32E-14	1.07E-13
Cs-129	1.22E-14	1.42E-14	1.17E-14	1.11E-14	2.36E-14	1.23E-14	1.12E-14	1.24E-14	1.52E-14
Cs-130	2.40E-14	2.75E-14	2.37E-14	2.29E-14	4.20E-14	2.44E-14	2.26E-14	2.45E-14	5.48E-14
Cs-131	4.25E-16	5.92E-16	1.75E-16	1.36E-16	9.15E-16	3.35E-16	1.93E-16	3.28E-16	7.84E-16
Cs-132	3.28E-14	3.75E-14	3.24E-14	3.15E-14	5.38E-14	3.34E-14	3.10E-14	3.34E-14	3.92E-14
Cs-134m	9.30E-16	1.12E-15	7.84E-16	6.81E-16	2.61E-15	8.88E-16	7.45E-16	9.05E-16	2.88E-15
Cs-134	7.40E-14	8.43E-14	7.37E-14	7.19E-14	1.20E-13	7.57E-14	7.06E-14	7.57E-14	9.45E-14
Cs-135m	7.60E-14	8.64E-14	7.57E-14	7.41E-14	1.19E-13	7.79E-14	7.25E-14	7.76E-14	9.10E-14
Cs-135	6.28E-19	8.23E-19	4.19E-19	3.34E-19	1.81E-18	5.50E-19	4.09E-19	5.65E-19	9.06E-16
Cs-136	1.04E-13	1.18E-13	1.04E-13	1.01E-13	1.66E-13	1.07E-13	9.95E-14	1.06E-13	1.25E-13

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	7.96E-18	9.67E-18	6.68E-18	5.70E-18	2.29E-17	7.55E-18	6.34E-18	7.74E-18	8.63E-15
Cs-138	1.17E-13	1.33E-13	1.19E-13	1.18E-13	1.70E-13	1.21E-13	1.15E-13	1.21E-13	2.17E-13
Barium									
Ba-126	6.99E-15	8.10E-15	6.62E-15	6.27E-15	1.39E-14	6.98E-15	6.32E-15	7.03E-15	9.26E-15
Ba-128	2.91E-15	3.44E-15	2.58E-15	2.39E-15	6.38E-15	2.84E-15	2.47E-15	2.86E-15	3.85E-15
Ba-131m	3.05E-15	3.62E-15	2.72E-15	2.33E-15	9.32E-15	2.96E-15	2.55E-15	3.04E-15	3.94E-15
Ba-131	2.06E-14	2.38E-14	2.00E-14	1.90E-14	4.08E-14	2.08E-14	1.90E-14	2.10E-14	2.55E-14
Ba-133m	2.64E-15	3.10E-15	2.39E-15	2.22E-15	5.81E-15	2.60E-15	2.28E-15	2.62E-15	1.36E-14
Ba-133	1.76E-14	2.04E-14	1.68E-14	1.58E-14	3.75E-14	1.76E-14	1.60E-14	1.78E-14	2.19E-14
Ba-135m	2.35E-15	2.77E-15	2.10E-15	1.94E-15	5.22E-15	2.30E-15	2.01E-15	2.32E-15	1.30E-14
Ba-137m	2.82E-14	3.22E-14	2.80E-14	2.73E-14	4.63E-14	2.88E-14	2.68E-14	2.88E-14	3.73E-14
Ba-139	2.13E-15	2.45E-15	2.03E-15	1.87E-15	5.29E-15	2.13E-15	1.92E-15	2.17E-15	6.16E-14
Ba-140	8.41E-15	9.64E-15	8.27E-15	7.93E-15	1.55E-14	8.53E-15	7.89E-15	8.58E-15	2.52E-14
Ba-141	4.06E-14	4.63E-14	4.03E-14	3.91E-14	7.17E-14	4.15E-14	3.87E-14	4.16E-14	1.07E-13
Ba-142	5.04E-14	5.73E-14	5.02E-14	4.91E-14	8.09E-14	5.17E-14	4.81E-14	5.15E-14	8.37E-14
Lanthanum									
La-131	3.08E-14	3.54E-14	3.02E-14	2.89E-14	5.81E-14	3.12E-14	2.88E-14	3.14E-14	4.87E-14
La-132	9.75E-14	1.11E-13	9.78E-14	9.59E-14	1.54E-13	1.00E-13	9.41E-14	1.00E-13	1.49E-13
La-134	3.27E-14	3.74E-14	3.24E-14	3.13E-14	5.72E-14	3.33E-14	3.10E-14	3.35E-14	8.88E-14
La-135	1.02E-15	1.28E-15	7.33E-16	6.52E-16	2.11E-15	9.28E-16	7.22E-16	9.21E-16	1.49E-15
La-137	5.10E-16	6.93E-16	2.40E-16	1.79E-16	1.20E-15	4.13E-16	2.52E-16	4.06E-16	8.68E-16
La-138	6.04E-14	6.85E-14	6.08E-14	6.02E-14	8.78E-14	6.22E-14	5.88E-14	6.20E-14	7.09E-14
La-140	1.14E-13	1.29E-13	1.15E-13	1.14E-13	1.69E-13	1.18E-13	1.11E-13	1.17E-13	1.66E-13
La-141	2.33E-15	2.64E-15	2.34E-15	2.31E-15	3.49E-15	2.39E-15	2.26E-15	2.39E-15	6.58E-14
La-142	1.40E-13	1.57E-13	1.42E-13	1.42E-13	1.95E-13	1.45E-13	1.38E-13	1.44E-13	2.16E-13
La-143	5.04E-15	5.70E-15	5.07E-15	5.01E-15	7.59E-15	5.19E-15	4.90E-15	5.18E-15	9.64E-14
Cerium									
Ce-134	5.83E-16	7.84E-16	2.92E-16	2.15E-16	1.43E-15	4.78E-16	3.00E-16	4.71E-16	9.60E-16
Ce-135	8.35E-14	9.54E-14	8.28E-14	7.98E-14	1.48E-13	8.51E-14	7.91E-14	8.54E-14	1.10E-13
Ce-137m	2.01E-15	2.39E-15	1.76E-15	1.61E-15	4.51E-15	1.95E-15	1.68E-15	1.96E-15	1.20E-14
Ce-137	9.85E-16	1.25E-15	6.86E-16	5.93E-16	2.16E-15	8.86E-16	6.76E-16	8.81E-16	1.45E-15
Ce-139	6.72E-15	7.85E-15	6.16E-15	5.55E-15	1.76E-14	6.61E-15	5.82E-15	6.73E-15	8.94E-15
Ce-141	3.38E-15	3.93E-15	3.17E-15	2.83E-15	9.41E-15	3.35E-15	2.98E-15	3.43E-15	1.02E-14
Ce-143	1.28E-14	1.47E-14	1.23E-14	1.17E-14	2.52E-14	1.28E-14	1.17E-14	1.29E-14	3.96E-14
Ce-144	8.53E-16	1.01E-15	7.69E-16	6.68E-16	2.49E-15	8.33E-16	7.23E-16	8.53E-16	2.93E-15
Praseodymium									
Pr-136	1.01E-13	1.15E-13	1.01E-13	9.85E-14	1.63E-13	1.03E-13	9.69E-14	1.03E-13	1.69E-13
Pr-137	2.32E-14	2.65E-14	2.28E-14	2.20E-14	4.03E-14	2.35E-14	2.18E-14	2.36E-14	4.01E-14
Pr-138m	1.18E-13	1.35E-13	1.18E-13	1.15E-13	1.91E-13	1.21E-13	1.13E-13	1.21E-13	1.52E-13
Pr-138	3.84E-14	4.39E-14	3.80E-14	3.67E-14	6.74E-14	3.91E-14	3.63E-14	3.92E-14	1.25E-13
Pr-139	5.17E-15	6.02E-15	4.87E-15	4.64E-15	9.34E-15	5.17E-15	4.67E-15	5.17E-15	8.75E-15
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	3.06E-15	3.46E-15	3.10E-15	3.07E-15	4.43E-15	3.16E-15	3.00E-15	3.15E-15	5.67E-14
Pr-143	2.13E-17	2.55E-17	1.86E-17	1.62E-17	5.93E-17	2.05E-17	1.76E-17	2.10E-17	1.76E-14
Pr-144m	3.25E-16	4.20E-16	2.00E-16	1.56E-16	8.16E-16	2.81E-16	1.98E-16	2.79E-16	5.08E-16
Pr-144	1.90E-15	2.15E-15	1.90E-15	1.87E-15	2.99E-15	1.95E-15	1.84E-15	1.95E-15	8.43E-14
Pr-145	7.24E-16	8.27E-16	7.11E-16	6.88E-16	1.23E-15	7.37E-16	6.81E-16	7.36E-16	4.44E-14
Pr-147	4.07E-14	4.65E-14	4.02E-14	3.89E-14	7.01E-14	4.14E-14	3.85E-14	4.15E-14	9.75E-14
Neodymium									
Nd-136	1.26E-14	1.47E-14	1.19E-14	1.11E-14	2.63E-14	1.26E-14	1.13E-14	1.27E-14	1.71E-14
Nd-138	1.37E-15	1.69E-15	1.04E-15	8.93E-16	3.29E-15	1.26E-15	1.01E-15	1.27E-15	1.92E-15
Nd-139m	7.48E-14	8.51E-14	7.42E-14	7.23E-14	1.20E-13	7.65E-14	7.11E-14	7.63E-14	9.17E-14
Nd-139	1.87E-14	2.14E-14	1.83E-14	1.77E-14	3.26E-14	1.90E-14	1.75E-14	1.90E-14	3.50E-14
Nd-141m	3.62E-14	4.12E-14	3.60E-14	3.52E-14	5.76E-14	3.71E-14	3.45E-14	3.70E-14	4.67E-14
Nd-141	2.94E-15	3.48E-15	2.63E-15	2.47E-15	5.50E-15	2.89E-15	2.53E-15	2.88E-15	4.24E-15
Nd-147	6.13E-15	7.12E-15	5.82E-15	5.40E-15	1.32E-14	6.12E-15	5.53E-15	6.19E-15	1.95E-14
Nd-149	1.78E-14	2.04E-14	1.72E-14	1.62E-14	3.74E-14	1.79E-14	1.64E-14	1.81E-14	4.99E-14
Nd-151	4.39E-14	4.99E-14	4.35E-14	4.21E-14	7.57E-14	4.48E-14	4.17E-14	4.48E-14	9.12E-14
Promethium									
Pm-141	3.52E-14	4.02E-14	3.50E-14	3.39E-14	5.94E-14	3.59E-14	3.35E-14	3.60E-14	8.42E-14
Pm-142	4.12E-14	4.71E-14	4.09E-14	3.95E-14	7.18E-14	4.20E-14	3.91E-14	4.22E-14	1.44E-13
Pm-143	1.44E-14	1.65E-14	1.40E-14	1.36E-14	2.38E-14	1.46E-14	1.34E-14	1.46E-14	1.72E-14

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Promethium, cont'd									
Pm-144	7.33E-14	8.37E-14	7.26E-14	7.04E-14	1.23E-13	7.47E-14	6.94E-14	7.48E-14	8.71E-14
Pm-145	8.23E-16	1.07E-15	5.04E-16	3.69E-16	2.32E-15	7.07E-16	4.94E-16	7.09E-16	1.22E-15
Pm-146	3.52E-14	4.03E-14	3.48E-14	3.37E-14	5.99E-14	3.59E-14	3.33E-14	3.59E-14	4.64E-14
Pm-147	7.48E-19	9.56E-19	5.45E-19	4.46E-19	2.18E-18	6.75E-19	5.26E-19	6.93E-19	8.11E-16
Pm-148m	9.47E-14	1.08E-13	9.42E-14	9.14E-14	1.58E-13	9.68E-14	9.01E-14	9.68E-14	1.18E-13
Pm-148	2.81E-14	3.19E-14	2.83E-14	2.79E-14	4.24E-14	2.89E-14	2.73E-14	2.89E-14	7.97E-14
Pm-149	5.30E-16	6.07E-16	5.17E-16	4.89E-16	1.10E-15	5.36E-16	4.91E-16	5.41E-16	2.19E-14
Pm-150	6.99E-14	7.92E-14	7.01E-14	6.89E-14	1.09E-13	7.18E-14	6.75E-14	7.17E-14	1.34E-13
Pm-151	1.48E-14	1.70E-14	1.44E-14	1.37E-14	2.99E-14	1.50E-14	1.37E-14	1.51E-14	3.32E-14
Samarium									
Sm-141m	9.49E-14	1.08E-13	9.44E-14	9.19E-14	1.57E-13	9.70E-14	9.06E-14	9.71E-14	1.39E-13
Sm-141	6.70E-14	7.64E-14	6.68E-14	6.50E-14	1.12E-13	6.85E-14	6.41E-14	6.87E-14	1.27E-13
Sm-142	3.83E-15	4.50E-15	3.51E-15	3.27E-15	7.52E-15	3.78E-15	3.36E-15	3.79E-15	6.44E-15
Sm-145	1.83E-15	2.35E-15	1.18E-15	8.62E-16	5.39E-15	1.59E-15	1.14E-15	1.61E-15	2.64E-15
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	5.20E-20	8.80E-20	7.08E-21	1.13E-20	7.09E-20	3.58E-20	1.49E-20	3.61E-20	1.90E-19
Sm-153	2.33E-15	2.82E-15	1.97E-15	1.62E-15	7.29E-15	2.22E-15	1.85E-15	2.28E-15	1.45E-14
Sm-155	4.58E-15	5.36E-15	4.26E-15	3.71E-15	1.37E-14	4.52E-15	3.99E-15	4.65E-15	4.01E-14
Sm-156	5.36E-15	6.20E-15	5.05E-15	4.57E-15	1.40E-14	5.32E-15	4.76E-15	5.43E-15	1.46E-14
Europium									
Eu-145	7.05E-14	8.01E-14	7.06E-14	6.95E-14	1.07E-13	7.24E-14	6.80E-14	7.22E-14	8.33E-14
Eu-146	1.20E-13	1.36E-13	1.20E-13	1.17E-13	1.89E-13	1.23E-13	1.15E-13	1.23E-13	1.43E-13
Eu-147	2.29E-14	2.62E-14	2.23E-14	2.14E-14	4.12E-14	2.32E-14	2.13E-14	2.32E-14	2.77E-14
Eu-148	1.03E-13	1.18E-13	1.03E-13	9.99E-14	1.69E-13	1.05E-13	9.84E-14	1.06E-13	1.22E-13
Eu-149	2.33E-15	2.80E-15	1.97E-15	1.75E-15	5.55E-15	2.23E-15	1.89E-15	2.25E-15	3.09E-15
Eu-150b[1]	7.02E-14	8.02E-14	6.94E-14	6.69E-14	1.24E-13	7.15E-14	6.63E-14	7.17E-14	8.50E-14
Eu-150a[2]	2.18E-15	2.50E-15	2.12E-15	2.03E-15	4.01E-15	2.20E-15	2.03E-15	2.21E-15	2.05E-14
Eu-152m	1.40E-14	1.59E-14	1.38E-14	1.35E-14	2.26E-14	1.43E-14	1.32E-14	1.42E-14	4.85E-14
Eu-152	5.53E-14	6.29E-14	5.50E-14	5.37E-14	8.89E-14	5.66E-14	5.28E-14	5.65E-14	6.90E-14
Eu-154	6.00E-14	6.81E-14	5.99E-14	5.87E-14	9.43E-14	6.15E-14	5.75E-14	6.14E-14	8.29E-14
Eu-155	2.49E-15	2.95E-15	2.22E-15	1.85E-15	8.09E-15	2.41E-15	2.07E-15	2.49E-15	3.39E-15
Eu-156	6.57E-14	7.42E-14	6.63E-14	6.56E-14	9.58E-14	6.78E-14	6.41E-14	6.75E-14	9.98E-14
Eu-157	1.16E-14	1.34E-14	1.11E-14	1.04E-14	2.37E-14	1.16E-14	1.06E-14	1.17E-14	3.57E-14
Eu-158	5.15E-14	5.84E-14	5.15E-14	5.06E-14	7.82E-14	5.29E-14	4.95E-14	5.27E-14	1.21E-13
Gadolinium									
Gd-145	1.12E-13	1.26E-13	1.13E-13	1.12E-13	1.64E-13	1.15E-13	1.09E-13	1.15E-13	1.66E-13
Gd-146	1.00E-14	1.19E-14	8.87E-15	7.60E-15	2.96E-14	9.72E-15	8.34E-15	9.95E-15	1.33E-14
Gd-147	6.32E-14	7.21E-14	6.24E-14	6.04E-14	1.09E-13	6.44E-14	5.97E-14	6.45E-14	7.67E-14
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	1.90E-14	2.18E-14	1.82E-14	1.72E-14	3.89E-14	1.91E-14	1.73E-14	1.92E-14	2.42E-14
Gd-151	2.29E-15	2.76E-15	1.89E-15	1.62E-15	6.16E-15	2.17E-15	1.80E-15	2.20E-15	3.25E-15
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	3.83E-15	4.66E-15	3.16E-15	2.56E-15	1.21E-14	3.61E-15	2.97E-15	3.71E-15	5.00E-15
Gd-159	2.19E-15	2.55E-15	2.07E-15	1.92E-15	4.74E-15	2.19E-15	1.97E-15	2.21E-15	1.91E-14
Terbium									
Tb-147	7.61E-14	8.66E-14	7.57E-14	7.39E-14	1.23E-13	7.79E-14	7.26E-14	7.78E-14	1.27E-13
Tb-149	7.82E-14	8.87E-14	7.82E-14	7.67E-14	1.24E-13	8.02E-14	7.53E-14	8.02E-14	1.02E-13
Tb-150	8.06E-14	9.17E-14	8.06E-14	7.87E-14	1.30E-13	8.26E-14	7.74E-14	8.26E-14	1.31E-13
Tb-151	4.12E-14	4.73E-14	4.03E-14	3.85E-14	7.78E-14	4.18E-14	3.85E-14	4.20E-14	5.07E-14
Tb-153	9.87E-15	1.15E-14	9.16E-15	8.37E-15	2.31E-14	9.77E-15	8.69E-15	9.89E-15	1.23E-14
Tb-154	1.17E-13	1.32E-13	1.18E-13	1.18E-13	1.69E-13	1.21E-13	1.15E-13	1.21E-13	1.38E-13
Tb-155	5.62E-15	6.66E-15	4.98E-15	4.30E-15	1.58E-14	5.44E-15	4.69E-15	5.56E-15	7.29E-15
Tb-156m[3]	8.33E-16	1.04E-15	6.21E-16	4.58E-16	2.77E-15	7.55E-16	5.86E-16	7.75E-16	1.11E-15
Tb-156n[4]	1.23E-16	1.52E-16	9.56E-17	7.39E-17	3.98E-16	1.13E-16	9.02E-17	1.16E-16	3.56E-16
Tb-156	8.74E-14	9.95E-14	8.70E-14	8.49E-14	1.42E-13	8.95E-14	8.36E-14	8.94E-14	1.04E-13
Tb-157	7.57E-17	9.64E-17	5.13E-17	3.72E-17	2.35E-16	6.68E-17	4.91E-17	6.78E-17	1.06E-16
Tb-158	3.78E-14	4.30E-14	3.73E-14	3.63E-14	6.10E-14	3.86E-14	3.57E-14	3.84E-14	4.70E-14

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	5.42E-14	6.16E-14	5.40E-14	5.28E-14	8.59E-14	5.56E-14	5.18E-14	5.54E-14	7.34E-14
Tb-161	1.09E-15	1.36E-15	8.20E-16	6.36E-16	3.46E-15	9.90E-16	7.79E-16	1.02E-15	7.69E-15
Dysprosium									
Dy-155	2.72E-14	3.11E-14	2.66E-14	2.55E-14	5.01E-14	2.76E-14	2.55E-14	2.77E-14	3.27E-14
Dy-157	1.61E-14	1.85E-14	1.54E-14	1.45E-14	3.42E-14	1.61E-14	1.47E-14	1.63E-14	1.94E-14
Dy-159	1.38E-15	1.74E-15	9.66E-16	7.04E-16	4.37E-15	1.23E-15	9.20E-16	1.25E-15	1.89E-15
Dy-165	1.19E-15	1.38E-15	1.13E-15	1.05E-15	2.58E-15	1.19E-15	1.07E-15	1.20E-15	2.82E-14
Dy-166	1.45E-15	1.77E-15	1.20E-15	9.60E-16	4.55E-15	1.36E-15	1.13E-15	1.40E-15	5.79E-15
Holmium									
Ho-155	1.76E-14	2.03E-14	1.71E-14	1.62E-14	3.42E-14	1.78E-14	1.63E-14	1.79E-14	3.46E-14
Ho-157	2.21E-14	2.55E-14	2.12E-14	2.00E-14	4.50E-14	2.22E-14	2.02E-14	2.24E-14	2.90E-14
Ho-159	1.59E-14	1.85E-14	1.49E-14	1.35E-14	3.86E-14	1.58E-14	1.41E-14	1.60E-14	1.98E-14
Ho-161	1.87E-15	2.35E-15	1.38E-15	1.05E-15	5.89E-15	1.70E-15	1.31E-15	1.73E-15	2.59E-15
Ho-162m	2.70E-14	3.08E-14	2.64E-14	2.55E-14	4.68E-14	2.74E-14	2.53E-14	2.74E-14	3.22E-14
Ho-162	7.32E-15	8.49E-15	6.92E-15	6.51E-15	1.42E-14	7.32E-15	6.62E-15	7.35E-15	1.01E-14
Ho-164m	1.44E-15	1.80E-15	1.05E-15	7.72E-16	4.67E-15	1.29E-15	9.92E-16	1.32E-15	1.93E-15
Ho-164	9.71E-16	1.21E-15	7.29E-16	5.47E-16	3.16E-15	8.83E-16	6.88E-16	9.05E-16	8.33E-15
Ho-166m	8.28E-14	9.43E-14	8.19E-14	7.92E-14	1.44E-13	8.44E-14	7.82E-14	8.45E-14	9.90E-14
Ho-166	1.40E-15	1.62E-15	1.34E-15	1.26E-15	2.84E-15	1.41E-15	1.28E-15	1.42E-15	4.46E-14
Ho-167	1.69E-14	1.94E-14	1.65E-14	1.56E-14	3.50E-14	1.71E-14	1.57E-14	1.73E-14	2.95E-14
Erbium									
Er-161	4.33E-14	4.94E-14	4.28E-14	4.17E-14	7.09E-14	4.42E-14	4.11E-14	4.42E-14	5.23E-14
Er-165	1.21E-15	1.51E-15	8.86E-16	6.52E-16	3.96E-15	1.09E-15	8.38E-16	1.11E-15	1.61E-15
Er-169	1.86E-18	2.34E-18	1.40E-18	1.14E-18	5.52E-18	1.69E-18	1.34E-18	1.74E-18	2.83E-15
Er-171	1.75E-14	2.01E-14	1.69E-14	1.58E-14	3.90E-14	1.76E-14	1.61E-14	1.78E-14	4.22E-14
Er-172	2.42E-14	2.78E-14	2.39E-14	2.29E-14	4.44E-14	2.46E-14	2.28E-14	2.47E-14	3.21E-14
Thulium									
Tm-162	8.78E-14	9.91E-14	8.82E-14	8.70E-14	1.33E-13	9.04E-14	8.52E-14	9.01E-14	1.24E-13
Tm-166	9.11E-14	1.03E-13	9.14E-14	9.00E-14	1.40E-13	9.37E-14	8.82E-14	9.35E-14	1.08E-13
Tm-167	6.08E-15	7.13E-15	5.53E-15	4.90E-15	1.60E-14	5.95E-15	5.22E-15	6.06E-15	1.17E-14
Tm-170	2.27E-16	2.72E-16	1.94E-16	1.56E-16	7.53E-16	2.15E-16	1.81E-16	2.23E-16	1.81E-14
Tm-171	2.26E-17	2.76E-17	1.80E-17	1.36E-17	7.68E-17	2.08E-17	1.68E-17	2.15E-17	3.17E-17
Tm-172	2.35E-14	2.66E-14	2.36E-14	2.34E-14	3.47E-14	2.42E-14	2.28E-14	2.41E-14	5.76E-14
Tm-173	1.81E-14	2.07E-14	1.78E-14	1.70E-14	3.47E-14	1.83E-14	1.70E-14	1.85E-14	3.89E-14
Tm-175	5.01E-14	5.71E-14	4.99E-14	4.85E-14	8.25E-14	5.13E-14	4.78E-14	5.13E-14	9.10E-14
Ytterbium									
Yb-162	5.66E-15	6.67E-15	5.10E-15	4.38E-15	1.67E-14	5.51E-15	4.79E-15	5.66E-15	6.99E-15
Yb-166	3.00E-15	3.68E-15	2.38E-15	1.81E-15	1.01E-14	2.77E-15	2.23E-15	2.86E-15	3.88E-15
Yb-167	1.09E-14	1.29E-14	9.82E-15	8.41E-15	3.21E-14	1.06E-14	9.23E-15	1.09E-14	1.38E-14
Yb-169	1.29E-14	1.52E-14	1.17E-14	1.01E-14	3.64E-14	1.26E-14	1.10E-14	1.29E-14	1.73E-14
Yb-175	1.83E-15	2.10E-15	1.78E-15	1.67E-15	3.86E-15	1.84E-15	1.69E-15	1.87E-15	6.93E-15
Yb-177	9.03E-15	1.03E-14	8.93E-15	8.64E-15	1.59E-14	9.22E-15	8.55E-15	9.23E-15	3.60E-14
Yb-178	1.63E-15	1.87E-15	1.60E-15	1.52E-15	3.22E-15	1.65E-15	1.53E-15	1.67E-15	1.07E-14
Lutetium									
Lu-169	4.98E-14	5.67E-14	4.94E-14	4.82E-14	8.12E-14	5.09E-14	4.75E-14	5.09E-14	5.90E-14
Lu-170	1.24E-13	1.40E-13	1.26E-13	1.25E-13	1.78E-13	1.29E-13	1.22E-13	1.28E-13	1.46E-13
Lu-171	3.20E-14	3.67E-14	3.13E-14	3.01E-14	5.64E-14	3.25E-14	2.99E-14	3.25E-14	3.80E-14
Lu-172	9.06E-14	1.03E-13	9.01E-14	8.80E-14	1.45E-13	9.28E-14	8.64E-14	9.25E-14	1.07E-13
Lu-173	5.17E-15	6.13E-15	4.55E-15	3.89E-15	1.45E-14	4.98E-15	4.29E-15	5.10E-15	6.45E-15
Lu-174m	2.26E-15	2.72E-15	1.88E-15	1.52E-15	6.88E-15	2.12E-15	1.77E-15	2.18E-15	2.89E-15
Lu-174	5.45E-15	6.33E-15	5.11E-15	4.74E-15	1.12E-14	5.42E-15	4.88E-15	5.46E-15	6.53E-15
Lu-176m	5.91E-16	7.05E-16	5.19E-16	4.22E-16	1.97E-15	5.66E-16	4.83E-16	5.87E-16	2.72E-14
Lu-176	2.27E-14	2.60E-14	2.20E-14	2.05E-14	5.18E-14	2.28E-14	2.08E-14	2.32E-14	3.74E-14
Lu-177m	4.59E-14	5.28E-14	4.42E-14	4.10E-14	1.06E-13	4.60E-14	4.18E-14	4.67E-14	5.89E-14
Lu-177	1.59E-15	1.84E-15	1.51E-15	1.37E-15	4.17E-15	1.58E-15	1.42E-15	1.62E-15	7.13E-15
Lu-178m	5.12E-14	5.88E-14	4.98E-14	4.67E-14	1.11E-13	5.16E-14	4.73E-14	5.23E-14	9.06E-14
Lu-178	6.92E-15	7.85E-15	6.92E-15	6.78E-15	1.09E-14	7.10E-15	6.67E-15	7.09E-15	5.68E-14
Lu-179	1.49E-15	1.71E-15	1.43E-15	1.33E-15	3.50E-15	1.50E-15	1.36E-15	1.52E-15	2.99E-14

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	2.48E-14	2.86E-14	2.39E-14	2.24E-14	5.22E-14	2.49E-14	2.27E-14	2.52E-14	3.00E-14
Hf-172	4.18E-15	5.07E-15	3.47E-15	2.75E-15	1.38E-14	3.93E-15	3.25E-15	4.06E-15	5.46E-15
Hf-173	1.82E-14	2.11E-14	1.73E-14	1.58E-14	4.53E-14	1.82E-14	1.64E-14	1.85E-14	2.23E-14
Hf-175	1.67E-14	1.92E-14	1.60E-14	1.50E-14	3.60E-14	1.67E-14	1.52E-14	1.69E-14	2.15E-14
Hf-177m	1.04E-13	1.19E-13	1.01E-13	9.45E-14	2.28E-13	1.05E-13	9.57E-14	1.06E-13	1.39E-13
Hf-178m	1.10E-13	1.25E-13	1.07E-13	1.02E-13	2.18E-13	1.11E-13	1.02E-13	1.12E-13	1.36E-13
Hf-179m	4.13E-14	4.74E-14	4.01E-14	3.75E-14	8.92E-14	4.16E-14	3.80E-14	4.21E-14	5.26E-14
Hf-180m	4.64E-14	5.33E-14	4.52E-14	4.26E-14	9.71E-14	4.69E-14	4.30E-14	4.74E-14	5.82E-14
Hf-181	2.57E-14	2.95E-14	2.52E-14	2.39E-14	5.12E-14	2.60E-14	2.40E-14	2.62E-14	3.62E-14
Hf-182m	4.35E-14	4.97E-14	4.26E-14	4.05E-14	8.39E-14	4.40E-14	4.05E-14	4.43E-14	5.82E-14
Hf-182	1.11E-14	1.28E-14	1.08E-14	1.01E-14	2.52E-14	1.12E-14	1.02E-14	1.14E-14	1.46E-14
Hf-183	3.56E-14	4.06E-14	3.52E-14	3.40E-14	6.08E-14	3.62E-14	3.36E-14	3.63E-14	6.83E-14
Hf-184	1.12E-14	1.29E-14	1.07E-14	9.87E-15	2.66E-14	1.12E-14	1.01E-14	1.14E-14	3.12E-14
Tantalum									
Ta-172	7.42E-14	8.45E-14	7.38E-14	7.18E-14	1.24E-13	7.59E-14	7.08E-14	7.59E-14	1.16E-13
Ta-173	2.70E-14	3.10E-14	2.64E-14	2.51E-14	5.11E-14	2.73E-14	2.52E-14	2.75E-14	5.08E-14
Ta-174	2.91E-14	3.34E-14	2.85E-14	2.71E-14	5.70E-14	2.95E-14	2.71E-14	2.97E-14	5.36E-14
Ta-175	4.45E-14	5.07E-14	4.41E-14	4.28E-14	7.62E-14	4.54E-14	4.24E-14	4.55E-14	5.32E-14
Ta-176	1.06E-13	1.20E-13	1.07E-13	1.06E-13	1.56E-13	1.09E-13	1.03E-13	1.09E-13	1.25E-13
Ta-177	2.58E-15	3.09E-15	2.22E-15	1.81E-15	7.97E-15	2.45E-15	2.08E-15	2.53E-15	3.36E-15
Ta-178b[1]	4.67E-14	5.37E-14	4.51E-14	4.20E-14	1.04E-13	4.69E-14	4.28E-14	4.75E-14	5.87E-14
Ta-178a[2]	4.61E-15	5.39E-15	4.27E-15	3.86E-15	1.07E-14	4.55E-15	4.06E-15	4.61E-15	5.65E-15
Ta-179	1.14E-15	1.39E-15	9.19E-16	6.96E-16	3.90E-15	1.05E-15	8.57E-16	1.09E-15	1.45E-15
Ta-180m	1.76E-15	2.14E-15	1.45E-15	1.12E-15	6.02E-15	1.64E-15	1.35E-15	1.71E-15	3.67E-15
Ta-180	2.55E-14	2.93E-14	2.45E-14	2.28E-14	5.83E-14	2.56E-14	2.33E-14	2.59E-14	3.26E-14
Ta-182m	1.10E-14	1.28E-14	1.03E-14	9.16E-15	3.01E-14	1.09E-14	9.69E-15	1.11E-14	1.93E-14
Ta-182	6.26E-14	7.11E-14	6.24E-14	6.10E-14	9.94E-14	6.42E-14	5.99E-14	6.40E-14	7.85E-14
Ta-183	1.30E-14	1.50E-14	1.23E-14	1.11E-14	3.27E-14	1.29E-14	1.16E-14	1.31E-14	2.62E-14
Ta-184	7.63E-14	8.70E-14	7.54E-14	7.27E-14	1.37E-13	7.78E-14	7.20E-14	7.80E-14	1.16E-13
Ta-185	8.63E-15	9.99E-15	8.14E-15	7.37E-15	2.17E-14	8.57E-15	7.69E-15	8.73E-15	5.20E-14
Ta-186	7.37E-14	8.41E-14	7.27E-14	6.98E-14	1.36E-13	7.49E-14	6.94E-14	7.53E-14	1.49E-13
Tungsten									
W-176	7.06E-15	8.41E-15	6.20E-15	5.04E-15	2.36E-14	6.76E-15	5.78E-15	7.02E-15	8.74E-15
W-177	4.18E-14	4.79E-14	4.08E-14	3.87E-14	8.11E-14	4.23E-14	3.89E-14	4.26E-14	5.11E-14
W-178	4.79E-16	5.81E-16	3.92E-16	2.99E-16	1.65E-15	4.45E-16	3.65E-16	4.62E-16	6.09E-16
W-179	1.94E-15	2.39E-15	1.51E-15	1.15E-15	6.42E-15	1.77E-15	1.42E-15	1.83E-15	2.58E-15
W-181	1.45E-15	1.76E-15	1.19E-15	9.10E-16	5.00E-15	1.35E-15	1.11E-15	1.40E-15	1.84E-15
W-185	5.53E-18	6.72E-18	4.61E-18	3.83E-18	1.70E-17	5.21E-18	4.35E-18	5.37E-18	4.52E-15
W-187	2.24E-14	2.56E-14	2.21E-14	2.12E-14	4.00E-14	2.27E-14	2.11E-14	2.28E-14	4.09E-14
W-188	8.89E-17	1.02E-16	8.52E-17	7.90E-17	2.07E-16	8.90E-17	8.08E-17	9.04E-17	2.91E-15
Rhenium									
Re-177	2.90E-14	3.32E-14	2.86E-14	2.74E-14	5.31E-14	2.94E-14	2.74E-14	2.96E-14	5.17E-14
Re-178	5.95E-14	6.72E-14	5.93E-14	5.78E-14	9.91E-14	6.10E-14	5.70E-14	6.09E-14	1.04E-13
Re-180	5.62E-14	6.40E-14	5.56E-14	5.40E-14	9.29E-14	5.74E-14	5.32E-14	5.72E-14	7.11E-14
Re-181	3.58E-14	4.10E-14	3.51E-14	3.35E-14	6.73E-14	3.63E-14	3.35E-14	3.65E-14	4.76E-14
Re-182b[3]	8.98E-14	1.02E-13	8.86E-14	8.54E-14	1.60E-13	9.14E-14	8.48E-14	9.16E-14	1.08E-13
Re-182a[4]	5.66E-14	6.43E-14	5.62E-14	5.48E-14	9.20E-14	5.79E-14	5.40E-14	5.78E-14	6.71E-14
Re-184m	1.79E-14	2.05E-14	1.74E-14	1.64E-14	3.62E-14	1.81E-14	1.65E-14	1.82E-14	2.19E-14
Re-184	4.22E-14	4.80E-14	4.16E-14	4.03E-14	7.07E-14	4.30E-14	3.98E-14	4.29E-14	5.00E-14
Re-186m	5.20E-16	6.35E-16	4.21E-16	3.23E-16	1.75E-15	4.82E-16	3.93E-16	5.00E-16	7.24E-16
Re-186	9.09E-16	1.06E-15	8.40E-16	7.27E-16	2.72E-15	8.93E-16	7.87E-16	9.19E-16	2.03E-14
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	3.06E-15	3.65E-15	2.65E-15	2.12E-15	1.04E-14	2.90E-15	2.46E-15	3.02E-15	3.91E-15
Re-188	2.81E-15	3.23E-15	2.74E-15	2.58E-15	6.02E-15	2.84E-15	2.61E-15	2.87E-15	5.35E-14
Re-189	3.17E-15	3.65E-15	3.03E-15	2.79E-15	7.74E-15	3.17E-15	2.87E-15	3.22E-15	2.15E-14
Osmium									
Os-180	2.34E-15	2.80E-15	2.02E-15	1.65E-15	7.32E-15	2.22E-15	1.89E-15	2.30E-15	3.19E-15

[1] $T_{1/2}$ = 2.2 h
[2] $T_{1/2}$ = 9.31 m
[3] $T_{1/2}$ = 64.0 h
[4] $T_{1/2}$ = 12.7 h

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	5.82E-14	6.63E-14	5.76E-14	5.58E-14	1.01E-13	5.94E-14	5.52E-14	5.94E-14	7.03E-14
Os-182	1.97E-14	2.27E-14	1.91E-14	1.79E-14	4.18E-14	1.99E-14	1.82E-14	2.01E-14	2.46E-14
Os-185	3.36E-14	3.84E-14	3.32E-14	3.20E-14	5.82E-14	3.42E-14	3.17E-14	3.43E-14	4.01E-14
Os-189m	8.32E-20	4.53E-19	1.28E-21	2.06E-20	1.12E-19	1.21E-20	3.69E-20	1.06E-19	7.16E-18
Os-190m	7.43E-14	8.50E-14	7.35E-14	7.05E-14	1.37E-13	7.56E-14	7.01E-14	7.60E-14	9.12E-14
Os-191m	2.81E-16	3.37E-16	2.38E-16	1.86E-16	9.73E-16	2.63E-16	2.21E-16	2.75E-16	3.67E-16
Os-191	3.20E-15	3.77E-15	2.89E-15	2.41E-15	1.03E-14	3.10E-15	2.69E-15	3.21E-15	4.35E-15
Os-193	3.34E-15	3.85E-15	3.22E-15	2.99E-15	7.45E-15	3.35E-15	3.05E-15	3.40E-15	2.44E-14
Os-194	3.08E-17	3.97E-17	2.06E-17	1.49E-17	9.43E-17	2.70E-17	1.98E-17	2.75E-17	5.22E-17
Iridium									
Ir-182	6.35E-14	7.25E-14	6.29E-14	6.05E-14	1.14E-13	6.47E-14	6.01E-14	6.50E-14	1.35E-13
Ir-184	9.16E-14	1.04E-13	9.12E-14	8.86E-14	1.55E-13	9.37E-14	8.75E-14	9.38E-14	1.21E-13
Ir-185	2.87E-14	3.27E-14	2.85E-14	2.77E-14	4.94E-14	2.93E-14	2.75E-14	2.94E-14	3.52E-14
Ir-186a[1]	7.87E-14	8.95E-14	7.83E-14	7.60E-14	1.35E-13	8.04E-14	7.51E-14	8.06E-14	9.55E-14
Ir-186b[2]	4.56E-14	5.20E-14	4.51E-14	4.35E-14	7.97E-14	4.64E-14	4.31E-14	4.65E-14	6.41E-14
Ir-187	1.66E-14	1.90E-14	1.61E-14	1.52E-14	3.23E-14	1.67E-14	1.53E-14	1.68E-14	2.03E-14
Ir-188	7.78E-14	8.81E-14	7.83E-14	7.72E-14	1.20E-13	8.01E-14	7.57E-14	8.01E-14	9.18E-14
Ir-189	3.23E-15	3.81E-15	2.87E-15	2.41E-15	9.89E-15	3.11E-15	2.69E-15	3.21E-15	4.14E-15
Ir-190n[3]	7.23E-14	8.28E-14	7.12E-14	6.80E-14	1.37E-13	7.34E-14	6.79E-14	7.39E-14	8.89E-14
Ir-190m[4]	1.06E-19	5.36E-19	7.98E-22	2.50E-20	1.35E-19	1.58E-20	4.29E-20	1.27E-19	7.52E-18
Ir-190	6.71E-14	7.69E-14	6.60E-14	6.30E-14	1.28E-13	6.81E-14	6.29E-14	6.86E-14	8.24E-14
Ir-191m	3.01E-15	3.55E-15	2.73E-15	2.29E-15	9.62E-15	2.92E-15	2.54E-15	3.02E-15	4.07E-15
Ir-192m	7.46E-15	8.59E-15	7.15E-15	6.49E-15	2.00E-14	7.47E-15	6.74E-15	7.63E-15	8.81E-15
Ir-192	3.83E-14	4.38E-14	3.76E-14	3.59E-14	7.50E-14	3.88E-14	3.59E-14	3.91E-14	5.53E-14
Ir-194m	1.10E-13	1.25E-13	1.09E-13	1.05E-13	1.97E-13	1.12E-13	1.04E-13	1.12E-13	1.34E-13
Ir-194	4.44E-15	5.06E-15	4.38E-15	4.21E-15	8.19E-15	4.51E-15	4.19E-15	4.54E-15	5.85E-14
Ir-195m	1.90E-14	2.18E-14	1.84E-14	1.72E-14	4.05E-14	1.91E-14	1.75E-14	1.93E-14	3.53E-14
Ir-195	2.32E-15	2.75E-15	2.06E-15	1.70E-15	7.63E-15	2.23E-15	1.92E-15	2.32E-15	2.19E-14
Platinum									
Pt-186	3.46E-14	3.96E-14	3.42E-14	3.30E-14	6.00E-14	3.53E-14	3.27E-14	3.53E-14	4.10E-14
Pt-188	8.77E-15	1.02E-14	8.22E-15	7.34E-15	2.30E-14	8.66E-15	7.74E-15	8.86E-15	1.18E-14
Pt-189	1.46E-14	1.68E-14	1.40E-14	1.30E-14	3.16E-14	1.46E-14	1.33E-14	1.48E-14	1.82E-14
Pt-191	1.33E-14	1.54E-14	1.26E-14	1.14E-14	3.20E-14	1.32E-14	1.19E-14	1.34E-14	1.71E-14
Pt-193m	4.20E-16	5.01E-16	3.63E-16	2.88E-16	1.45E-15	3.97E-16	3.37E-16	4.15E-16	3.07E-15
Pt-193	3.58E-19	1.63E-18	2.61E-21	7.99E-20	4.34E-19	6.58E-20	1.30E-19	3.98E-19	2.07E-17
Pt-195m	2.85E-15	3.39E-15	2.51E-15	2.03E-15	9.64E-15	2.72E-15	2.33E-15	2.84E-15	5.92E-15
Pt-197m	3.46E-15	4.03E-15	3.24E-15	2.89E-15	8.95E-15	3.41E-15	3.05E-15	3.49E-15	1.86E-14
Pt-197	1.00E-15	1.18E-15	9.18E-16	7.81E-16	3.10E-15	9.76E-16	8.57E-16	1.01E-15	1.06E-14
Pt-199	9.52E-15	1.09E-14	9.41E-15	9.03E-15	1.75E-14	9.68E-15	8.97E-15	9.73E-15	4.38E-14
Pt-200	2.53E-15	2.95E-15	2.34E-15	2.04E-15	7.22E-15	2.48E-15	2.19E-15	2.55E-15	1.13E-14
Gold									
Au-193	6.79E-15	7.92E-15	6.28E-15	5.49E-15	1.90E-14	6.65E-15	5.90E-15	6.83E-15	9.16E-15
Au-194	5.16E-14	5.86E-14	5.15E-14	5.02E-14	8.58E-14	5.28E-14	4.96E-14	5.29E-14	6.19E-14
Au-195m	9.19E-15	1.05E-14	8.88E-15	8.26E-15	2.12E-14	9.23E-15	8.41E-15	9.37E-15	1.35E-14
Au-195	3.24E-15	3.85E-15	2.83E-15	2.27E-15	1.11E-14	3.08E-15	2.63E-15	3.21E-15	4.12E-15
Au-198m	2.61E-14	3.01E-14	2.49E-14	2.26E-14	6.81E-14	2.60E-14	2.34E-14	2.66E-14	3.75E-14
Au-198	1.89E-14	2.17E-14	1.87E-14	1.79E-14	3.58E-14	1.92E-14	1.78E-14	1.94E-14	4.08E-14
Au-199	4.00E-15	4.62E-15	3.80E-15	3.42E-15	1.09E-14	3.98E-15	3.57E-15	4.08E-15	8.23E-15
Au-200m	9.84E-14	1.12E-13	9.73E-14	9.36E-14	1.78E-13	1.00E-13	9.28E-14	1.01E-13	1.27E-13
Au-200	1.33E-14	1.51E-14	1.33E-14	1.31E-14	2.11E-14	1.37E-14	1.28E-14	1.37E-14	6.36E-14
Au-201	2.51E-15	2.88E-15	2.48E-15	2.37E-15	4.63E-15	2.55E-15	2.36E-15	2.57E-15	2.78E-14
Mercury									
Hg-193m	4.94E-14	5.64E-14	4.89E-14	4.71E-14	8.88E-14	5.03E-14	4.68E-14	5.05E-14	6.21E-14
Hg-193	8.61E-15	1.00E-14	8.00E-15	7.04E-15	2.40E-14	8.46E-15	7.52E-15	8.69E-15	1.26E-14
Hg-194	7.05E-19	2.69E-18	6.10E-21	1.46E-19	7.98E-19	1.67E-19	2.16E-19	6.92E-19	2.65E-17
Hg-195m	9.47E-15	1.09E-14	9.14E-15	8.52E-15	2.08E-14	9.50E-15	8.67E-15	9.63E-15	1.38E-14
Hg-195	9.08E-15	1.05E-14	8.73E-15	8.13E-15	1.93E-14	9.11E-15	8.29E-15	9.20E-15	1.11E-14

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	3.99E-15	4.64E-15	3.73E-15	3.26E-15	1.17E-14	3.93E-15	3.49E-15	4.05E-15	1.02E-14
Hg-197	2.68E-15	3.18E-15	2.35E-15	1.88E-15	9.18E-15	2.55E-15	2.18E-15	2.66E-15	3.35E-15
Hg-199m	8.22E-15	9.52E-15	7.80E-15	7.00E-15	2.18E-14	8.17E-15	7.34E-15	8.36E-15	2.71E-14
Hg-203	1.11E-14	1.27E-14	1.08E-14	1.01E-14	2.45E-14	1.12E-14	1.02E-14	1.13E-14	1.56E-14
Thallium									
Tl-194m	1.09E-13	1.24E-13	1.08E-13	1.04E-13	1.92E-13	1.11E-13	1.03E-13	1.11E-13	1.47E-13
Tl-194	3.62E-14	4.15E-14	3.57E-14	3.41E-14	6.76E-14	3.68E-14	3.40E-14	3.70E-14	4.41E-14
Tl-195	6.17E-14	7.00E-14	6.19E-14	6.08E-14	9.72E-14	6.34E-14	5.97E-14	6.34E-14	7.52E-14
Tl-197	1.89E-14	2.17E-14	1.85E-14	1.76E-14	3.72E-14	1.91E-14	1.77E-14	1.93E-14	2.43E-14
Tl-198m	5.57E-14	6.37E-14	5.49E-14	5.26E-14	1.03E-13	5.66E-14	5.24E-14	5.69E-14	7.40E-14
Tl-198	9.81E-14	1.11E-13	9.87E-14	9.71E-14	1.52E-13	1.01E-13	9.53E-14	1.01E-13	1.16E-13
Tl-199	1.11E-14	1.28E-14	1.07E-14	9.79E-15	2.61E-14	1.11E-14	1.01E-14	1.13E-14	1.49E-14
Tl-200	6.27E-14	7.13E-14	6.24E-14	6.06E-14	1.05E-13	6.41E-14	5.98E-14	6.42E-14	7.50E-14
Tl-201	3.77E-15	4.44E-15	3.39E-15	2.81E-15	1.23E-14	3.63E-15	3.16E-15	3.78E-15	4.89E-15
Tl-202	2.14E-14	2.46E-14	2.09E-14	1.97E-14	4.33E-14	2.16E-14	1.99E-14	2.18E-14	2.63E-14
Tl-204	5.64E-17	6.72E-17	4.92E-17	4.01E-17	1.86E-16	5.37E-17	4.59E-17	5.59E-17	1.24E-14
Tl-206	6.74E-17	7.93E-17	6.13E-17	5.49E-17	1.74E-16	6.60E-17	5.81E-17	6.73E-17	3.36E-14
Tl-207	1.60E-16	1.84E-16	1.55E-16	1.47E-16	3.03E-16	1.62E-16	1.47E-16	1.62E-16	3.06E-14
Tl-208	1.72E-13	1.92E-13	1.75E-13	1.74E-13	2.42E-13	1.78E-13	1.70E-13	1.77E-13	2.34E-13
Tl-209	9.95E-14	1.13E-13	1.00E-13	9.86E-14	1.55E-13	1.02E-13	9.69E-14	1.02E-13	1.59E-13
Lead									
Pb-195m	7.51E-14	8.58E-14	7.43E-14	7.15E-14	1.34E-13	7.65E-14	7.09E-14	7.68E-14	9.97E-14
Pb-198	2.00E-14	2.30E-14	1.94E-14	1.81E-14	4.42E-14	2.01E-14	1.84E-14	2.04E-14	2.66E-14
Pb-199	7.13E-14	8.10E-14	7.13E-14	6.96E-14	1.16E-13	7.31E-14	6.85E-14	7.31E-14	8.55E-14
Pb-200	9.07E-15	1.05E-14	8.51E-15	7.52E-15	2.53E-14	8.96E-15	7.99E-15	9.20E-15	1.31E-14
Pb-201	3.55E-14	4.06E-14	3.50E-14	3.34E-14	6.68E-14	3.61E-14	3.33E-14	3.63E-14	4.43E-14
Pb-202m	9.75E-14	1.11E-13	9.70E-14	9.45E-14	1.59E-13	9.98E-14	9.29E-14	9.96E-14	1.17E-13
Pb-202	3.86E-19	1.88E-18	2.77E-21	8.91E-20	4.82E-19	6.67E-20	1.51E-19	4.52E-19	2.72E-17
Pb-203	1.41E-14	1.62E-14	1.35E-14	1.24E-14	3.37E-14	1.41E-14	1.28E-14	1.44E-14	1.87E-14
Pb-205	4.44E-19	2.09E-18	3.36E-21	1.01E-19	5.47E-19	8.26E-20	1.68E-19	5.06E-19	2.92E-17
Pb-209	8.37E-18	1.02E-17	6.98E-18	5.93E-18	2.43E-17	7.91E-18	6.62E-18	8.12E-18	9.35E-15
Pb-210	6.19E-17	8.18E-17	4.25E-17	3.14E-17	1.95E-16	5.42E-17	4.09E-17	5.64E-17	1.28E-16
Pb-211	2.44E-15	2.79E-15	2.42E-15	2.34E-15	4.19E-15	2.49E-15	2.31E-15	2.49E-15	3.06E-14
Pb-212	6.75E-15	7.76E-15	6.46E-15	5.92E-15	1.68E-14	6.75E-15	6.10E-15	6.87E-15	1.35E-14
Pb-214	1.16E-14	1.33E-14	1.13E-14	1.06E-14	2.44E-14	1.17E-14	1.07E-14	1.18E-14	2.77E-14
Bismuth									
Bi-200	1.14E-13	1.29E-13	1.12E-13	1.09E-13	1.97E-13	1.16E-13	1.08E-13	1.16E-13	1.43E-13
Bi-201	6.38E-14	7.26E-14	6.33E-14	6.16E-14	1.05E-13	6.52E-14	6.07E-14	6.51E-14	8.99E-14
Bi-202	1.30E-13	1.48E-13	1.30E-13	1.26E-13	2.12E-13	1.33E-13	1.24E-13	1.33E-13	1.57E-13
Bi-203	1.17E-13	1.32E-13	1.17E-13	1.16E-13	1.77E-13	1.20E-13	1.13E-13	1.20E-13	1.39E-13
Bi-205	8.26E-14	9.36E-14	8.32E-14	8.19E-14	1.26E-13	8.50E-14	8.03E-14	8.49E-14	9.70E-14
Bi-206	1.58E-13	1.79E-13	1.57E-13	1.54E-13	2.53E-13	1.62E-13	1.51E-13	1.61E-13	1.90E-13
Bi-207	7.37E-14	8.38E-14	7.35E-14	7.17E-14	1.19E-13	7.55E-14	7.04E-14	7.54E-14	9.31E-14
Bi-210m	1.20E-14	1.37E-14	1.17E-14	1.10E-14	2.59E-14	1.21E-14	1.11E-14	1.22E-14	1.63E-14
Bi-210	3.32E-17	3.95E-17	2.95E-17	2.60E-17	8.98E-17	3.22E-17	2.79E-17	3.29E-17	2.30E-14
Bi-211	2.17E-15	2.49E-15	2.13E-15	2.01E-15	4.44E-15	2.19E-15	2.02E-15	2.22E-15	3.07E-15
Bi-212	9.02E-15	1.02E-14	9.03E-15	8.87E-15	1.39E-14	9.26E-15	8.69E-15	9.24E-15	4.05E-14
Bi-213	6.25E-15	7.16E-15	6.17E-15	5.91E-15	1.17E-14	6.35E-15	5.89E-15	6.39E-15	3.39E-14
Bi-214	7.44E-14	8.42E-14	7.51E-14	7.43E-14	1.09E-13	7.67E-14	7.26E-14	7.65E-14	1.28E-13
Polonium									
Po-203	7.93E-14	9.00E-14	7.91E-14	7.74E-14	1.27E-13	8.13E-14	7.60E-14	8.12E-14	1.00E-13
Po-205	7.62E-14	8.65E-14	7.60E-14	7.44E-14	1.21E-13	7.81E-14	7.30E-14	7.80E-14	9.10E-14
Po-207	6.38E-14	7.25E-14	6.34E-14	6.18E-14	1.03E-13	6.53E-14	6.08E-14	6.51E-14	7.67E-14
Po-210	4.08E-19	4.63E-19	4.06E-19	3.97E-19	6.39E-19	4.18E-19	3.89E-19	4.16E-19	4.81E-19
Po-211	3.73E-16	4.24E-16	3.71E-16	3.62E-16	5.97E-16	3.82E-16	3.56E-16	3.81E-16	4.47E-16
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	4.00E-18	4.54E-18	3.98E-18	3.89E-18	6.27E-18	4.09E-18	3.81E-18	4.08E-18	4.71E-18
Po-215	8.24E-18	9.43E-18	8.15E-18	7.81E-18	1.53E-17	8.37E-18	7.77E-18	8.43E-18	1.01E-17
Po-216	8.12E-19	9.23E-19	8.09E-19	7.91E-19	1.27E-18	8.32E-19	7.75E-19	8.29E-19	9.57E-19
Po-218	4.39E-19	4.98E-19	4.37E-19	4.28E-19	6.81E-19	4.50E-19	4.19E-19	4.48E-19	7.56E-19

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	6.37E-14	7.23E-14	6.35E-14	6.20E-14	1.04E-13	6.52E-14	6.10E-14	6.52E-14	7.76E-14
At-211	1.58E-15	1.87E-15	1.44E-15	1.19E-15	5.22E-15	1.53E-15	1.33E-15	1.59E-15	1.96E-15
At-215	9.02E-18	1.03E-17	8.90E-18	8.50E-18	1.72E-17	9.15E-18	8.48E-18	9.22E-18	1.12E-17
At-216	6.19E-17	7.29E-17	5.62E-17	4.65E-17	2.06E-16	5.99E-17	5.22E-17	6.24E-17	8.03E-17
At-217	1.45E-17	1.65E-17	1.43E-17	1.37E-17	2.67E-17	1.47E-17	1.36E-17	1.48E-17	1.86E-17
At-218	1.26E-16	1.60E-16	9.67E-17	7.25E-17	4.23E-16	1.14E-16	9.12E-17	1.19E-16	2.12E-16
Radon									
Rn-218	3.57E-17	4.08E-17	3.55E-17	3.45E-17	6.00E-17	3.65E-17	3.40E-17	3.65E-17	4.30E-17
Rn-219	2.62E-15	3.00E-15	2.56E-15	2.43E-15	5.44E-15	2.65E-15	2.44E-15	2.68E-15	3.38E-15
Rn-220	1.81E-17	2.07E-17	1.80E-17	1.74E-17	3.13E-17	1.85E-17	1.72E-17	1.85E-17	2.20E-17
Rn-222	1.87E-17	2.14E-17	1.86E-17	1.79E-17	3.31E-17	1.90E-17	1.77E-17	1.91E-17	2.28E-17
Francium									
Fr-219	1.62E-16	1.86E-16	1.60E-16	1.52E-16	3.21E-16	1.65E-16	1.52E-16	1.66E-16	2.04E-16
Fr-220	4.82E-16	5.61E-16	4.56E-16	4.07E-16	1.36E-15	4.79E-16	4.29E-16	4.92E-16	8.53E-16
Fr-221	1.43E-15	1.64E-15	1.38E-15	1.27E-15	3.48E-15	1.44E-15	1.30E-15	1.46E-15	2.02E-15
Fr-222	1.17E-16	1.37E-16	1.08E-16	9.80E-17	2.86E-16	1.15E-16	1.02E-16	1.17E-16	4.76E-14
Fr-223	2.30E-15	2.72E-15	2.07E-15	1.80E-15	6.29E-15	2.24E-15	1.95E-15	2.29E-15	2.30E-14
Radium									
Ra-222	4.29E-16	4.91E-16	4.21E-16	3.99E-16	8.87E-16	4.35E-16	4.00E-16	4.39E-16	5.51E-16
Ra-223	5.97E-15	6.91E-15	5.70E-15	5.16E-15	1.54E-14	5.96E-15	5.37E-15	6.09E-15	8.87E-15
Ra-224	4.61E-16	5.28E-16	4.47E-16	4.17E-16	1.07E-15	4.64E-16	4.24E-16	4.71E-16	6.35E-16
Ra-225	3.24E-16	4.24E-16	1.96E-16	1.42E-16	9.20E-16	2.77E-16	1.93E-16	2.79E-16	3.01E-15
Ra-226	3.08E-16	3.54E-16	2.95E-16	2.70E-16	7.95E-16	3.09E-16	2.79E-16	3.15E-16	4.79E-16
Ra-227	7.28E-15	8.38E-15	7.07E-15	6.69E-15	1.49E-14	7.34E-15	6.73E-15	7.41E-15	3.19E-14
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	2.03E-16	2.37E-16	1.94E-16	1.79E-16	4.87E-16	2.03E-16	1.84E-16	2.07E-16	3.05E-16
Ac-224	8.82E-15	1.02E-14	8.37E-15	7.49E-15	2.44E-14	8.78E-15	7.87E-15	9.00E-15	1.08E-14
Ac-225	7.08E-16	8.28E-16	6.64E-16	5.83E-16	2.07E-15	6.99E-16	6.22E-16	7.21E-16	9.40E-16
Ac-226	5.91E-15	6.79E-15	5.67E-15	5.20E-15	1.49E-14	5.91E-15	5.35E-15	6.03E-15	2.15E-14
Ac-227	5.78E-18	6.98E-18	5.22E-18	4.59E-18	1.68E-17	5.60E-18	4.92E-18	5.82E-18	1.10E-17
Ac-228	4.67E-14	5.30E-14	4.66E-14	4.56E-14	7.39E-14	4.79E-14	4.48E-14	4.78E-14	7.88E-14
Thorium									
Th-226	3.52E-16	4.10E-16	3.33E-16	2.97E-16	9.97E-16	3.50E-16	3.13E-16	3.59E-16	6.37E-16
Th-227	4.80E-15	5.53E-15	4.61E-15	4.27E-15	1.12E-14	4.81E-15	4.36E-15	4.88E-15	6.50E-15
Th-228	9.12E-17	1.09E-16	8.33E-17	7.32E-17	2.64E-16	8.88E-17	7.84E-17	9.20E-17	1.50E-16
Th-229	3.77E-15	4.42E-15	3.50E-15	3.03E-15	1.15E-14	3.70E-15	3.27E-15	3.83E-15	5.41E-15
Th-230	1.80E-17	2.38E-17	1.43E-17	1.22E-17	5.29E-17	1.63E-17	1.37E-17	1.74E-17	4.51E-17
Th-231	5.39E-16	6.79E-16	4.35E-16	3.70E-16	1.63E-15	5.00E-16	4.15E-16	5.22E-16	2.52E-15
Th-232	9.34E-18	1.36E-17	6.37E-18	5.52E-18	2.60E-17	7.90E-18	6.34E-18	8.72E-18	3.44E-17
Th-234	3.38E-16	4.03E-16	3.01E-16	2.49E-16	1.12E-15	3.25E-16	2.81E-16	3.38E-16	7.50E-16
Protactinium									
Pa-227	8.46E-16	1.00E-15	7.68E-16	6.43E-16	2.78E-15	8.21E-16	7.16E-16	8.54E-16	1.08E-15
Pa-228	5.41E-14	6.16E-14	5.38E-14	5.23E-14	9.14E-14	5.53E-14	5.15E-14	5.54E-14	6.56E-14
Pa-230	3.07E-14	3.50E-14	3.04E-14	2.94E-14	5.27E-14	3.13E-14	2.90E-14	3.13E-14	3.73E-14
Pa-231	1.71E-15	1.99E-15	1.62E-15	1.52E-15	3.64E-15	1.70E-15	1.54E-15	1.72E-15	2.44E-15
Pa-232	4.47E-14	5.08E-14	4.44E-14	4.34E-14	7.19E-14	4.57E-14	4.26E-14	4.56E-14	5.57E-14
Pa-233	9.16E-15	1.05E-14	8.88E-15	8.27E-15	2.08E-14	9.21E-15	8.42E-15	9.35E-15	1.66E-14
Pa-234m	7.05E-16	8.05E-16	6.94E-16	6.70E-16	1.24E-15	7.18E-16	6.64E-16	7.19E-16	5.48E-14
Pa-234	9.14E-14	1.04E-13	9.09E-14	8.86E-14	1.50E-13	9.35E-14	8.71E-14	9.34E-14	1.24E-13
Uranium									
U-230	5.31E-17	6.66E-17	4.52E-17	4.03E-17	1.45E-16	5.00E-17	4.32E-17	5.23E-17	1.07E-16
U-231	2.91E-15	3.46E-15	2.65E-15	2.27E-15	9.26E-15	2.84E-15	2.48E-15	2.95E-15	3.82E-15
U-232	1.55E-17	2.32E-17	9.84E-18	8.99E-18	3.86E-17	1.29E-17	1.00E-17	1.42E-17	5.92E-17
U-233	1.69E-17	2.22E-17	1.35E-17	1.24E-17	4.12E-17	1.55E-17	1.31E-17	1.63E-17	4.57E-17
U-234	8.79E-18	1.44E-17	4.38E-18	4.20E-18	1.99E-17	6.69E-18	4.80E-18	7.63E-18	4.25E-17
U-235	7.05E-15	8.11E-15	6.75E-15	6.15E-15	1.84E-14	7.05E-15	6.37E-15	7.20E-15	8.64E-15
U-236	6.10E-18	1.10E-17	2.18E-18	2.33E-18	1.19E-17	4.19E-18	2.70E-18	5.01E-18	3.57E-17
U-237	5.90E-15	6.90E-15	5.48E-15	4.82E-15	1.69E-14	5.81E-15	5.15E-15	5.97E-15	9.97E-15
U-238	4.39E-18	8.54E-18	9.96E-19	1.24E-18	7.40E-18	2.72E-18	1.51E-18	3.41E-18	2.91E-17
U-239	2.18E-15	2.57E-15	1.96E-15	1.67E-15	6.50E-15	2.11E-15	1.84E-15	2.17E-15	2.61E-14
U-240	4.92E-17	8.04E-17	1.84E-17	1.71E-17	1.05E-16	3.61E-17	2.17E-17	3.93E-17	3.12E-15

Table III.1. Dose Coefficients for Air Submersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	5.68E-14	6.47E-14	5.62E-14	5.43E-14	9.95E-14	5.79E-14	5.37E-14	5.80E-14	6.94E-14
Np-233	3.78E-15	4.43E-15	3.54E-15	3.07E-15	1.16E-14	3.73E-15	3.31E-15	3.85E-15	4.78E-15
Np-234	7.06E-14	8.00E-14	7.12E-14	7.04E-14	1.05E-13	7.27E-14	6.89E-14	7.26E-14	8.41E-14
Np-235	5.63E-17	8.36E-17	3.47E-17	3.22E-17	1.40E-16	4.69E-17	3.57E-17	5.10E-17	1.82E-16
Np-236a[1]	5.26E-15	6.18E-15	4.91E-15	4.29E-15	1.58E-14	5.19E-15	4.60E-15	5.36E-15	9.17E-15
Np-236b[2]	2.10E-15	2.45E-15	1.97E-15	1.73E-15	6.11E-15	2.08E-15	1.85E-15	2.14E-15	5.76E-15
Np-237	1.04E-15	1.26E-15	9.02E-16	7.69E-16	3.20E-15	9.94E-16	8.50E-16	1.03E-15	1.54E-15
Np-238	2.66E-14	3.02E-14	2.65E-14	2.61E-14	3.99E-14	2.73E-14	2.55E-14	2.72E-14	4.31E-14
Np-239	7.53E-15	8.73E-15	7.18E-15	6.50E-15	2.00E-14	7.52E-15	6.76E-15	7.69E-15	1.60E-14
Np-240m	1.58E-14	1.80E-14	1.57E-14	1.53E-14	2.61E-14	1.62E-14	1.51E-14	1.62E-14	5.93E-14
Np-240	6.18E-14	7.04E-14	6.12E-14	5.94E-14	1.05E-13	6.31E-14	5.86E-14	6.31E-14	9.15E-14
Plutonium									
Pu-234	2.79E-15	3.28E-15	2.60E-15	2.23E-15	8.87E-15	2.75E-15	2.43E-15	2.85E-15	3.46E-15
Pu-235	3.85E-15	4.51E-15	3.60E-15	3.14E-15	1.15E-14	3.80E-15	3.37E-15	3.92E-15	4.78E-15
Pu-236	8.31E-18	1.56E-17	1.89E-18	2.47E-18	1.31E-17	5.35E-18	2.88E-18	6.35E-18	4.83E-17
Pu-237	1.99E-15	2.35E-15	1.83E-15	1.57E-15	6.31E-15	1.95E-15	1.71E-15	2.02E-15	2.54E-15
Pu-238	6.56E-18	1.27E-17	1.06E-18	1.68E-18	9.30E-18	4.01E-18	1.99E-18	4.88E-18	4.09E-17
Pu-239	4.84E-18	7.55E-18	2.65E-18	2.67E-18	9.47E-18	3.88E-18	2.86E-18	4.24E-18	1.86E-17
Pu-240	6.36E-18	1.23E-17	1.09E-18	1.65E-18	9.26E-18	3.92E-18	1.96E-18	4.75E-18	3.92E-17
Pu-241	7.19E-20	8.67E-20	6.48E-20	5.63E-20	2.19E-19	6.98E-20	6.09E-20	7.25E-20	1.17E-19
Pu-242	5.34E-18	1.03E-17	9.69E-19	1.43E-18	7.90E-18	3.32E-18	1.68E-18	4.01E-18	3.27E-17
Pu-243	1.02E-15	1.21E-15	9.28E-16	7.84E-16	3.23E-15	9.91E-16	8.66E-16	1.03E-15	8.15E-15
Pu-244	4.10E-18	8.23E-18	4.23E-19	8.80E-19	5.29E-18	2.39E-18	1.08E-18	2.97E-18	2.69E-17
Pu-245	1.95E-14	2.23E-14	1.92E-14	1.85E-14	3.57E-14	1.98E-14	1.84E-14	1.99E-14	4.00E-14
Pu-246	5.93E-15	6.91E-15	5.55E-15	4.97E-15	1.61E-14	5.88E-15	5.23E-15	6.01E-15	8.82E-15
Americium									
Am-237	1.67E-14	1.92E-14	1.62E-14	1.51E-14	3.78E-14	1.68E-14	1.53E-14	1.70E-14	2.14E-14
Am-238	4.24E-14	4.82E-14	4.21E-14	4.10E-14	7.05E-14	4.34E-14	4.04E-14	4.33E-14	5.09E-14
Am-239	1.02E-14	1.18E-14	9.62E-15	8.60E-15	2.83E-14	1.01E-14	9.04E-15	1.04E-14	1.56E-14
Am-240	4.90E-14	5.56E-14	4.87E-14	4.75E-14	7.84E-14	5.02E-14	4.66E-14	5.00E-14	5.79E-14
Am-241	8.58E-16	1.07E-15	6.74E-16	5.21E-16	2.87E-15	7.83E-16	6.34E-16	8.18E-16	1.28E-15
Am-242m	3.80E-17	6.01E-17	1.72E-17	1.72E-17	7.94E-17	2.95E-17	1.94E-17	3.17E-17	1.36E-16
Am-242	6.09E-16	7.30E-16	5.51E-16	4.77E-16	1.88E-15	5.94E-16	5.18E-16	6.15E-16	8.20E-15
Am-243	2.19E-15	2.61E-15	1.92E-15	1.55E-15	7.47E-15	2.09E-15	1.79E-15	2.18E-15	2.75E-15
Am-244m	6.38E-17	8.04E-17	5.16E-17	4.69E-17	1.56E-16	5.97E-17	5.00E-17	6.13E-17	3.11E-14
Am-244	3.77E-14	4.30E-14	3.74E-14	3.65E-14	6.17E-14	3.86E-14	3.58E-14	3.85E-14	5.25E-14
Am-245	1.43E-15	1.66E-15	1.37E-15	1.24E-15	3.75E-15	1.43E-15	1.29E-15	1.46E-15	1.62E-14
Am-246m	4.92E-14	5.58E-14	4.92E-14	4.83E-14	7.46E-14	5.05E-14	4.72E-14	5.03E-14	8.56E-14
Am-246	3.21E-14	3.67E-14	3.16E-14	3.04E-14	5.82E-14	3.26E-14	3.02E-14	3.28E-14	6.42E-14
Curium									
Cm-238	3.18E-15	3.74E-15	2.98E-15	2.58E-15	9.94E-15	3.15E-15	2.78E-15	3.25E-15	3.94E-15
Cm-240	8.38E-18	1.60E-17	9.64E-19	1.82E-18	1.11E-17	5.14E-18	2.26E-18	6.00E-18	4.68E-17
Cm-241	2.25E-14	2.59E-14	2.21E-14	2.08E-14	4.63E-14	2.28E-14	2.10E-14	2.31E-14	3.14E-14
Cm-242	7.83E-18	1.48E-17	1.13E-18	1.89E-18	1.06E-17	4.91E-18	2.27E-18	5.69E-18	4.29E-17
Cm-243	5.77E-15	6.68E-15	5.50E-15	5.00E-15	1.50E-14	5.76E-15	5.19E-15	5.88E-15	9.79E-15
Cm-244	6.90E-18	1.33E-17	7.08E-19	1.46E-18	8.82E-18	4.19E-18	1.81E-18	4.91E-18	3.91E-17
Cm-245	3.88E-15	4.55E-15	3.63E-15	3.17E-15	1.18E-14	3.84E-15	3.40E-15	3.96E-15	5.36E-15
Cm-246	6.24E-18	1.20E-17	7.00E-19	1.35E-18	8.17E-18	3.82E-18	1.67E-18	4.46E-18	3.49E-17
Cm-247	1.47E-14	1.68E-14	1.44E-14	1.38E-14	2.83E-14	1.49E-14	1.38E-14	1.50E-14	1.79E-14
Cm-248	4.75E-18	9.12E-18	5.17E-19	1.02E-18	6.17E-18	2.90E-18	1.26E-18	3.39E-18	2.67E-17
Cm-249	9.16E-16	1.05E-15	9.07E-16	8.74E-16	1.62E-15	9.33E-16	8.66E-16	9.36E-16	1.59E-14
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	1.01E-14	1.18E-14	9.65E-15	8.67E-15	2.77E-14	1.01E-14	9.07E-15	1.04E-14	1.58E-14
Bk-246	4.49E-14	5.12E-14	4.46E-14	4.34E-14	7.44E-14	4.60E-14	4.27E-14	4.59E-14	5.31E-14
Bk-247	4.63E-15	5.38E-15	4.37E-15	3.88E-15	1.30E-14	4.59E-15	4.10E-15	4.71E-15	7.43E-15
Bk-249	9.74E-20	1.37E-19	5.21E-20	4.24E-20	2.45E-19	8.02E-20	5.38E-20	8.21E-20	4.07E-17
Bk-250	4.29E-14	4.86E-14	4.28E-14	4.22E-14	6.42E-14	4.41E-14	4.11E-14	4.38E-14	6.43E-14

[1] $T_{½}$ = 1.15E5 y

[2] $T_{½}$ = 22.5 h

Table III.1. Dose Coefficients for Air Submersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	9.79E-18	1.80E-17	1.15E-18	2.09E-18	1.29E-17	6.26E-18	2.67E-18	6.91E-18	4.65E-17
Cf-246	7.43E-18	1.31E-17	1.50E-18	2.05E-18	1.11E-17	5.02E-18	2.46E-18	5.48E-18	3.35E-17
Cf-248	6.70E-18	1.23E-17	8.04E-19	1.44E-18	8.86E-18	4.29E-18	1.84E-18	4.73E-18	3.17E-17
Cf-249	1.54E-14	1.77E-14	1.52E-14	1.44E-14	3.06E-14	1.56E-14	1.44E-14	1.58E-14	1.91E-14
Cf-250	6.38E-18	1.17E-17	7.62E-19	1.37E-18	8.42E-18	4.08E-18	1.75E-18	4.50E-18	3.02E-17
Cf-251	5.48E-15	6.38E-15	5.18E-15	4.65E-15	1.51E-14	5.45E-15	4.87E-15	5.58E-15	1.12E-14
Cf-252	6.85E-18	1.21E-17	1.42E-18	1.91E-18	1.04E-17	4.64E-18	2.29E-18	5.06E-18	3.08E-17
Cf-253	1.20E-18	1.60E-18	7.94E-19	6.55E-19	3.35E-18	1.05E-18	7.83E-19	1.08E-18	1.66E-15
Cf-254	2.08E-20	3.81E-20	2.49E-21	4.46E-21	2.75E-20	1.33E-20	5.70E-21	1.47E-20	9.83E-20
Einsteinium									
Es-250	1.86E-14	2.12E-14	1.84E-14	1.77E-14	3.38E-14	1.90E-14	1.75E-14	1.90E-14	2.21E-14
Es-251	4.05E-15	4.75E-15	3.80E-15	3.34E-15	1.21E-14	4.01E-15	3.56E-15	4.13E-15	5.35E-15
Es-253	1.94E-17	2.52E-17	1.50E-17	1.44E-17	3.81E-17	1.79E-17	1.48E-17	1.83E-17	4.55E-17
Es-254m	2.21E-14	2.52E-14	2.19E-14	2.13E-14	3.64E-14	2.25E-14	2.10E-14	2.25E-14	3.76E-14
Es-254	2.19E-16	3.11E-16	1.31E-16	1.22E-16	4.88E-16	1.85E-16	1.36E-16	1.93E-16	5.65E-16
Fermium									
Fm-252	7.13E-18	1.26E-17	9.95E-19	1.57E-18	9.82E-18	4.72E-18	2.05E-18	5.03E-18	2.95E-17
Fm-253	3.46E-15	4.04E-15	3.25E-15	2.88E-15	1.00E-14	3.43E-15	3.05E-15	3.53E-15	4.55E-15
Fm-254	8.79E-18	1.48E-17	2.20E-18	2.64E-18	1.44E-17	6.22E-18	3.19E-18	6.57E-18	3.43E-17
Fm-255	1.26E-16	1.86E-16	7.01E-17	6.42E-17	3.05E-16	1.03E-16	7.34E-17	1.10E-16	3.95E-16
Fm-257	4.58E-15	5.35E-15	4.31E-15	3.84E-15	1.29E-14	4.55E-15	4.05E-15	4.66E-15	7.18E-15
Mendelevium									
Md-257	4.93E-15	5.72E-15	4.71E-15	4.29E-15	1.27E-14	4.93E-15	4.44E-15	5.03E-15	6.20E-15
Md-258	6.28E-17	9.54E-17	2.66E-17	2.55E-17	1.36E-16	4.89E-17	3.02E-17	5.08E-17	1.82E-16

TABLE III.2

Dose Coefficients for Water Immersion

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units. The coefficients are for water at a density of 1×10^3 kg m^{-3}.

h_T: The tissue dose equivalent coefficient for organ or tissue T (Sv per Bq s m^{-3}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-3}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

> To convert to a source per unit mass basis (Sv per Bq s kg^{-1}), multiply table entries by 1×10^3 (kg m^{-3}).
>
> To convert to conventional units (mrem per µCi y cm^{-3} or mrem per µCi y g^{-1}), multiply table entries by 1.168×10^{23}.
>
> To derive coefficients for a water density other than 1×10^3 kg m^{-3}, multiply coefficients (in any units) by $(1 \times 10^3/\rho)$, where ρ is the water density in kg m^{-3}.

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium									
Be-7	5.03E-18	5.76E-18	4.98E-18	4.78E-18	9.12E-18	5.12E-18	4.75E-18	5.15E-18	5.97E-18
Be-10	2.24E-20	2.73E-20	1.86E-20	1.57E-20	6.52E-20	2.11E-20	1.76E-20	2.17E-20	1.37E-17
Carbon									
C-11	1.04E-16	1.19E-16	1.03E-16	9.93E-17	1.85E-16	1.06E-16	9.85E-17	1.06E-16	1.47E-16
C-14	5.10E-22	6.96E-22	2.96E-22	2.35E-22	1.37E-21	4.29E-22	2.98E-22	4.39E-22	2.55E-19
Nitrogen									
N-13	1.04E-16	1.19E-16	1.03E-16	9.94E-17	1.85E-16	1.06E-16	9.86E-17	1.07E-16	1.56E-16
Oxygen									
O-15	1.04E-16	1.19E-16	1.03E-16	9.96E-17	1.85E-16	1.06E-16	9.87E-17	1.07E-16	1.74E-16
Fluorine									
F-18	1.04E-16	1.19E-16	1.03E-16	9.95E-17	1.85E-16	1.06E-16	9.87E-17	1.07E-16	1.37E-16
Neon									
Ne-19	1.05E-16	1.20E-16	1.04E-16	9.98E-17	1.86E-16	1.06E-16	9.90E-17	1.07E-16	1.92E-16
Sodium									
Na-22	2.30E-16	2.61E-16	2.30E-16	2.25E-16	3.62E-16	2.35E-16	2.21E-16	2.35E-16	2.78E-16
Na-24	4.59E-16	5.12E-16	4.67E-16	4.68E-16	6.23E-16	4.77E-16	4.54E-16	4.73E-16	5.59E-16
Magnesium									
Mg-28	1.44E-16	1.63E-16	1.44E-16	1.42E-16	2.17E-16	1.48E-16	1.39E-16	1.47E-16	1.74E-16
Aluminum									
Al-26	2.86E-16	3.24E-16	2.89E-16	2.85E-16	4.29E-16	2.94E-16	2.80E-16	2.94E-16	3.61E-16
Al-28	1.94E-16	2.19E-16	1.98E-16	1.97E-16	2.70E-16	2.01E-16	1.93E-16	2.01E-16	3.14E-16
Silicon									
Si-31	2.34E-19	2.72E-19	2.21E-19	2.06E-19	4.98E-19	2.34E-19	2.11E-19	2.36E-19	4.03E-17
Si-32	1.15E-21	1.51E-21	7.49E-22	5.97E-22	3.27E-21	9.97E-22	7.36E-22	1.02E-21	8.69E-19
Phosphorus									
P-30	1.05E-16	1.20E-16	1.04E-16	1.00E-16	1.87E-16	1.07E-16	9.94E-17	1.07E-16	2.30E-16
P-32	1.90E-19	2.24E-19	1.73E-19	1.56E-19	4.79E-19	1.86E-19	1.64E-19	1.90E-19	4.79E-17
P-33	1.77E-21	2.29E-21	1.21E-21	9.73E-22	5.13E-21	1.56E-21	1.18E-21	1.60E-21	1.45E-18
Sulphur									
S-35	5.46E-22	7.40E-22	3.25E-22	2.58E-22	1.49E-21	4.63E-22	3.26E-22	4.74E-22	3.06E-19
Chlorine									
Cl-36	4.52E-20	5.37E-20	4.05E-20	3.63E-20	1.12E-19	4.40E-20	3.84E-20	4.48E-20	1.56E-17
Cl-38	1.65E-16	1.85E-16	1.68E-16	1.68E-16	2.27E-16	1.71E-16	1.64E-16	1.70E-16	3.03E-16
Cl-39	1.54E-16	1.74E-16	1.55E-16	1.53E-16	2.30E-16	1.58E-16	1.49E-16	1.58E-16	2.35E-16
Argon									
Ar-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar-39	1.82E-20	2.23E-20	1.50E-20	1.27E-20	5.30E-20	1.71E-20	1.42E-20	1.76E-20	1.13E-17
Ar-41	1.37E-16	1.55E-16	1.38E-16	1.37E-16	1.97E-16	1.41E-16	1.33E-16	1.41E-16	1.88E-16
Potassium									
K-38	3.44E-16	3.89E-16	3.49E-16	3.46E-16	5.11E-16	3.55E-16	3.38E-16	3.55E-16	4.86E-16
K-40	1.69E-17	1.91E-17	1.71E-17	1.70E-17	2.41E-17	1.74E-17	1.66E-17	1.74E-17	5.46E-17
K-42	3.06E-17	3.46E-17	3.10E-17	3.07E-17	4.39E-17	3.15E-17	3.00E-17	3.15E-17	1.41E-16
K-43	9.95E-17	1.14E-16	9.84E-17	9.48E-17	1.78E-16	1.01E-16	9.40E-17	1.02E-16	1.36E-16
K-44	2.51E-16	2.81E-16	2.54E-16	2.54E-16	3.50E-16	2.60E-16	2.46E-16	2.58E-16	3.97E-16
K-45	2.03E-16	2.29E-16	2.06E-16	2.05E-16	2.99E-16	2.10E-16	2.00E-16	2.10E-16	3.04E-16
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	1.85E-21	2.39E-21	1.28E-21	1.03E-21	5.38E-21	1.64E-21	1.24E-21	1.68E-21	1.53E-18
Ca-47	1.13E-16	1.28E-16	1.14E-16	1.13E-16	1.65E-16	1.17E-16	1.10E-16	1.16E-16	1.52E-16
Ca-49	3.65E-16	4.02E-16	3.72E-16	3.75E-16	4.79E-16	3.82E-16	3.62E-16	3.76E-16	4.70E-16
Scandium									
Sc-43	1.12E-16	1.28E-16	1.11E-16	1.06E-16	2.04E-16	1.14E-16	1.06E-16	1.14E-16	1.52E-16
Sc-44m	2.89E-17	3.31E-17	2.83E-17	2.68E-17	6.03E-17	2.93E-17	2.69E-17	2.96E-17	3.58E-17
Sc-44	2.23E-16	2.54E-16	2.22E-16	2.17E-16	3.57E-16	2.28E-16	2.13E-16	2.28E-16	3.01E-16
Sc-46	2.12E-16	2.40E-16	2.11E-16	2.08E-16	3.18E-16	2.18E-16	2.03E-16	2.16E-16	2.49E-16
Sc-47	1.11E-17	1.28E-17	1.06E-17	9.59E-18	3.00E-17	1.11E-17	9.99E-18	1.14E-17	2.04E-17
Sc-48	3.55E-16	4.02E-16	3.55E-16	3.51E-16	5.25E-16	3.65E-16	3.42E-16	3.63E-16	4.23E-16
Sc-49	3.79E-19	4.39E-19	3.60E-19	3.37E-19	8.08E-19	3.79E-19	3.44E-19	3.83E-19	5.80E-17

Table III.2. Dose Coefficients for Water Immersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	1.26E-17	1.50E-17	1.10E-17	8.84E-18	4.32E-17	1.20E-17	1.03E-17	1.25E-17	1.56E-17
Ti-45	8.89E-17	1.02E-16	8.81E-17	8.48E-17	1.58E-16	9.04E-17	8.41E-17	9.09E-17	1.29E-16
Vanadium									
V-47	1.02E-16	1.17E-16	1.01E-16	9.72E-17	1.81E-16	1.04E-16	9.64E-17	1.04E-16	1.77E-16
V-48	3.07E-16	3.49E-16	3.08E-16	3.03E-16	4.67E-16	3.16E-16	2.96E-16	3.15E-16	3.65E-16
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	4.44E-17	5.11E-17	4.30E-17	3.98E-17	1.04E-16	4.46E-17	4.07E-17	4.54E-17	5.29E-17
Cr-49	1.07E-16	1.23E-16	1.06E-16	1.01E-16	2.04E-16	1.09E-16	1.01E-16	1.10E-16	1.68E-16
Cr-51	3.23E-18	3.69E-18	3.15E-18	2.99E-18	6.69E-18	3.26E-18	3.00E-18	3.30E-18	3.82E-18
Manganese									
Mn-51	1.02E-16	1.17E-16	1.01E-16	9.75E-17	1.81E-16	1.04E-16	9.66E-17	1.04E-16	1.87E-16
Mn-52m	2.54E-16	2.88E-16	2.55E-16	2.50E-16	3.97E-16	2.60E-16	2.45E-16	2.60E-16	3.78E-16
Mn-52	3.65E-16	4.14E-16	3.65E-16	3.60E-16	5.52E-16	3.75E-16	3.52E-16	3.74E-16	4.27E-16
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	8.71E-17	9.89E-17	8.66E-17	8.48E-17	1.36E-16	8.92E-17	8.30E-17	8.88E-17	1.01E-16
Mn-56	1.81E-16	2.05E-16	1.83E-16	1.81E-16	2.65E-16	1.87E-16	1.77E-16	1.86E-16	2.68E-16
Iron									
Fe-52	7.56E-17	8.67E-17	7.43E-17	7.07E-17	1.49E-16	7.66E-17	7.08E-17	7.73E-17	1.01E-16
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-59	1.26E-16	1.43E-16	1.27E-16	1.25E-16	1.85E-16	1.30E-16	1.22E-16	1.29E-16	1.50E-16
Fe-60	4.48E-22	6.19E-22	2.49E-22	1.98E-22	1.18E-21	3.73E-22	2.54E-22	3.81E-22	1.73E-19
Cobalt									
Co-55	2.08E-16	2.36E-16	2.07E-16	2.02E-16	3.36E-16	2.12E-16	1.98E-16	2.12E-16	2.72E-16
Co-56	3.87E-16	4.35E-16	3.90E-16	3.87E-16	5.60E-16	3.99E-16	3.77E-16	3.97E-16	4.53E-16
Co-57	1.22E-17	1.42E-17	1.16E-17	1.01E-17	3.64E-17	1.21E-17	1.08E-17	1.25E-17	1.47E-17
Co-58m	2.89E-22	4.43E-22	6.82E-23	7.29E-23	4.78E-22	2.12E-22	1.01E-22	2.07E-22	7.22E-22
Co-58	1.01E-16	1.15E-16	1.01E-16	9.81E-17	1.62E-16	1.03E-16	9.63E-17	1.03E-16	1.20E-16
Co-60m	4.70E-19	5.41E-19	4.52E-19	4.29E-19	8.84E-19	4.73E-19	4.33E-19	4.75E-19	6.55E-19
Co-60	2.67E-16	3.02E-16	2.68E-16	2.66E-16	3.86E-16	2.75E-16	2.59E-16	2.74E-16	3.11E-16
Co-61	8.81E-18	1.03E-17	7.99E-18	6.95E-18	2.38E-17	8.57E-18	7.52E-18	8.77E-18	4.00E-17
Co-62m	2.90E-16	3.27E-16	2.92E-16	2.89E-16	4.16E-16	2.99E-16	2.82E-16	2.97E-16	4.09E-16
Nickel									
Ni-56	1.79E-16	2.04E-16	1.77E-16	1.72E-16	3.07E-16	1.83E-16	1.70E-16	1.83E-16	2.09E-16
Ni-57	2.04E-16	2.32E-16	2.06E-16	2.03E-16	3.07E-16	2.10E-16	1.99E-16	2.10E-16	2.46E-16
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	5.88E-17	6.66E-17	5.93E-17	5.87E-17	8.55E-17	6.06E-17	5.73E-17	6.04E-17	1.11E-16
Ni-66	1.33E-21	1.74E-21	8.94E-22	7.15E-22	3.84E-21	1.17E-21	8.74E-22	1.20E-21	1.06E-18
Copper									
Cu-60	4.17E-16	4.72E-16	4.20E-16	4.15E-16	6.24E-16	4.30E-16	4.06E-16	4.29E-16	5.47E-16
Cu-61	8.48E-17	9.70E-17	8.41E-17	8.11E-17	1.49E-16	8.64E-17	8.03E-17	8.67E-17	1.20E-16
Cu-62	1.03E-16	1.18E-16	1.02E-16	9.87E-17	1.84E-16	1.05E-16	9.78E-17	1.06E-16	2.16E-16
Cu-64	1.94E-17	2.21E-17	1.92E-17	1.85E-17	3.41E-17	1.97E-17	1.83E-17	1.98E-17	2.92E-17
Cu-66	9.41E-18	1.07E-17	9.36E-18	9.19E-18	1.44E-17	9.64E-18	8.99E-18	9.59E-18	8.75E-17
Cu-67	1.17E-17	1.35E-17	1.12E-17	1.01E-17	3.13E-17	1.17E-17	1.05E-17	1.20E-17	1.98E-17
Zinc									
Zn-62	4.42E-17	5.06E-17	4.35E-17	4.19E-17	7.85E-17	4.49E-17	4.16E-17	4.51E-17	5.37E-17
Zn-63	1.13E-16	1.29E-16	1.12E-16	1.08E-16	1.97E-16	1.15E-16	1.07E-16	1.16E-16	1.99E-16
Zn-65	6.15E-17	6.97E-17	6.15E-17	6.07E-17	9.10E-17	6.32E-17	5.92E-17	6.29E-17	7.12E-17
Zn-69m	4.24E-17	4.86E-17	4.19E-17	4.01E-17	7.90E-17	4.31E-17	4.00E-17	4.34E-17	5.18E-17
Zn-69	4.24E-20	5.10E-20	3.66E-20	3.18E-20	1.18E-19	4.07E-20	3.47E-20	4.16E-20	1.91E-17
Zn-71m	1.60E-16	1.82E-16	1.58E-16	1.53E-16	2.81E-16	1.62E-16	1.51E-16	1.63E-16	2.25E-16
Zn-72	1.50E-17	1.74E-17	1.42E-17	1.27E-17	4.19E-17	1.49E-17	1.34E-17	1.53E-17	2.00E-17
Gallium									
Ga-65	1.20E-16	1.38E-16	1.19E-16	1.14E-16	2.21E-16	1.22E-16	1.13E-16	1.23E-16	2.00E-16
Ga-66	2.72E-16	3.04E-16	2.75E-16	2.73E-16	3.96E-16	2.82E-16	2.66E-16	2.80E-16	3.83E-16
Ga-67	1.56E-17	1.80E-17	1.49E-17	1.36E-17	3.88E-17	1.56E-17	1.41E-17	1.59E-17	1.87E-17
Ga-68	9.74E-17	1.11E-16	9.65E-17	9.30E-17	1.72E-16	9.91E-17	9.22E-17	9.96E-17	1.67E-16
Ga-70	9.65E-19	1.10E-18	9.46E-19	9.15E-19	1.67E-18	9.82E-19	9.05E-19	9.81E-19	4.49E-17
Ga-72	2.92E-16	3.30E-16	2.95E-16	2.92E-16	4.25E-16	3.01E-16	2.85E-16	3.00E-16	3.70E-16
Ga-73	3.18E-17	3.64E-17	3.10E-17	2.93E-17	6.63E-17	3.21E-17	2.95E-17	3.25E-17	6.58E-17

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	6.95E-17	7.96E-17	6.82E-17	6.52E-17	1.31E-16	7.04E-17	6.50E-17	7.09E-17	8.76E-17
Ge-67	1.46E-16	1.67E-16	1.45E-16	1.39E-16	2.60E-16	1.49E-16	1.38E-16	1.49E-16	2.67E-16
Ge-68	1.10E-22	7.68E-22	5.99E-25	3.07E-23	1.64E-22	8.63E-24	6.19E-23	1.70E-22	1.53E-20
Ge-69	9.06E-17	1.03E-16	9.02E-17	8.80E-17	1.47E-16	9.27E-17	8.65E-17	9.26E-17	1.18E-16
Ge-71	1.12E-22	7.78E-22	6.06E-25	3.11E-23	1.66E-22	8.74E-24	6.27E-23	1.72E-22	1.55E-20
Ge-75	3.59E-18	4.11E-18	3.48E-18	3.26E-18	7.93E-18	3.61E-18	3.30E-18	3.66E-18	3.09E-17
Ge-77	1.13E-16	1.29E-16	1.12E-16	1.08E-16	2.03E-16	1.15E-16	1.07E-16	1.16E-16	1.77E-16
Ge-78	2.86E-17	3.28E-17	2.79E-17	2.62E-17	6.25E-17	2.89E-17	2.65E-17	2.92E-17	4.66E-17
Arsenic									
As-69	1.04E-16	1.19E-16	1.03E-16	9.89E-17	1.86E-16	1.06E-16	9.82E-17	1.06E-16	2.16E-16
As-70	4.32E-16	4.90E-16	4.33E-16	4.26E-16	6.67E-16	4.44E-16	4.17E-16	4.43E-16	5.64E-16
As-71	5.86E-17	6.70E-17	5.75E-17	5.48E-17	1.15E-16	5.94E-17	5.48E-17	5.99E-17	7.58E-17
As-72	1.87E-16	2.12E-16	1.86E-16	1.81E-16	3.08E-16	1.91E-16	1.78E-16	1.91E-16	2.93E-16
As-73	4.63E-19	5.75E-19	3.57E-19	2.66E-19	1.56E-18	4.23E-19	3.36E-19	4.37E-19	6.49E-19
As-74	7.75E-17	8.86E-17	7.69E-17	7.44E-17	1.34E-16	7.90E-17	7.35E-17	7.93E-17	1.09E-16
As-76	4.52E-17	5.14E-17	4.50E-17	4.39E-17	7.39E-17	4.62E-17	4.32E-17	4.62E-17	1.29E-16
As-77	9.22E-19	1.06E-18	8.96E-19	8.43E-19	1.98E-18	9.30E-19	8.51E-19	9.41E-19	1.32E-17
As-78	1.33E-16	1.51E-16	1.34E-16	1.32E-16	2.03E-16	1.37E-16	1.29E-16	1.37E-16	2.55E-16
Selenium									
Se-70	1.01E-16	1.16E-16	9.94E-17	9.52E-17	1.87E-16	1.02E-16	9.48E-17	1.03E-16	1.51E-16
Se-73m	2.48E-17	2.84E-17	2.46E-17	2.37E-17	4.43E-17	2.53E-17	2.35E-17	2.54E-17	4.05E-17
Se-73	1.10E-16	1.26E-16	1.08E-16	1.03E-16	2.11E-16	1.12E-16	1.03E-16	1.13E-16	1.56E-16
Se-75	3.98E-17	4.58E-17	3.85E-17	3.56E-17	9.44E-17	4.00E-17	3.64E-17	4.07E-17	4.75E-17
Se-77m	8.72E-18	1.01E-17	8.32E-18	7.53E-18	2.34E-17	8.71E-18	7.83E-18	8.90E-18	1.28E-17
Se-79	6.82E-22	9.22E-22	4.08E-22	3.24E-22	1.87E-21	5.79E-22	4.08E-22	5.93E-22	3.90E-19
Se-81m	1.36E-18	1.60E-18	1.26E-18	1.08E-18	4.29E-18	1.34E-18	1.18E-18	1.38E-18	2.43E-18
Se-81	1.10E-18	1.26E-18	1.07E-18	1.02E-18	2.18E-18	1.11E-18	1.02E-18	1.12E-18	4.26E-17
Se-83	2.57E-16	2.91E-16	2.57E-16	2.52E-16	4.07E-16	2.63E-16	2.47E-16	2.63E-16	3.32E-16
Bromine									
Br-74m	4.39E-16	4.95E-16	4.41E-16	4.35E-16	6.70E-16	4.53E-16	4.25E-16	4.51E-16	6.12E-16
Br-74	5.04E-16	5.61E-16	5.08E-16	5.05E-16	7.32E-16	5.22E-16	4.92E-16	5.17E-16	6.55E-16
Br-75	1.24E-16	1.42E-16	1.23E-16	1.18E-16	2.31E-16	1.26E-16	1.17E-16	1.27E-16	1.83E-16
Br-76	2.82E-16	3.18E-16	2.84E-16	2.80E-16	4.30E-16	2.91E-16	2.74E-16	2.90E-16	3.77E-16
Br-77	3.23E-17	3.70E-17	3.18E-17	3.05E-17	6.11E-17	3.28E-17	3.03E-17	3.30E-17	3.85E-17
Br-80m	8.70E-19	1.17E-18	4.77E-19	3.47E-19	2.29E-18	7.25E-19	4.80E-19	7.27E-19	1.68E-18
Br-80	8.18E-18	9.35E-18	8.12E-18	7.85E-18	1.40E-17	8.34E-18	7.76E-18	8.36E-18	2.64E-17
Br-82	2.76E-16	3.14E-16	2.75E-16	2.70E-16	4.34E-16	2.83E-16	2.64E-16	2.82E-16	3.28E-16
Br-83	8.09E-19	9.27E-19	7.96E-19	7.64E-19	1.46E-18	8.21E-19	7.60E-19	8.25E-19	2.01E-17
Br-84	1.98E-16	2.22E-16	2.01E-16	2.00E-16	2.78E-16	2.06E-16	1.95E-16	2.04E-16	3.16E-16
Krypton									
Kr-74	1.19E-16	1.37E-16	1.17E-16	1.12E-16	2.28E-16	1.21E-16	1.12E-16	1.22E-16	1.96E-16
Kr-76	4.36E-17	4.99E-17	4.25E-17	4.02E-17	8.90E-17	4.40E-17	4.04E-17	4.44E-17	5.20E-17
Kr-77	1.04E-16	1.19E-16	1.02E-16	9.70E-17	2.03E-16	1.05E-16	9.71E-17	1.06E-16	1.67E-16
Kr-79	2.58E-17	2.95E-17	2.55E-17	2.44E-17	4.79E-17	2.62E-17	2.43E-17	2.64E-17	3.17E-17
Kr-81m	1.33E-17	1.52E-17	1.27E-17	1.17E-17	3.33E-17	1.33E-17	1.20E-17	1.35E-17	1.82E-17
Kr-81	5.74E-19	6.73E-19	5.53E-19	5.21E-19	1.25E-18	5.74E-19	5.27E-19	5.86E-19	8.97E-19
Kr-83m	3.99E-21	1.18E-20	3.83E-22	8.93E-22	5.24E-21	1.50E-21	1.24E-21	3.49E-21	8.31E-20
Kr-85m	1.62E-17	1.86E-17	1.55E-17	1.41E-17	4.17E-17	1.62E-17	1.46E-17	1.65E-17	3.38E-17
Kr-85	2.51E-19	2.89E-19	2.45E-19	2.34E-19	4.72E-19	2.54E-19	2.33E-19	2.55E-19	1.41E-17
Kr-87	8.67E-17	9.77E-17	8.75E-17	8.66E-17	1.31E-16	8.95E-17	8.47E-17	8.93E-17	1.97E-16
Kr-88	2.14E-16	2.41E-16	2.18E-16	2.18E-16	3.03E-16	2.22E-16	2.12E-16	2.21E-16	2.68E-16
Rubidium									
Rb-79	1.39E-16	1.59E-16	1.37E-16	1.32E-16	2.53E-16	1.41E-16	1.31E-16	1.42E-16	2.20E-16
Rb-80	1.29E-16	1.47E-16	1.28E-16	1.23E-16	2.27E-16	1.31E-16	1.22E-16	1.32E-16	3.04E-16
Rb-81m	4.24E-19	5.24E-19	3.71E-19	3.09E-19	1.39E-18	4.02E-19	3.48E-19	4.25E-19	8.26E-19
Rb-81	6.31E-17	7.22E-17	6.21E-17	5.92E-17	1.22E-16	6.40E-17	5.91E-17	6.45E-17	8.59E-17
Rb-82m	3.03E-16	3.45E-16	3.03E-16	2.96E-16	4.79E-16	3.11E-16	2.90E-16	3.10E-16	3.60E-16
Rb-82	1.13E-16	1.29E-16	1.12E-16	1.08E-16	1.98E-16	1.15E-16	1.07E-16	1.15E-16	2.37E-16
Rb-83	5.07E-17	5.81E-17	5.03E-17	4.85E-17	8.89E-17	5.16E-17	4.80E-17	5.19E-17	6.04E-17
Rb-84	9.50E-17	1.08E-16	9.45E-17	9.22E-17	1.52E-16	9.72E-17	9.05E-17	9.70E-17	1.18E-16
Rb-86	1.02E-17	1.15E-17	1.02E-17	1.00E-17	1.53E-17	1.05E-17	9.77E-18	1.04E-17	5.76E-17
Rb-87	3.83E-21	4.88E-21	2.79E-21	2.26E-21	1.13E-20	3.45E-21	2.69E-21	3.54E-21	3.31E-18

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	7.04E-17	7.93E-17	7.14E-17	7.11E-17	9.99E-17	7.28E-17	6.93E-17	7.26E-17	2.38E-16
Rb-89	2.24E-16	2.53E-16	2.26E-16	2.24E-16	3.21E-16	2.31E-16	2.19E-16	2.30E-16	3.31E-16
Strontium									
Sr-80	1.85E-20	5.39E-20	2.16E-22	3.46E-21	1.93E-20	6.13E-21	4.44E-21	1.52E-20	3.36E-19
Sr-81	1.42E-16	1.63E-16	1.41E-16	1.35E-16	2.63E-16	1.45E-16	1.34E-16	1.45E-16	2.40E-16
Sr-82	1.82E-20	5.30E-20	2.13E-22	3.41E-21	1.90E-20	6.03E-21	4.37E-21	1.50E-20	3.31E-19
Sr-83	8.20E-17	9.34E-17	8.15E-17	7.92E-17	1.37E-16	8.37E-17	7.81E-17	8.38E-17	1.05E-16
Sr-85m	2.25E-17	2.58E-17	2.17E-17	2.02E-17	5.33E-17	2.26E-17	2.06E-17	2.30E-17	2.69E-17
Sr-85	5.14E-17	5.89E-17	5.10E-17	4.91E-17	9.11E-17	5.23E-17	4.87E-17	5.26E-17	6.15E-17
Sr-87m	3.25E-17	3.73E-17	3.20E-17	3.05E-17	6.31E-17	3.30E-17	3.05E-17	3.33E-17	4.27E-17
Sr-89	1.50E-19	1.76E-19	1.36E-19	1.23E-19	3.76E-19	1.47E-19	1.29E-19	1.49E-19	3.94E-17
Sr-90	1.51E-20	1.85E-20	1.23E-20	1.04E-20	4.41E-20	1.42E-20	1.17E-20	1.46E-20	9.71E-18
Sr-91	7.33E-17	8.32E-17	7.30E-17	7.16E-17	1.13E-16	7.51E-17	7.01E-17	7.48E-17	1.30E-16
Sr-92	1.43E-16	1.62E-16	1.44E-16	1.43E-16	2.06E-16	1.48E-16	1.40E-16	1.47E-16	1.75E-16
Yttrium									
Y-86m	2.27E-17	2.60E-17	2.19E-17	2.04E-17	5.30E-17	2.29E-17	2.08E-17	2.32E-17	2.75E-17
Y-86	3.79E-16	4.30E-16	3.81E-16	3.75E-16	5.77E-16	3.90E-16	3.67E-16	3.89E-16	4.56E-16
Y-87	4.57E-17	5.24E-17	4.53E-17	4.35E-17	8.25E-17	4.65E-17	4.32E-17	4.68E-17	5.47E-17
Y-88	2.89E-16	3.27E-16	2.93E-16	2.91E-16	4.13E-16	2.98E-16	2.84E-16	2.98E-16	3.34E-16
Y-90m	6.42E-17	7.36E-17	6.30E-17	5.98E-17	1.29E-16	6.50E-17	6.00E-17	6.56E-17	7.90E-17
Y-90	3.61E-19	4.22E-19	3.36E-19	3.07E-19	8.56E-19	3.58E-19	3.19E-19	3.63E-19	6.67E-17
Y-91m	5.42E-17	6.19E-17	5.38E-17	5.19E-17	9.37E-17	5.52E-17	5.14E-17	5.54E-17	6.59E-17
Y-91	5.35E-19	6.13E-19	5.22E-19	5.04E-19	9.44E-19	5.43E-19	5.01E-19	5.44E-19	4.12E-17
Y-92	2.74E-17	3.11E-17	2.74E-17	2.69E-17	4.22E-17	2.81E-17	2.63E-17	2.81E-17	1.38E-16
Y-93	1.01E-17	1.14E-17	1.01E-17	9.86E-18	1.64E-17	1.03E-17	9.70E-18	1.03E-17	9.66E-17
Y-94	1.19E-16	1.35E-16	1.19E-16	1.17E-16	1.79E-16	1.22E-16	1.15E-16	1.22E-16	2.63E-16
Y-95	1.01E-16	1.12E-16	1.02E-16	1.02E-16	1.39E-16	1.05E-16	9.93E-17	1.04E-16	2.28E-16
Zirconium									
Zr-86	2.76E-17	3.17E-17	2.66E-17	2.50E-17	6.11E-17	2.77E-17	2.53E-17	2.81E-17	3.40E-17
Zr-88	4.01E-17	4.60E-17	3.95E-17	3.76E-17	7.74E-17	4.07E-17	3.76E-17	4.10E-17	4.87E-17
Zr-89	1.21E-16	1.37E-16	1.20E-16	1.18E-16	1.90E-16	1.24E-16	1.15E-16	1.23E-16	1.47E-16
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	7.66E-17	8.72E-17	7.61E-17	7.42E-17	1.23E-16	7.83E-17	7.29E-17	7.82E-17	9.36E-17
Zr-97	1.91E-17	2.17E-17	1.91E-17	1.87E-17	3.01E-17	1.96E-17	1.84E-17	1.96E-17	7.04E-17
Niobium									
Nb-88	4.29E-16	4.88E-16	4.27E-16	4.16E-16	6.99E-16	4.39E-16	4.09E-16	4.38E-16	5.89E-16
Nb-89b[1]	1.48E-16	1.67E-16	1.48E-16	1.45E-16	2.35E-16	1.52E-16	1.42E-16	1.51E-16	2.54E-16
Nb-89a[2]	1.97E-16	2.25E-16	1.95E-16	1.88E-16	3.44E-16	2.01E-16	1.87E-16	2.01E-16	2.92E-16
Nb-90	4.57E-16	5.15E-16	4.62E-16	4.58E-16	6.71E-16	4.72E-16	4.48E-16	4.70E-16	5.52E-16
Nb-93m	1.48E-20	3.08E-20	5.97E-22	2.76E-21	1.62E-20	8.05E-21	3.20E-21	1.04E-20	1.01E-19
Nb-94	1.64E-16	1.86E-16	1.63E-16	1.59E-16	2.59E-16	1.68E-16	1.56E-16	1.67E-16	1.99E-16
Nb-95m	6.32E-18	7.30E-18	6.06E-18	5.66E-18	1.46E-17	6.33E-18	5.75E-18	6.43E-18	1.58E-17
Nb-95	7.95E-17	9.04E-17	7.90E-17	7.72E-17	1.26E-16	8.13E-17	7.57E-17	8.11E-17	9.32E-17
Nb-96	2.58E-16	2.93E-16	2.57E-16	2.51E-16	4.08E-16	2.64E-16	2.46E-16	2.64E-16	3.15E-16
Nb-97m	7.55E-17	8.59E-17	7.50E-17	7.31E-17	1.21E-16	7.72E-17	7.18E-17	7.70E-17	8.93E-17
Nb-97	6.76E-17	7.71E-17	6.72E-17	6.53E-17	1.12E-16	6.90E-17	6.43E-17	6.91E-17	1.10E-16
Nb-98	2.55E-16	2.90E-16	2.55E-16	2.51E-16	3.93E-16	2.62E-16	2.45E-16	2.61E-16	3.60E-16
Molybdenum									
Mo-90	8.41E-17	9.62E-17	8.25E-17	7.87E-17	1.65E-16	8.52E-17	7.87E-17	8.59E-17	1.10E-16
Mo-93m	2.38E-16	2.70E-16	2.39E-16	2.36E-16	3.63E-16	2.45E-16	2.31E-16	2.45E-16	2.82E-16
Mo-93	8.43E-20	1.75E-19	3.38E-21	1.57E-20	9.21E-20	4.57E-20	1.82E-20	5.92E-20	5.71E-19
Mo-99	1.55E-17	1.77E-17	1.53E-17	1.48E-17	2.71E-17	1.58E-17	1.46E-17	1.58E-17	4.26E-17
Mo-101	1.45E-16	1.65E-16	1.46E-16	1.43E-16	2.23E-16	1.49E-16	1.40E-16	1.49E-16	2.07E-16
Technetium									
Tc-93m	7.87E-17	8.84E-17	7.95E-17	7.87E-17	1.19E-16	8.13E-17	7.70E-17	8.10E-17	9.54E-17
Tc-93	1.55E-16	1.76E-16	1.57E-16	1.56E-16	2.21E-16	1.60E-16	1.52E-16	1.60E-16	1.80E-16
Tc-94m	1.95E-16	2.21E-16	1.94E-16	1.90E-16	3.11E-16	2.00E-16	1.87E-16	1.99E-16	2.81E-16
Tc-94	2.77E-16	3.15E-16	2.76E-16	2.69E-16	4.37E-16	2.84E-16	2.64E-16	2.83E-16	3.26E-16
Tc-95m	6.88E-17	7.85E-17	6.79E-17	6.55E-17	1.22E-16	7.01E-17	6.49E-17	7.02E-17	8.16E-17

[1] $T_{1/2}$ = 122 m

[2] $T_{1/2}$ = 66 m

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Technetium, cont'd									
Tc-95	8.17E-17	9.30E-17	8.11E-17	7.92E-17	1.29E-16	8.35E-17	7.77E-17	8.33E-17	9.60E-17
Tc-96m	4.78E-18	5.48E-18	4.69E-18	4.62E-18	7.33E-18	4.86E-18	4.52E-18	4.85E-18	5.86E-18
Tc-96	2.60E-16	2.96E-16	2.59E-16	2.53E-16	4.07E-16	2.66E-16	2.48E-16	2.65E-16	3.04E-16
Tc-97m	1.42E-19	2.46E-19	3.61E-20	4.55E-20	2.31E-19	9.86E-20	5.17E-20	1.08E-19	9.02E-19
Tc-97	1.13E-19	2.22E-19	6.23E-21	2.14E-20	1.28E-19	6.55E-20	2.54E-20	7.82E-20	6.38E-19
Tc-98	1.46E-16	1.66E-16	1.45E-16	1.41E-16	2.37E-16	1.49E-16	1.39E-16	1.49E-16	1.78E-16
Tc-99m	1.28E-17	1.48E-17	1.21E-17	1.08E-17	3.63E-17	1.28E-17	1.14E-17	1.31E-17	1.56E-17
Tc-99	3.39E-21	4.32E-21	2.48E-21	2.01E-21	1.00E-20	3.06E-21	2.38E-21	3.14E-21	2.88E-18
Tc-101	3.43E-17	3.93E-17	3.36E-17	3.18E-17	7.07E-17	3.47E-17	3.20E-17	3.51E-17	7.16E-17
Tc-104	2.13E-16	2.41E-16	2.14E-16	2.11E-16	3.29E-16	2.19E-16	2.07E-16	2.19E-16	3.66E-16
Ruthenium									
Ru-94	5.41E-17	6.18E-17	5.34E-17	5.16E-17	9.50E-17	5.51E-17	5.10E-17	5.52E-17	6.43E-17
Ru-97	2.35E-17	2.71E-17	2.26E-17	2.11E-17	5.45E-17	2.36E-17	2.14E-17	2.40E-17	2.87E-17
Ru-103	4.78E-17	5.47E-17	4.73E-17	4.56E-17	8.52E-17	4.86E-17	4.52E-17	4.89E-17	5.85E-17
Ru-105	8.10E-17	9.23E-17	8.03E-17	7.78E-17	1.37E-16	8.26E-17	7.68E-17	8.27E-17	1.20E-16
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	7.00E-17	7.99E-17	6.93E-17	6.72E-17	1.21E-16	7.14E-17	6.64E-17	7.16E-17	8.42E-17
Rh-99	6.09E-17	6.99E-17	5.97E-17	5.71E-17	1.15E-16	6.17E-17	5.70E-17	6.21E-17	7.37E-17
Rh-100	2.97E-16	3.35E-16	3.00E-16	2.97E-16	4.36E-16	3.06E-16	2.90E-16	3.05E-16	3.48E-16
Rh-101m	3.03E-17	3.48E-17	2.94E-17	2.79E-17	6.29E-17	3.05E-17	2.80E-17	3.09E-17	3.70E-17
Rh-101	2.62E-17	3.03E-17	2.49E-17	2.27E-17	6.67E-17	2.61E-17	2.35E-17	2.66E-17	3.24E-17
Rh-102m	4.92E-17	5.63E-17	4.86E-17	4.70E-17	8.58E-17	5.00E-17	4.65E-17	5.02E-17	6.91E-17
Rh-102	2.21E-16	2.51E-16	2.19E-16	2.13E-16	3.60E-16	2.25E-16	2.10E-16	2.25E-16	2.59E-16
Rh-103m	2.95E-20	5.06E-20	4.37E-21	6.63E-21	4.13E-20	2.01E-20	8.63E-21	2.07E-20	1.06E-19
Rh-105	7.97E-18	9.12E-18	7.78E-18	7.37E-18	1.66E-17	8.05E-18	7.40E-18	8.14E-18	1.62E-17
Rh-106m	3.05E-16	3.47E-16	3.05E-16	2.98E-16	4.83E-16	3.13E-16	2.93E-16	3.12E-16	3.75E-16
Rh-106	2.19E-17	2.50E-17	2.17E-17	2.11E-17	3.75E-17	2.23E-17	2.08E-17	2.24E-17	1.30E-16
Rh-107	3.21E-17	3.67E-17	3.14E-17	2.98E-17	6.58E-17	3.24E-17	2.99E-17	3.28E-17	6.64E-17
Palladium									
Pd-100	1.06E-17	1.27E-17	9.19E-18	7.61E-18	3.45E-17	1.01E-17	8.61E-18	1.05E-17	1.39E-17
Pd-101	3.27E-17	3.75E-17	3.20E-17	3.09E-17	5.73E-17	3.31E-17	3.06E-17	3.32E-17	4.09E-17
Pd-103	2.54E-19	4.37E-19	3.99E-20	6.18E-20	3.41E-19	1.74E-19	7.67E-20	1.80E-19	9.20E-19
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	6.09E-19	7.96E-19	4.27E-19	3.81E-19	1.56E-18	5.47E-19	4.22E-19	5.59E-19	2.34E-17
Silver									
Ag-102	3.54E-16	4.01E-16	3.55E-16	3.48E-16	5.53E-16	3.63E-16	3.41E-16	3.63E-16	4.71E-16
Ag-103	7.83E-17	8.95E-17	7.74E-17	7.47E-17	1.39E-16	7.97E-17	7.41E-17	8.00E-17	1.10E-16
Ag-104m	1.23E-16	1.40E-16	1.23E-16	1.20E-16	2.00E-16	1.26E-16	1.18E-16	1.26E-16	1.80E-16
Ag-104	2.79E-16	3.18E-16	2.79E-16	2.73E-16	4.40E-16	2.86E-16	2.68E-16	2.86E-16	3.32E-16
Ag-105	5.25E-17	6.02E-17	5.13E-17	4.91E-17	9.99E-17	5.31E-17	4.89E-17	5.35E-17	6.31E-17
Ag-106m	2.93E-16	3.34E-16	2.93E-16	2.86E-16	4.68E-16	3.00E-16	2.81E-16	3.00E-16	3.44E-16
Ag-106	7.22E-17	8.27E-17	7.14E-17	6.88E-17	1.28E-16	7.34E-17	6.82E-17	7.38E-17	1.21E-16
Ag-108m	1.66E-16	1.90E-16	1.64E-16	1.59E-16	2.83E-16	1.69E-16	1.57E-16	1.69E-16	1.97E-16
Ag-108	1.96E-18	2.25E-18	1.93E-18	1.86E-18	3.47E-18	1.99E-18	1.84E-18	2.00E-18	4.37E-17
Ag-109m	4.89E-19	6.57E-19	3.15E-19	2.77E-19	1.30E-18	4.29E-19	3.16E-19	4.38E-19	1.09E-18
Ag-110m	2.88E-16	3.27E-16	2.87E-16	2.82E-16	4.46E-16	2.95E-16	2.76E-16	2.94E-16	3.38E-16
Ag-110	3.72E-18	4.26E-18	3.67E-18	3.54E-18	6.48E-18	3.79E-18	3.51E-18	3.79E-18	8.99E-17
Ag-111	2.75E-18	3.15E-18	2.68E-18	2.54E-18	5.69E-18	2.78E-18	2.55E-18	2.81E-18	2.49E-17
Ag-112	7.04E-17	7.98E-17	7.07E-17	6.96E-17	1.08E-16	7.23E-17	6.81E-17	7.23E-17	1.84E-16
Ag-115	7.61E-17	8.62E-17	7.65E-17	7.52E-17	1.22E-16	7.82E-17	7.39E-17	7.83E-17	1.63E-16
Cadmium									
Cd-104	2.46E-17	2.85E-17	2.37E-17	2.25E-17	4.74E-17	2.48E-17	2.26E-17	2.49E-17	3.01E-17
Cd-107	1.50E-18	2.00E-18	1.01E-18	9.61E-19	3.10E-18	1.34E-18	1.02E-18	1.35E-18	3.09E-18
Cd-109	8.31E-19	1.21E-18	3.74E-19	3.56E-19	1.80E-18	6.71E-19	4.17E-19	6.77E-19	2.12E-18
Cd-113m	1.39E-20	1.71E-20	1.14E-20	9.57E-21	4.06E-20	1.31E-20	1.08E-20	1.34E-20	8.95E-18
Cd-113	3.05E-21	3.88E-21	2.23E-21	1.81E-21	8.99E-21	2.75E-21	2.14E-21	2.82E-21	2.53E-18
Cd-115m	2.47E-18	2.81E-18	2.46E-18	2.41E-18	3.88E-18	2.53E-18	2.36E-18	2.52E-18	4.38E-17
Cd-115	2.37E-17	2.72E-17	2.35E-17	2.26E-17	4.24E-17	2.41E-17	2.24E-17	2.43E-17	4.59E-17
Cd-117m	2.20E-16	2.49E-16	2.23E-16	2.21E-16	3.18E-16	2.27E-16	2.15E-16	2.27E-16	2.66E-16
Cd-117	1.15E-16	1.31E-16	1.15E-16	1.14E-16	1.79E-16	1.18E-16	1.11E-16	1.18E-16	1.62E-16

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	6.86E-17	7.84E-17	6.75E-17	6.51E-17	1.23E-16	6.97E-17	6.46E-17	7.00E-17	8.32E-17
In-110b[1]	3.16E-16	3.60E-16	3.15E-16	3.08E-16	4.98E-16	3.24E-16	3.02E-16	3.23E-16	3.70E-16
In-110a[2]	1.62E-16	1.84E-16	1.61E-16	1.57E-16	2.66E-16	1.65E-16	1.55E-16	1.66E-16	2.34E-16
In-111	4.02E-17	4.64E-17	3.84E-17	3.55E-17	9.68E-17	4.02E-17	3.63E-17	4.09E-17	4.95E-17
In-112	2.69E-17	3.09E-17	2.66E-17	2.56E-17	4.73E-17	2.74E-17	2.54E-17	2.75E-17	4.71E-17
In-113m	2.58E-17	2.97E-17	2.53E-17	2.41E-17	4.99E-17	2.61E-17	2.41E-17	2.64E-17	3.90E-17
In-114m	9.04E-18	1.04E-17	8.68E-18	8.28E-18	1.76E-17	9.09E-18	8.28E-18	9.14E-18	1.67E-17
In-114	2.95E-19	3.35E-19	2.94E-19	2.90E-19	4.33E-19	3.02E-19	2.84E-19	3.01E-19	3.29E-18
In-115m	1.59E-17	1.83E-17	1.54E-17	1.46E-17	3.23E-17	1.60E-17	1.46E-17	1.62E-17	2.90E-17
In-115	9.12E-21	1.13E-20	7.25E-21	6.04E-21	2.69E-20	8.47E-21	6.91E-21	8.70E-21	6.51E-18
In-116m	2.64E-16	2.99E-16	2.66E-16	2.63E-16	3.87E-16	2.72E-16	2.56E-16	2.71E-16	3.23E-16
In-117m	9.04E-18	1.04E-17	8.66E-18	8.09E-18	2.04E-17	9.06E-18	8.22E-18	9.18E-18	3.93E-17
In-117	7.06E-17	8.10E-17	6.95E-17	6.63E-17	1.36E-16	7.17E-17	6.62E-17	7.22E-17	9.78E-17
In-119m	1.29E-18	1.53E-18	1.17E-18	1.12E-18	2.49E-18	1.27E-18	1.13E-18	1.28E-18	7.67E-17
In-119	7.97E-17	9.07E-17	7.91E-17	7.72E-17	1.27E-16	8.15E-17	7.57E-17	8.12E-17	1.35E-16
Tin									
Sn-110	2.96E-17	3.41E-17	2.85E-17	2.68E-17	6.40E-17	2.97E-17	2.71E-17	3.01E-17	3.62E-17
Sn-111	5.21E-17	5.95E-17	5.17E-17	5.03E-17	8.64E-17	5.31E-17	4.96E-17	5.33E-17	7.65E-17
Sn-113	1.00E-18	1.35E-18	5.94E-19	5.73E-19	1.95E-18	8.68E-19	6.20E-19	8.63E-19	1.88E-18
Sn-117m	1.50E-17	1.74E-17	1.39E-17	1.25E-17	3.99E-17	1.48E-17	1.31E-17	1.51E-17	2.28E-17
Sn-119m	3.31E-19	5.04E-19	8.38E-20	8.58E-20	5.63E-19	2.45E-19	1.19E-19	2.39E-19	8.09E-19
Sn-121m	1.86E-19	2.67E-19	6.78E-20	5.71E-20	3.79E-19	1.44E-19	7.97E-20	1.41E-19	1.33E-18
Sn-121	4.89E-21	6.15E-21	3.72E-21	3.05E-21	1.45E-20	4.47E-21	3.56E-21	4.60E-21	3.90E-18
Sn-123m	1.42E-17	1.64E-17	1.35E-17	1.22E-17	3.81E-17	1.42E-17	1.27E-17	1.45E-17	4.68E-17
Sn-123	8.44E-19	9.61E-19	8.32E-19	8.11E-19	1.38E-18	8.61E-19	7.98E-19	8.59E-19	3.53E-17
Sn-125	3.35E-17	3.79E-17	3.35E-17	3.30E-17	5.02E-17	3.44E-17	3.23E-17	3.43E-17	9.57E-17
Sn-126	4.83E-18	5.81E-18	4.15E-18	3.43E-18	1.57E-17	4.60E-18	3.89E-18	4.76E-18	1.04E-17
Sn-127	2.03E-16	2.30E-16	2.03E-16	2.00E-16	3.08E-16	2.09E-16	1.96E-16	2.08E-16	2.70E-16
Sn-128	6.46E-17	7.46E-17	6.25E-17	5.97E-17	1.20E-16	6.51E-17	5.97E-17	6.55E-17	8.81E-17
Antimony									
Sb-115	9.21E-17	1.05E-16	9.10E-17	8.77E-17	1.63E-16	9.36E-17	8.69E-17	9.41E-17	1.25E-16
Sb-116m	3.29E-16	3.73E-16	3.27E-16	3.21E-16	5.16E-16	3.37E-16	3.15E-16	3.36E-16	3.90E-16
Sb-116	2.29E-16	2.59E-16	2.29E-16	2.26E-16	3.44E-16	2.35E-16	2.21E-16	2.34E-16	2.95E-16
Sb-117	1.74E-17	2.03E-17	1.63E-17	1.49E-17	4.37E-17	1.73E-17	1.54E-17	1.76E-17	2.22E-17
Sb-118m	2.71E-16	3.07E-16	2.69E-16	2.64E-16	4.18E-16	2.77E-16	2.59E-16	2.76E-16	3.16E-16
Sb-119	7.02E-19	1.06E-18	1.84E-19	1.84E-19	1.21E-18	5.21E-19	2.57E-19	5.08E-19	1.68E-18
Sb-120b[3]	2.59E-16	2.94E-16	2.57E-16	2.51E-16	4.13E-16	2.65E-16	2.47E-16	2.64E-16	3.02E-16
Sb-120a[4]	4.55E-17	5.22E-17	4.48E-17	4.32E-17	8.01E-17	4.62E-17	4.28E-17	4.64E-17	7.53E-17
Sb-122	4.53E-17	5.18E-17	4.50E-17	4.36E-17	7.75E-17	4.62E-17	4.30E-17	4.64E-17	9.15E-17
Sb-124n[5]	2.22E-21	3.40E-21	5.32E-22	5.63E-22	3.70E-21	1.63E-21	7.82E-22	1.59E-21	5.50E-21
Sb-124m[6]	3.61E-17	4.12E-17	3.58E-17	3.47E-17	6.15E-17	3.68E-17	3.42E-17	3.69E-17	4.79E-17
Sb-124	1.93E-16	2.19E-16	1.94E-16	1.92E-16	2.91E-16	1.98E-16	1.88E-16	1.98E-16	2.49E-16
Sb-125	4.32E-17	4.95E-17	4.23E-17	4.07E-17	7.75E-17	4.38E-17	4.04E-17	4.39E-17	5.46E-17
Sb-126m	1.60E-16	1.82E-16	1.58E-16	1.53E-16	2.70E-16	1.63E-16	1.51E-16	1.63E-16	2.28E-16
Sb-126	2.92E-16	3.33E-16	2.90E-16	2.82E-16	4.86E-16	2.99E-16	2.78E-16	2.99E-16	3.60E-16
Sb-127	7.09E-17	8.09E-17	7.02E-17	6.80E-17	1.21E-16	7.23E-17	6.71E-17	7.24E-17	1.02E-16
Sb-128b[7]	3.20E-16	3.65E-16	3.18E-16	3.09E-16	5.29E-16	3.27E-16	3.05E-16	3.27E-16	4.03E-16
Sb-128a[8]	2.06E-16	2.35E-16	2.04E-16	1.99E-16	3.43E-16	2.11E-16	1.96E-16	2.10E-16	3.07E-16
Sb-129	1.51E-16	1.72E-16	1.51E-16	1.49E-16	2.33E-16	1.55E-16	1.45E-16	1.55E-16	2.02E-16
Sb-130	3.41E-16	3.88E-16	3.39E-16	3.30E-16	5.57E-16	3.49E-16	3.25E-16	3.48E-16	4.47E-16
Sb-131	1.98E-16	2.24E-16	1.99E-16	1.96E-16	2.97E-16	2.04E-16	1.92E-16	2.03E-16	2.66E-16
Tellurium									
Te-116	5.35E-18	6.55E-18	4.38E-18	3.87E-18	1.40E-17	5.06E-18	4.20E-18	5.14E-18	7.55E-18
Te-121m	2.15E-17	2.47E-17	2.04E-17	1.91E-17	4.86E-17	2.15E-17	1.94E-17	2.17E-17	2.64E-17

[1] $T_{½}$ = 4.9 h
[2] $T_{½}$ = 69.1 m
[3] $T_{½}$ = 5.76 d
[4] $T_{½}$ = 15.89 m
[5] $T_{½}$ = 20.2 m
[6] $T_{½}$ = 93 s
[7] $T_{½}$ = 9.01 h
[8] $T_{½}$ = 10.4 m

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	5.77E-17	6.62E-17	5.67E-17	5.48E-17	9.97E-17	5.86E-17	5.43E-17	5.88E-17	6.91E-17
Te-123m	1.43E-17	1.66E-17	1.33E-17	1.20E-17	3.81E-17	1.41E-17	1.25E-17	1.44E-17	1.81E-17
Te-123	6.86E-19	1.01E-18	2.11E-19	1.91E-19	1.27E-18	5.19E-19	2.69E-19	5.05E-19	1.50E-18
Te-125m	1.40E-18	2.00E-18	5.20E-19	4.35E-19	2.85E-18	1.09E-18	6.06E-19	1.06E-18	3.59E-18
Te-127m	4.47E-19	6.33E-19	1.76E-19	1.49E-19	9.20E-19	3.51E-19	2.01E-19	3.44E-19	1.38E-18
Te-127	5.16E-19	5.93E-19	5.04E-19	4.79E-19	1.01E-18	5.21E-19	4.80E-19	5.26E-19	1.24E-17
Te-129m	3.40E-18	3.97E-18	3.18E-18	3.08E-18	5.70E-18	3.40E-18	3.06E-18	3.39E-18	1.81E-17
Te-129	5.91E-18	6.81E-18	5.73E-18	5.50E-18	1.07E-17	5.96E-18	5.48E-18	5.99E-18	4.16E-17
Te-131m	1.49E-16	1.69E-16	1.48E-16	1.45E-16	2.38E-16	1.52E-16	1.42E-16	1.52E-16	1.83E-16
Te-131	4.35E-17	4.98E-17	4.27E-17	4.08E-17	8.35E-17	4.42E-17	4.07E-17	4.44E-17	9.96E-17
Te-132	2.26E-17	2.62E-17	2.12E-17	1.96E-17	5.37E-17	2.25E-17	2.01E-17	2.28E-17	2.90E-17
Te-133m	2.43E-16	2.76E-16	2.42E-16	2.37E-16	3.81E-16	2.49E-16	2.32E-16	2.48E-16	3.30E-16
Te-133	9.75E-17	1.11E-16	9.71E-17	9.45E-17	1.64E-16	9.97E-17	9.32E-17	9.99E-17	1.71E-16
Te-134	9.06E-17	1.04E-16	8.91E-17	8.56E-17	1.66E-16	9.21E-17	8.50E-17	9.24E-17	1.22E-16
Iodine									
I-120m	5.61E-16	6.35E-16	5.62E-16	5.52E-16	8.70E-16	5.76E-16	5.41E-16	5.75E-16	7.44E-16
I-120	2.92E-16	3.30E-16	2.93E-16	2.88E-16	4.53E-16	3.00E-16	2.83E-16	3.00E-16	4.45E-16
I-121	4.18E-17	4.80E-17	4.04E-17	3.83E-17	8.53E-17	4.21E-17	3.85E-17	4.24E-17	5.47E-17
I-122	9.70E-17	1.11E-16	9.61E-17	9.27E-17	1.70E-16	9.88E-17	9.19E-17	9.92E-17	1.92E-16
I-123	1.60E-17	1.87E-17	1.48E-17	1.34E-17	4.11E-17	1.58E-17	1.40E-17	1.61E-17	2.04E-17
I-124	1.14E-16	1.30E-16	1.14E-16	1.11E-16	1.81E-16	1.17E-16	1.09E-16	1.17E-16	1.47E-16
I-125	1.63E-18	2.33E-18	5.81E-19	4.86E-19	3.26E-18	1.26E-18	6.86E-19	1.23E-18	3.29E-18
I-126	4.60E-17	5.27E-17	4.53E-17	4.37E-17	8.02E-17	4.68E-17	4.33E-17	4.69E-17	6.38E-17
I-128	8.85E-18	1.01E-17	8.70E-18	8.33E-18	1.63E-17	8.97E-18	8.30E-18	9.02E-18	6.26E-17
I-129	1.14E-18	1.57E-18	4.99E-19	3.84E-19	2.56E-18	9.06E-19	5.39E-19	8.91E-19	2.29E-18
I-130	2.21E-16	2.52E-16	2.19E-16	2.13E-16	3.67E-16	2.25E-16	2.10E-16	2.25E-16	2.77E-16
I-131	3.90E-17	4.46E-17	3.83E-17	3.65E-17	7.58E-17	3.95E-17	3.64E-17	3.98E-17	5.53E-17
I-132m	3.26E-17	3.73E-17	3.21E-17	3.10E-17	5.57E-17	3.31E-17	3.07E-17	3.32E-17	4.34E-17
I-132	2.38E-16	2.70E-16	2.37E-16	2.31E-16	3.78E-16	2.43E-16	2.27E-16	2.43E-16	3.10E-16
I-133	6.25E-17	7.13E-17	6.20E-17	6.01E-17	1.06E-16	6.37E-17	5.93E-17	6.39E-17	9.96E-17
I-134	2.76E-16	3.13E-16	2.75E-16	2.70E-16	4.26E-16	2.83E-16	2.64E-16	2.82E-16	3.63E-16
I-135	1.68E-16	1.91E-16	1.70E-16	1.68E-16	2.46E-16	1.74E-16	1.64E-16	1.73E-16	2.17E-16
Xenon									
Xe-120	4.20E-17	4.84E-17	4.04E-17	3.87E-17	7.68E-17	4.23E-17	3.86E-17	4.24E-17	5.16E-17
Xe-121	1.93E-16	2.19E-16	1.94E-16	1.91E-16	3.04E-16	1.99E-16	1.87E-16	1.98E-16	2.64E-16
Xe-122	5.57E-18	6.65E-18	4.87E-18	4.53E-18	1.18E-17	5.40E-18	4.68E-18	5.44E-18	7.42E-18
Xe-123	6.47E-17	7.40E-17	6.37E-17	6.14E-17	1.16E-16	6.58E-17	6.10E-17	6.61E-17	8.74E-17
Xe-125	2.61E-17	3.02E-17	2.45E-17	2.29E-17	5.81E-17	2.60E-17	2.33E-17	2.62E-17	3.25E-17
Xe-127	2.72E-17	3.15E-17	2.56E-17	2.37E-17	6.40E-17	2.71E-17	2.43E-17	2.74E-17	3.38E-17
Xe-129m	2.83E-18	3.71E-18	1.71E-18	1.45E-18	6.52E-18	2.44E-18	1.72E-18	2.43E-18	1.12E-17
Xe-131m	1.06E-18	1.40E-18	6.06E-19	5.12E-19	2.43E-18	8.99E-19	6.17E-19	8.93E-19	6.02E-18
Xe-133m	3.17E-18	3.82E-18	2.63E-18	2.41E-18	7.23E-18	3.02E-18	2.54E-18	3.04E-18	1.32E-17
Xe-133	3.69E-18	4.50E-18	2.97E-18	2.41E-18	1.16E-17	3.43E-18	2.80E-18	3.54E-18	7.89E-18
Xe-135m	4.36E-17	4.99E-17	4.31E-17	4.15E-17	7.67E-17	4.43E-17	4.11E-17	4.45E-17	5.80E-17
Xe-135	2.56E-17	2.93E-17	2.48E-17	2.33E-17	5.68E-17	2.57E-17	2.35E-17	2.61E-17	4.86E-17
Xe-138	1.21E-16	1.37E-16	1.23E-16	1.21E-16	1.84E-16	1.25E-16	1.19E-16	1.25E-16	1.86E-16
Cesium									
Cs-125	6.87E-17	7.87E-17	6.77E-17	6.53E-17	1.21E-16	6.98E-17	6.47E-17	7.01E-17	1.05E-16
Cs-126	1.12E-16	1.28E-16	1.10E-16	1.06E-16	2.01E-16	1.13E-16	1.05E-16	1.14E-16	2.41E-16
Cs-127	4.16E-17	4.78E-17	4.04E-17	3.85E-17	7.89E-17	4.19E-17	3.85E-17	4.22E-17	5.10E-17
Cs-128	9.20E-17	1.05E-16	9.10E-17	8.76E-17	1.63E-16	9.35E-17	8.69E-17	9.40E-17	1.70E-16
Cs-129	2.68E-17	3.11E-17	2.56E-17	2.43E-17	5.21E-17	2.69E-17	2.44E-17	2.70E-17	3.31E-17
Cs-130	5.22E-17	5.99E-17	5.15E-17	4.96E-17	9.20E-17	5.31E-17	4.92E-17	5.33E-17	9.03E-17
Cs-131	9.99E-19	1.39E-18	4.07E-19	3.19E-19	2.15E-18	7.86E-19	4.52E-19	7.70E-19	1.85E-18
Cs-132	7.14E-17	8.16E-17	7.03E-17	6.83E-17	1.18E-16	7.26E-17	6.73E-17	7.26E-17	8.50E-17
Cs-134m	2.10E-18	2.54E-18	1.75E-18	1.51E-18	5.87E-18	2.00E-18	1.66E-18	2.03E-18	4.52E-18
Cs-134	1.61E-16	1.83E-16	1.60E-16	1.56E-16	2.62E-16	1.64E-16	1.53E-16	1.64E-16	1.97E-16
Cs-135m	1.65E-16	1.88E-16	1.64E-16	1.61E-16	2.59E-16	1.69E-16	1.57E-16	1.68E-16	1.95E-16
Cs-135	1.23E-21	1.62E-21	8.08E-22	6.44E-22	3.52E-21	1.07E-21	7.93E-22	1.10E-21	9.52E-19
Cs-136	2.27E-16	2.57E-16	2.25E-16	2.20E-16	3.62E-16	2.32E-16	2.16E-16	2.31E-16	2.68E-16

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	1.54E-20	1.88E-20	1.28E-20	1.09E-20	4.43E-20	1.46E-20	1.22E-20	1.49E-20	9.12E-18
Cs-138	2.55E-16	2.87E-16	2.57E-16	2.55E-16	3.70E-16	2.63E-16	2.49E-16	2.62E-16	3.81E-16
Barium									
Ba-126	1.53E-17	1.78E-17	1.45E-17	1.37E-17	3.07E-17	1.53E-17	1.38E-17	1.54E-17	1.96E-17
Ba-128	6.46E-18	7.65E-18	5.67E-18	5.24E-18	1.42E-17	6.27E-18	5.43E-18	6.32E-18	8.45E-18
Ba-131m	6.87E-18	8.19E-18	6.06E-18	5.17E-18	2.10E-17	6.65E-18	5.70E-18	6.83E-18	8.79E-18
Ba-131	4.52E-17	5.21E-17	4.36E-17	4.13E-17	9.00E-17	4.55E-17	4.15E-17	4.58E-17	5.52E-17
Ba-133m	5.86E-18	6.89E-18	5.25E-18	4.86E-18	1.29E-17	5.73E-18	5.02E-18	5.78E-18	1.83E-17
Ba-133	3.88E-17	4.49E-17	3.68E-17	3.44E-17	8.30E-17	3.87E-17	3.50E-17	3.91E-17	4.77E-17
Ba-135m	5.22E-18	6.16E-18	4.62E-18	4.26E-18	1.16E-17	5.08E-18	4.42E-18	5.12E-18	1.72E-17
Ba-137m	6.13E-17	6.99E-17	6.09E-17	5.91E-17	1.01E-16	6.26E-17	5.82E-17	6.26E-17	7.65E-17
Ba-139	4.66E-18	5.38E-18	4.43E-18	4.05E-18	1.16E-17	4.65E-18	4.19E-18	4.73E-18	6.85E-17
Ba-140	1.83E-17	2.10E-17	1.80E-17	1.72E-17	3.40E-17	1.86E-17	1.72E-17	1.87E-17	3.79E-17
Ba-141	8.85E-17	1.01E-16	8.76E-17	8.48E-17	1.57E-16	9.02E-17	8.40E-17	9.05E-17	1.66E-16
Ba-142	1.10E-16	1.25E-16	1.09E-16	1.06E-16	1.77E-16	1.12E-16	1.04E-16	1.12E-16	1.54E-16
Lanthanum									
La-131	6.74E-17	7.74E-17	6.58E-17	6.28E-17	1.28E-16	6.82E-17	6.28E-17	6.86E-17	9.32E-17
La-132	2.12E-16	2.40E-16	2.12E-16	2.08E-16	3.36E-16	2.17E-16	2.04E-16	2.17E-16	2.85E-16
La-134	7.12E-17	8.16E-17	7.04E-17	6.79E-17	1.25E-16	7.24E-17	6.73E-17	7.27E-17	1.38E-16
La-135	2.31E-18	2.92E-18	1.63E-18	1.45E-18	4.81E-18	2.09E-18	1.61E-18	2.08E-18	3.42E-18
La-137	1.20E-18	1.63E-18	5.59E-19	4.19E-19	2.80E-18	9.67E-19	5.89E-19	9.51E-19	2.05E-18
La-138	1.31E-16	1.49E-16	1.32E-16	1.30E-16	1.91E-16	1.35E-16	1.27E-16	1.34E-16	1.53E-16
La-140	2.47E-16	2.80E-16	2.50E-16	2.47E-16	3.67E-16	2.55E-16	2.41E-16	2.54E-16	3.22E-16
La-141	4.99E-18	5.66E-18	5.01E-18	4.95E-18	7.46E-18	5.13E-18	4.84E-18	5.12E-18	7.31E-17
La-142	3.03E-16	3.40E-16	3.08E-16	3.07E-16	4.25E-16	3.14E-16	2.99E-16	3.12E-16	4.06E-16
La-143	1.08E-17	1.22E-17	1.09E-17	1.07E-17	1.63E-17	1.11E-17	1.05E-17	1.11E-17	1.09E-16
Cerium									
Ce-134	1.37E-18	1.84E-18	6.78E-19	5.01E-19	3.33E-18	1.12E-18	7.00E-19	1.10E-18	2.27E-18
Ce-135	1.82E-16	2.08E-16	1.80E-16	1.73E-16	3.25E-16	1.85E-16	1.72E-16	1.86E-16	2.28E-16
Ce-137m	4.49E-18	5.34E-18	3.87E-18	3.53E-18	1.01E-17	4.33E-18	3.71E-18	4.36E-18	1.57E-17
Ce-137	2.25E-18	2.85E-18	1.54E-18	1.32E-18	4.94E-18	2.01E-18	1.52E-18	2.00E-18	3.33E-18
Ce-139	1.50E-17	1.75E-17	1.36E-17	1.22E-17	3.94E-17	1.47E-17	1.29E-17	1.49E-17	1.92E-17
Ce-141	7.52E-18	8.77E-18	7.01E-18	6.23E-18	2.10E-17	7.45E-18	6.59E-18	7.62E-18	1.55E-17
Ce-143	2.80E-17	3.22E-17	2.68E-17	2.54E-17	5.56E-17	2.81E-17	2.56E-17	2.83E-17	5.93E-17
Ce-144	1.92E-18	2.27E-18	1.71E-18	1.48E-18	5.59E-18	1.86E-18	1.61E-18	1.91E-18	4.35E-18
Praseodymium									
Pr-136	2.19E-16	2.50E-16	2.19E-16	2.14E-16	3.57E-16	2.24E-16	2.10E-16	2.25E-16	3.11E-16
Pr-137	5.05E-17	5.79E-17	4.96E-17	4.78E-17	8.83E-17	5.12E-17	4.74E-17	5.14E-17	7.34E-17
Pr-138m	2.58E-16	2.93E-16	2.55E-16	2.49E-16	4.17E-16	2.63E-16	2.45E-16	2.63E-16	3.15E-16
Pr-138	8.35E-17	9.56E-17	8.26E-17	7.96E-17	1.48E-16	8.49E-17	7.89E-17	8.53E-17	1.85E-16
Pr-139	1.14E-17	1.32E-17	1.06E-17	1.01E-17	2.07E-17	1.13E-17	1.02E-17	1.13E-17	1.65E-17
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	6.59E-18	7.46E-18	6.66E-18	6.61E-18	9.54E-18	6.79E-18	6.46E-18	6.79E-18	6.42E-17
Pr-143	4.12E-20	4.95E-20	3.55E-20	3.08E-20	1.15E-19	3.95E-20	3.37E-20	4.04E-20	1.87E-17
Pr-144m	7.53E-19	9.78E-19	4.58E-19	3.56E-19	1.89E-18	6.49E-19	4.54E-19	6.45E-19	1.16E-18
Pr-144	4.04E-18	4.58E-18	4.05E-18	3.98E-18	6.34E-18	4.15E-18	3.91E-18	4.15E-18	9.23E-17
Pr-145	1.55E-18	1.77E-18	1.52E-18	1.47E-18	2.63E-18	1.58E-18	1.45E-18	1.57E-18	4.82E-17
Pr-147	8.86E-17	1.01E-16	8.72E-17	8.43E-17	1.54E-16	9.02E-17	8.36E-17	9.03E-17	1.57E-16
Neodymium									
Nd-136	2.78E-17	3.24E-17	2.61E-17	2.43E-17	5.83E-17	2.77E-17	2.48E-17	2.79E-17	3.59E-17
Nd-138	3.11E-18	3.85E-18	2.32E-18	1.99E-18	7.49E-18	2.85E-18	2.25E-18	2.86E-18	4.36E-18
Nd-139m	1.63E-16	1.85E-16	1.61E-16	1.57E-16	2.63E-16	1.66E-16	1.54E-16	1.66E-16	1.95E-16
Nd-139	4.07E-17	4.68E-17	3.99E-17	3.84E-17	7.15E-17	4.13E-17	3.81E-17	4.14E-17	6.21E-17
Nd-141m	7.87E-17	8.95E-17	7.81E-17	7.62E-17	1.26E-16	8.04E-17	7.48E-17	8.02E-17	9.66E-17
Nd-141	6.52E-18	7.72E-18	5.77E-18	5.40E-18	1.23E-17	6.36E-18	5.56E-18	6.35E-18	8.83E-18
Nd-147	1.35E-17	1.57E-17	1.28E-17	1.18E-17	2.93E-17	1.35E-17	1.21E-17	1.36E-17	2.92E-17
Nd-149	3.89E-17	4.48E-17	3.77E-17	3.54E-17	8.26E-17	3.92E-17	3.58E-17	3.96E-17	7.69E-17
Nd-151	9.56E-17	1.09E-16	9.45E-17	9.15E-17	1.66E-16	9.75E-17	9.05E-17	9.76E-17	1.54E-16
Promethium									
Pm-141	7.66E-17	8.75E-17	7.59E-17	7.36E-17	1.30E-16	7.81E-17	7.27E-17	7.83E-17	1.36E-16
Pm-142	8.96E-17	1.02E-16	8.87E-17	8.56E-17	1.57E-16	9.12E-17	8.48E-17	9.16E-17	2.08E-16
Pm-143	3.14E-17	3.60E-17	3.05E-17	2.94E-17	5.23E-17	3.18E-17	2.91E-17	3.17E-17	3.74E-17

Table III.2. Dose Coefficients for Water Immersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Promethium, cont'd									
Pm-144	1.59E-16	1.82E-16	1.58E-16	1.53E-16	2.69E-16	1.62E-16	1.51E-16	1.63E-16	1.89E-16
Pm-145	1.92E-18	2.50E-18	1.16E-18	8.52E-19	5.38E-18	1.65E-18	1.14E-18	1.65E-18	2.87E-18
Pm-146	7.67E-17	8.77E-17	7.56E-17	7.31E-17	1.31E-16	7.81E-17	7.23E-17	7.82E-17	9.58E-17
Pm-147	1.52E-21	1.94E-21	1.10E-21	9.01E-22	4.41E-21	1.37E-21	1.06E-21	1.40E-21	8.52E-19
Pm-148m	2.06E-16	2.35E-16	2.04E-16	1.98E-16	3.46E-16	2.10E-16	1.95E-16	2.10E-16	2.50E-16
Pm-148	6.10E-17	6.92E-17	6.12E-17	6.03E-17	9.23E-17	6.26E-17	5.90E-17	6.26E-17	1.21E-16
Pm-149	1.15E-18	1.32E-18	1.12E-18	1.06E-18	2.39E-18	1.16E-18	1.07E-18	1.17E-18	2.39E-17
Pm-150	1.52E-16	1.72E-16	1.52E-16	1.49E-16	2.37E-16	1.56E-16	1.46E-16	1.56E-16	2.32E-16
Pm-151	3.25E-17	3.73E-17	3.15E-17	2.98E-17	6.59E-17	3.27E-17	3.00E-17	3.30E-17	5.51E-17
Samarium									
Sm-141m	2.06E-16	2.35E-16	2.05E-16	1.99E-16	3.44E-16	2.11E-16	1.97E-16	2.11E-16	2.71E-16
Sm-141	1.46E-16	1.66E-16	1.45E-16	1.41E-16	2.45E-16	1.49E-16	1.39E-16	1.49E-16	2.23E-16
Sm-142	8.47E-18	9.97E-18	7.68E-18	7.15E-18	1.68E-17	8.33E-18	7.36E-18	8.35E-18	1.24E-17
Sm-145	4.26E-18	5.49E-18	2.72E-18	1.99E-18	1.25E-17	3.70E-18	2.64E-18	3.73E-18	6.19E-18
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	1.22E-22	2.07E-22	1.66E-23	2.67E-23	1.67E-22	8.42E-23	3.51E-23	8.50E-23	4.29E-22
Sm-153	5.31E-18	6.43E-18	4.42E-18	3.62E-18	1.65E-17	5.02E-18	4.16E-18	5.15E-18	1.90E-17
Sm-155	1.02E-17	1.20E-17	9.46E-18	8.19E-18	3.08E-17	1.01E-17	8.86E-18	1.04E-17	4.91E-17
Sm-156	1.19E-17	1.38E-17	1.11E-17	1.00E-17	3.12E-17	1.18E-17	1.05E-17	1.20E-17	2.29E-17
Europium									
Eu-145	1.53E-16	1.74E-16	1.53E-16	1.51E-16	2.33E-16	1.57E-16	1.47E-16	1.57E-16	1.80E-16
Eu-146	2.61E-16	2.96E-16	2.59E-16	2.54E-16	4.13E-16	2.67E-16	2.49E-16	2.66E-16	3.07E-16
Eu-147	5.01E-17	5.74E-17	4.85E-17	4.65E-17	9.07E-17	5.06E-17	4.64E-17	5.07E-17	5.99E-17
Eu-148	2.24E-16	2.56E-16	2.23E-16	2.17E-16	3.70E-16	2.29E-16	2.13E-16	2.29E-16	2.65E-16
Eu-149	5.23E-18	6.30E-18	4.38E-18	3.86E-18	1.25E-17	4.98E-18	4.19E-18	5.02E-18	6.87E-18
Eu-150b[1]	1.53E-16	1.75E-16	1.51E-16	1.45E-16	2.72E-16	1.56E-16	1.44E-16	1.56E-16	1.83E-16
Eu-150a[2]	4.75E-18	5.46E-18	4.62E-18	4.42E-18	8.82E-18	4.80E-18	4.42E-18	4.82E-18	2.46E-17
Eu-152m	3.04E-17	3.47E-17	3.00E-17	2.92E-17	4.94E-17	3.10E-17	2.87E-17	3.09E-17	6.98E-17
Eu-152	1.20E-16	1.37E-16	1.19E-16	1.16E-16	1.94E-16	1.23E-16	1.15E-16	1.23E-16	1.45E-16
Eu-154	1.30E-16	1.48E-16	1.30E-16	1.27E-16	2.06E-16	1.34E-16	1.25E-16	1.33E-16	1.66E-16
Eu-155	5.63E-18	6.70E-18	4.98E-18	4.13E-18	1.83E-17	5.43E-18	4.65E-18	5.61E-18	7.32E-18
Eu-156	1.42E-16	1.61E-16	1.44E-16	1.42E-16	2.08E-16	1.47E-16	1.39E-16	1.46E-16	1.90E-16
Eu-157	2.56E-17	2.96E-17	2.43E-17	2.27E-17	5.26E-17	2.55E-17	2.31E-17	2.58E-17	5.38E-17
Eu-158	1.12E-16	1.27E-16	1.11E-16	1.10E-16	1.70E-16	1.15E-16	1.07E-16	1.14E-16	1.95E-16
Gadolinium									
Gd-145	2.42E-16	2.74E-16	2.45E-16	2.42E-16	3.58E-16	2.49E-16	2.37E-16	2.49E-16	3.20E-16
Gd-146	2.26E-17	2.69E-17	1.98E-17	1.69E-17	6.67E-17	2.18E-17	1.86E-17	2.23E-17	2.91E-17
Gd-147	1.38E-16	1.57E-16	1.36E-16	1.31E-16	2.39E-16	1.40E-16	1.30E-16	1.40E-16	1.64E-16
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	4.17E-17	4.81E-17	3.99E-17	3.75E-17	8.61E-17	4.18E-17	3.79E-17	4.21E-17	5.15E-17
Gd-151	5.17E-18	6.27E-18	4.23E-18	3.59E-18	1.40E-17	4.88E-18	4.03E-18	4.95E-18	7.05E-18
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	8.75E-18	1.07E-17	7.13E-18	5.76E-18	2.75E-17	8.21E-18	6.72E-18	8.42E-18	1.14E-17
Gd-159	4.84E-18	5.63E-18	4.54E-18	4.20E-18	1.05E-17	4.80E-18	4.31E-18	4.86E-18	2.33E-17
Terbium									
Tb-147	1.65E-16	1.88E-16	1.64E-16	1.60E-16	2.69E-16	1.69E-16	1.58E-16	1.69E-16	2.34E-16
Tb-149	1.70E-16	1.93E-16	1.70E-16	1.66E-16	2.71E-16	1.74E-16	1.63E-16	1.74E-16	2.10E-16
Tb-150	1.75E-16	1.99E-16	1.75E-16	1.71E-16	2.83E-16	1.79E-16	1.68E-16	1.79E-16	2.45E-16
Tb-151	9.02E-17	1.03E-16	8.78E-17	8.37E-17	1.72E-16	9.12E-17	8.38E-17	9.17E-17	1.09E-16
Tb-153	2.19E-17	2.55E-17	2.02E-17	1.84E-17	5.16E-17	2.16E-17	1.91E-17	2.19E-17	2.69E-17
Tb-154	2.54E-16	2.87E-16	2.57E-16	2.55E-16	3.69E-16	2.62E-16	2.49E-16	2.61E-16	2.96E-16
Tb-155	1.26E-17	1.50E-17	1.11E-17	9.54E-18	3.57E-17	1.22E-17	1.05E-17	1.25E-17	1.61E-17
Tb-156m[3]	1.93E-18	2.42E-18	1.43E-18	1.05E-18	6.37E-18	1.75E-18	1.35E-18	1.79E-18	2.59E-18
Tb-156n[4]	2.84E-19	3.52E-19	2.18E-19	1.68E-19	9.11E-19	2.60E-19	2.06E-19	2.67E-19	5.80E-19
Tb-156	1.90E-16	2.17E-16	1.89E-16	1.84E-16	3.10E-16	1.94E-16	1.81E-16	1.94E-16	2.25E-16
Tb-157	1.76E-19	2.25E-19	1.18E-19	8.58E-20	5.42E-19	1.55E-19	1.14E-19	1.57E-19	2.48E-19
Tb-158	8.22E-17	9.37E-17	8.09E-17	7.87E-17	1.34E-16	8.39E-17	7.75E-17	8.35E-17	9.92E-17

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	1.18E-16	1.34E-16	1.17E-16	1.15E-16	1.88E-16	1.21E-16	1.12E-16	1.20E-16	1.48E-16
Tb-161	2.51E-18	3.14E-18	1.87E-18	1.45E-18	7.91E-18	2.27E-18	1.78E-18	2.33E-18	9.99E-18
Dysprosium									
Dy-155	5.95E-17	6.81E-17	5.80E-17	5.55E-17	1.10E-16	6.03E-17	5.55E-17	6.05E-17	7.08E-17
Dy-157	3.53E-17	4.08E-17	3.38E-17	3.16E-17	7.58E-17	3.54E-17	3.21E-17	3.57E-17	4.26E-17
Dy-159	3.20E-18	4.06E-18	2.22E-18	1.62E-18	1.01E-17	2.84E-18	2.12E-18	2.90E-18	4.43E-18
Dy-165	2.62E-18	3.04E-18	2.47E-18	2.28E-18	5.70E-18	2.61E-18	2.34E-18	2.63E-18	3.15E-17
Dy-166	3.32E-18	4.05E-18	2.70E-18	2.16E-18	1.04E-17	3.10E-18	2.55E-18	3.19E-18	8.42E-18
Holmium									
Ho-155	3.85E-17	4.44E-17	3.73E-17	3.53E-17	7.55E-17	3.88E-17	3.55E-17	3.91E-17	6.05E-17
Ho-157	4.87E-17	5.62E-17	4.64E-17	4.36E-17	9.98E-17	4.88E-17	4.42E-17	4.91E-17	6.11E-17
Ho-159	3.54E-17	4.12E-17	3.28E-17	2.97E-17	8.63E-17	3.50E-17	3.11E-17	3.55E-17	4.35E-17
Ho-161	4.33E-18	5.45E-18	3.14E-18	2.40E-18	1.35E-17	3.91E-18	3.00E-18	3.99E-18	6.03E-18
Ho-162m	5.89E-17	6.73E-17	5.75E-17	5.54E-17	1.03E-16	5.98E-17	5.51E-17	5.98E-17	6.98E-17
Ho-162	1.61E-17	1.87E-17	1.52E-17	1.42E-17	3.16E-17	1.61E-17	1.45E-17	1.61E-17	2.09E-17
Ho-164m	3.33E-18	4.19E-18	2.40E-18	1.77E-18	1.08E-17	2.99E-18	2.28E-18	3.06E-18	4.52E-18
Ho-164	2.25E-18	2.81E-18	1.66E-18	1.25E-18	7.25E-18	2.03E-18	1.58E-18	2.08E-18	1.05E-17
Ho-166m	1.80E-16	2.06E-16	1.78E-16	1.72E-16	3.15E-16	1.84E-16	1.70E-16	1.84E-16	2.14E-16
Ho-166	3.06E-18	3.54E-18	2.91E-18	2.72E-18	6.24E-18	3.06E-18	2.79E-18	3.09E-18	4.93E-17
Ho-167	3.71E-17	4.25E-17	3.61E-17	3.40E-17	7.71E-17	3.74E-17	3.43E-17	3.78E-17	5.41E-17
Erbium									
Er-161	9.43E-17	1.08E-16	9.30E-17	9.04E-17	1.55E-16	9.62E-17	8.91E-17	9.60E-17	1.12E-16
Er-165	2.80E-18	3.51E-18	2.03E-18	1.50E-18	9.12E-18	2.52E-18	1.93E-18	2.58E-18	3.77E-18
Er-169	3.63E-21	4.59E-21	2.69E-21	2.20E-21	1.07E-20	3.29E-21	2.59E-21	3.38E-21	2.97E-18
Er-171	3.85E-17	4.43E-17	3.71E-17	3.45E-17	8.63E-17	3.86E-17	3.51E-17	3.92E-17	6.86E-17
Er-172	5.29E-17	6.07E-17	5.20E-17	4.97E-17	9.75E-17	5.36E-17	4.95E-17	5.39E-17	6.64E-17
Thulium									
Tm-162	1.91E-16	2.15E-16	1.91E-16	1.89E-16	2.90E-16	1.96E-16	1.85E-16	1.96E-16	2.44E-16
Tm-166	1.98E-16	2.25E-16	1.98E-16	1.95E-16	3.05E-16	2.03E-16	1.91E-16	2.03E-16	2.32E-16
Tm-167	1.36E-17	1.60E-17	1.22E-17	1.08E-17	3.58E-17	1.33E-17	1.16E-17	1.35E-17	2.12E-17
Tm-170	5.10E-19	6.14E-19	4.33E-19	3.46E-19	1.69E-18	4.82E-19	4.04E-19	5.00E-19	1.95E-17
Tm-171	5.21E-20	6.40E-20	4.10E-20	3.09E-20	1.76E-19	4.78E-20	3.84E-20	4.95E-20	7.02E-20
Tm-172	5.09E-17	5.77E-17	5.12E-17	5.06E-17	7.56E-17	5.24E-17	4.95E-17	5.23E-17	9.13E-17
Tm-173	3.95E-17	4.53E-17	3.88E-17	3.70E-17	7.63E-17	4.00E-17	3.70E-17	4.03E-17	6.54E-17
Tm-175	1.09E-16	1.24E-16	1.08E-16	1.05E-16	1.80E-16	1.11E-16	1.04E-16	1.11E-16	1.62E-16
Ytterbium									
Yb-162	1.27E-17	1.51E-17	1.14E-17	9.73E-18	3.75E-17	1.24E-17	1.07E-17	1.27E-17	1.57E-17
Yb-166	6.92E-18	8.52E-18	5.42E-18	4.11E-18	2.31E-17	6.36E-18	5.09E-18	6.57E-18	9.01E-18
Yb-167	2.46E-17	2.92E-17	2.19E-17	1.87E-17	7.23E-17	2.39E-17	2.06E-17	2.45E-17	3.08E-17
Yb-169	2.89E-17	3.42E-17	2.59E-17	2.24E-17	8.19E-17	2.81E-17	2.44E-17	2.88E-17	3.71E-17
Yb-175	4.01E-18	4.62E-18	3.89E-18	3.65E-18	8.54E-18	4.04E-18	3.69E-18	4.09E-18	9.78E-18
Yb-177	1.97E-17	2.24E-17	1.94E-17	1.87E-17	3.49E-17	2.01E-17	1.86E-17	2.01E-17	4.99E-17
Yb-178	3.57E-18	4.09E-18	3.49E-18	3.32E-18	7.08E-18	3.61E-18	3.32E-18	3.64E-18	1.35E-17
Lutetium									
Lu-169	1.08E-16	1.24E-16	1.07E-16	1.05E-16	1.78E-16	1.11E-16	1.03E-16	1.11E-16	1.28E-16
Lu-170	2.70E-16	3.04E-16	2.72E-16	2.71E-16	3.87E-16	2.79E-16	2.64E-16	2.77E-16	3.13E-16
Lu-171	7.00E-17	8.03E-17	6.82E-17	6.53E-17	1.24E-16	7.09E-17	6.51E-17	7.09E-17	8.30E-17
Lu-172	1.97E-16	2.24E-16	1.95E-16	1.91E-16	3.16E-16	2.02E-16	1.88E-16	2.01E-16	2.31E-16
Lu-173	1.16E-17	1.39E-17	1.02E-17	8.64E-18	3.29E-17	1.12E-17	9.58E-18	1.14E-17	1.45E-17
Lu-174m	5.14E-18	6.23E-18	4.24E-18	3.42E-18	1.57E-17	4.83E-18	4.00E-18	4.95E-18	6.59E-18
Lu-174	1.20E-17	1.40E-17	1.12E-17	1.04E-17	2.51E-17	1.20E-17	1.07E-17	1.20E-17	1.45E-17
Lu-176m	1.33E-18	1.59E-18	1.16E-18	9.37E-19	4.42E-18	1.27E-18	1.08E-18	1.32E-18	2.98E-17
Lu-176	5.00E-17	5.74E-17	4.81E-17	4.48E-17	1.15E-16	5.01E-17	4.56E-17	5.09E-17	7.03E-17
Lu-177m	1.01E-16	1.16E-16	9.69E-17	8.96E-17	2.35E-16	1.01E-16	9.18E-17	1.03E-16	1.25E-16
Lu-177	3.52E-18	4.08E-18	3.33E-18	3.00E-18	9.30E-18	3.50E-18	3.13E-18	3.58E-18	9.72E-18
Lu-178m	1.12E-16	1.29E-16	1.09E-16	1.02E-16	2.45E-16	1.13E-16	1.03E-16	1.15E-16	1.65E-16
Lu-178	1.50E-17	1.70E-17	1.50E-17	1.47E-17	2.37E-17	1.54E-17	1.44E-17	1.54E-17	6.93E-17
Lu-179	3.26E-18	3.75E-18	3.13E-18	2.90E-18	7.72E-18	3.27E-18	2.97E-18	3.32E-18	3.37E-17

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	5.45E-17	6.29E-17	5.24E-17	4.88E-17	1.16E-16	5.47E-17	4.97E-17	5.52E-17	6.57E-17
Hf-172	9.58E-18	1.17E-17	7.87E-18	6.21E-18	3.14E-17	8.96E-18	7.37E-18	9.25E-18	1.24E-17
Hf-173	4.04E-17	4.69E-17	3.82E-17	3.46E-17	1.01E-16	4.02E-17	3.61E-17	4.09E-17	4.90E-17
Hf-175	3.66E-17	4.23E-17	3.51E-17	3.27E-17	7.99E-17	3.67E-17	3.33E-17	3.71E-17	4.56E-17
Hf-177m	2.28E-16	2.62E-16	2.21E-16	2.06E-16	5.05E-16	2.30E-16	2.09E-16	2.33E-16	2.88E-16
Hf-178m	2.40E-16	2.75E-16	2.34E-16	2.22E-16	4.81E-16	2.42E-16	2.23E-16	2.44E-16	2.92E-16
Hf-179m	9.07E-17	1.04E-16	8.76E-17	8.19E-17	1.97E-16	9.11E-17	8.32E-17	9.23E-17	1.12E-16
Hf-180m	1.02E-16	1.17E-16	9.89E-17	9.29E-17	2.15E-16	1.03E-16	9.39E-17	1.04E-16	1.24E-16
Hf-181	5.62E-17	6.46E-17	5.50E-17	5.20E-17	1.13E-16	5.68E-17	5.23E-17	5.74E-17	7.29E-17
Hf-182m	9.51E-17	1.09E-16	9.28E-17	8.82E-17	1.85E-16	9.62E-17	8.84E-17	9.68E-17	1.20E-16
Hf-182	2.45E-17	2.81E-17	2.36E-17	2.20E-17	5.57E-17	2.46E-17	2.24E-17	2.49E-17	3.05E-17
Hf-183	7.75E-17	8.84E-17	7.64E-17	7.38E-17	1.33E-16	7.88E-17	7.30E-17	7.89E-17	1.19E-16
Hf-184	2.46E-17	2.85E-17	2.35E-17	2.16E-17	5.91E-17	2.46E-17	2.23E-17	2.50E-17	4.84E-17
Tantalum									
Ta-172	1.62E-16	1.84E-16	1.60E-16	1.56E-16	2.71E-16	1.65E-16	1.54E-16	1.65E-16	2.20E-16
Ta-173	5.91E-17	6.78E-17	5.75E-17	5.46E-17	1.13E-16	5.97E-17	5.48E-17	6.00E-17	9.02E-17
Ta-174	6.38E-17	7.32E-17	6.21E-17	5.89E-17	1.26E-16	6.45E-17	5.92E-17	6.49E-17	9.59E-17
Ta-175	9.71E-17	1.11E-16	9.60E-17	9.29E-17	1.68E-16	9.90E-17	9.23E-17	9.92E-17	1.15E-16
Ta-176	2.30E-16	2.60E-16	2.31E-16	2.29E-16	3.40E-16	2.37E-16	2.24E-16	2.36E-16	2.69E-16
Ta-177	5.86E-18	7.04E-18	4.99E-18	4.06E-18	1.81E-17	5.56E-18	4.68E-18	5.72E-18	7.51E-18
Ta-178b[1]	1.03E-16	1.18E-16	9.88E-17	9.18E-17	2.30E-16	1.03E-16	9.36E-17	1.04E-16	1.26E-16
Ta-178a[2]	1.03E-17	1.20E-17	9.43E-18	8.48E-18	2.41E-17	1.01E-17	8.97E-18	1.02E-17	1.25E-17
Ta-179	2.62E-18	3.21E-18	2.09E-18	1.59E-18	8.93E-18	2.42E-18	1.96E-18	2.51E-18	3.37E-18
Ta-180m	4.05E-18	4.94E-18	3.30E-18	2.54E-18	1.37E-17	3.77E-18	3.08E-18	3.90E-18	6.68E-18
Ta-180	5.62E-17	6.47E-17	5.38E-17	4.98E-17	1.29E-16	5.62E-17	5.10E-17	5.70E-17	6.93E-17
Ta-182m	2.45E-17	2.85E-17	2.28E-17	2.02E-17	6.73E-17	2.42E-17	2.14E-17	2.47E-17	3.59E-17
Ta-182	1.36E-16	1.55E-16	1.35E-16	1.32E-16	2.17E-16	1.39E-16	1.30E-16	1.39E-16	1.64E-16
Ta-183	2.87E-17	3.33E-17	2.70E-17	2.44E-17	7.28E-17	2.85E-17	2.55E-17	2.90E-17	4.58E-17
Ta-184	1.66E-16	1.90E-16	1.64E-16	1.58E-16	3.00E-16	1.69E-16	1.57E-16	1.70E-16	2.24E-16
Ta-185	1.91E-17	2.22E-17	1.79E-17	1.62E-17	4.84E-17	1.89E-17	1.69E-17	1.93E-17	6.73E-17
Ta-186	1.61E-16	1.84E-16	1.58E-16	1.52E-16	2.99E-16	1.63E-16	1.51E-16	1.64E-16	2.56E-16
Tungsten									
W-176	1.60E-17	1.92E-17	1.40E-17	1.13E-17	5.34E-17	1.53E-17	1.30E-17	1.59E-17	2.00E-17
W-177	9.16E-17	1.05E-16	8.91E-17	8.44E-17	1.79E-16	9.26E-17	8.48E-17	9.31E-17	1.10E-16
W-178	1.10E-18	1.34E-18	8.93E-19	6.80E-19	3.77E-18	1.02E-18	8.33E-19	1.06E-18	1.41E-18
W-179	4.48E-18	5.54E-18	3.43E-18	2.62E-18	1.47E-17	4.08E-18	3.24E-18	4.21E-18	6.00E-18
W-181	3.34E-18	4.07E-18	2.71E-18	2.07E-18	1.14E-17	3.10E-18	2.53E-18	3.22E-18	4.27E-18
W-185	1.15E-20	1.40E-20	9.52E-21	7.88E-21	3.53E-20	1.08E-20	8.99E-21	1.11E-20	4.76E-18
W-187	4.88E-17	5.58E-17	4.80E-17	4.60E-17	8.79E-17	4.95E-17	4.58E-17	4.97E-17	7.31E-17
W-188	1.95E-19	2.25E-19	1.87E-19	1.72E-19	4.57E-19	1.95E-19	1.77E-19	1.98E-19	3.18E-18
Rhenium									
Re-177	6.34E-17	7.26E-17	6.22E-17	5.96E-17	1.17E-16	6.43E-17	5.96E-17	6.47E-17	9.35E-17
Re-178	1.30E-16	1.46E-16	1.29E-16	1.26E-16	2.17E-16	1.33E-16	1.24E-16	1.33E-16	1.87E-16
Re-180	1.22E-16	1.39E-16	1.21E-16	1.17E-16	2.03E-16	1.25E-16	1.15E-16	1.25E-16	1.49E-16
Re-181	7.83E-17	8.98E-17	7.65E-17	7.29E-17	1.48E-16	7.93E-17	7.29E-17	7.97E-17	9.83E-17
Re-182b[3]	1.96E-16	2.23E-16	1.93E-16	1.86E-16	3.52E-16	1.99E-16	1.85E-16	2.00E-16	2.33E-16
Re-182a[4]	1.23E-16	1.40E-16	1.22E-16	1.19E-16	2.02E-16	1.26E-16	1.17E-16	1.26E-16	1.45E-16
Re-184m	3.93E-17	4.51E-17	3.79E-17	3.57E-17	8.01E-17	3.95E-17	3.61E-17	3.98E-17	4.73E-17
Re-184	9.19E-17	1.05E-16	9.04E-17	8.75E-17	1.55E-16	9.36E-17	8.65E-17	9.34E-17	1.08E-16
Re-186m	1.20E-18	1.47E-18	9.57E-19	7.34E-19	4.01E-18	1.10E-18	8.96E-19	1.14E-18	1.65E-18
Re-186	2.03E-18	2.38E-18	1.86E-18	1.61E-18	6.10E-18	1.99E-18	1.75E-18	2.05E-18	2.28E-17
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	6.97E-18	8.36E-18	5.98E-18	4.77E-18	2.35E-17	6.60E-18	5.57E-18	6.86E-18	8.85E-18
Re-188	6.15E-18	7.06E-18	5.96E-18	5.59E-18	1.32E-17	6.20E-18	5.66E-18	6.26E-18	6.07E-17
Re-189	6.99E-18	8.06E-18	6.66E-18	6.10E-18	1.72E-17	6.98E-18	6.29E-18	7.10E-18	2.71E-17
Osmium									
Os-180	5.32E-18	6.39E-18	4.53E-18	3.69E-18	1.66E-17	5.03E-18	4.25E-18	5.20E-18	7.04E-18

[1] $T_{½}$ = 2.2 h
[2] $T_{½}$ = 9.31 m
[3] $T_{½}$ = 64.0 h
[4] $T_{½}$ = 12.7 h

Table III.2. Dose Coefficients for Water Immersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	1.27E-16	1.45E-16	1.25E-16	1.21E-16	2.21E-16	1.29E-16	1.20E-16	1.29E-16	1.51E-16
Os-182	4.34E-17	5.00E-17	4.18E-17	3.91E-17	9.25E-17	4.35E-17	3.97E-17	4.40E-17	5.29E-17
Os-185	7.33E-17	8.38E-17	7.22E-17	6.95E-17	1.28E-16	7.45E-17	6.89E-17	7.47E-17	8.70E-17
Os-189m	1.93E-22	1.05E-21	2.97E-24	4.78E-23	2.59E-22	2.80E-23	8.55E-23	2.46E-22	1.66E-20
Os-190m	1.62E-16	1.86E-16	1.60E-16	1.53E-16	3.02E-16	1.65E-16	1.52E-16	1.66E-16	1.96E-16
Os-191m	6.43E-19	7.76E-19	5.40E-19	4.20E-19	2.22E-18	6.02E-19	5.02E-19	6.28E-19	8.39E-19
Os-191	7.23E-18	8.55E-18	6.47E-18	5.39E-18	2.32E-17	6.98E-18	6.04E-18	7.23E-18	9.36E-18
Os-193	7.35E-18	8.49E-18	7.06E-18	6.53E-18	1.65E-17	7.36E-18	6.69E-18	7.46E-18	3.04E-17
Os-194	7.18E-20	9.28E-20	4.74E-20	3.45E-20	2.18E-19	6.28E-20	4.58E-20	6.39E-20	1.20E-19
Iridium									
Ir-182	1.39E-16	1.58E-16	1.37E-16	1.31E-16	2.50E-16	1.41E-16	1.31E-16	1.41E-16	2.28E-16
Ir-184	1.99E-16	2.27E-16	1.98E-16	1.92E-16	3.39E-16	2.04E-16	1.90E-16	2.04E-16	2.48E-16
Ir-185	6.26E-17	7.14E-17	6.21E-17	6.02E-17	1.09E-16	6.38E-17	5.99E-17	6.42E-17	7.51E-17
Ir-186a[1]	1.71E-16	1.95E-16	1.70E-16	1.65E-16	2.95E-16	1.75E-16	1.63E-16	1.75E-16	2.04E-16
Ir-186b[2]	9.93E-17	1.13E-16	9.80E-17	9.45E-17	1.75E-16	1.01E-16	9.38E-17	1.01E-16	1.28E-16
Ir-187	3.63E-17	4.18E-17	3.52E-17	3.32E-17	7.15E-17	3.66E-17	3.35E-17	3.68E-17	4.39E-17
Ir-188	1.69E-16	1.91E-16	1.70E-16	1.67E-16	2.63E-16	1.74E-16	1.64E-16	1.74E-16	1.98E-16
Ir-189	7.29E-18	8.64E-18	6.43E-18	5.37E-18	2.23E-17	6.99E-18	6.02E-18	7.22E-18	9.21E-18
Ir-190n[3]	1.58E-16	1.81E-16	1.55E-16	1.48E-16	3.01E-16	1.60E-16	1.48E-16	1.61E-16	1.91E-16
Ir-190m[4]	2.46E-22	1.24E-21	1.85E-24	5.79E-23	3.13E-22	3.68E-23	9.94E-23	2.95E-22	1.74E-20
Ir-190	1.47E-16	1.68E-16	1.44E-16	1.37E-16	2.81E-16	1.49E-16	1.37E-16	1.50E-16	1.77E-16
Ir-191m	6.80E-18	8.03E-18	6.10E-18	5.10E-18	2.17E-17	6.57E-18	5.70E-18	6.81E-18	8.78E-18
Ir-192m	1.65E-17	1.91E-17	1.58E-17	1.43E-17	4.44E-17	1.65E-17	1.48E-17	1.69E-17	1.96E-17
Ir-192	8.36E-17	9.57E-17	8.21E-17	7.81E-17	1.65E-16	8.47E-17	7.81E-17	8.54E-17	1.10E-16
Ir-194m	2.39E-16	2.73E-16	2.36E-16	2.27E-16	4.33E-16	2.43E-16	2.25E-16	2.44E-16	2.88E-16
Ir-194	9.63E-18	1.10E-17	9.49E-18	9.12E-18	1.79E-17	9.79E-18	9.07E-18	9.84E-18	6.80E-17
Ir-195m	4.17E-17	4.81E-17	4.03E-17	3.76E-17	8.97E-17	4.19E-17	3.82E-17	4.24E-17	6.33E-17
Ir-195	5.26E-18	6.25E-18	4.63E-18	3.79E-18	1.72E-17	5.03E-18	4.32E-18	5.23E-18	2.67E-17
Platinum									
Pt-186	7.55E-17	8.63E-17	7.44E-17	7.16E-17	1.32E-16	7.68E-17	7.10E-17	7.69E-17	8.92E-17
Pt-188	1.95E-17	2.27E-17	1.82E-17	1.62E-17	5.14E-17	1.92E-17	1.71E-17	1.97E-17	2.49E-17
Pt-189	3.21E-17	3.71E-17	3.07E-17	2.84E-17	7.02E-17	3.21E-17	2.91E-17	3.25E-17	3.93E-17
Pt-191	2.95E-17	3.43E-17	2.77E-17	2.51E-17	7.14E-17	2.92E-17	2.62E-17	2.97E-17	3.67E-17
Pt-193m	9.58E-19	1.15E-18	8.21E-19	6.49E-19	3.29E-18	9.03E-19	7.63E-19	9.43E-19	3.88E-18
Pt-193	8.32E-22	3.78E-21	6.05E-24	1.86E-22	1.01E-21	1.53E-22	3.02E-22	9.23E-22	4.79E-20
Pt-195m	6.49E-18	7.74E-18	5.65E-18	4.56E-18	2.18E-17	6.17E-18	5.26E-18	6.43E-18	1.06E-17
Pt-197m	7.70E-18	8.99E-18	7.16E-18	6.37E-18	2.00E-17	7.57E-18	6.75E-18	7.75E-18	2.46E-17
Pt-197	2.25E-18	2.65E-18	2.05E-18	1.74E-18	6.97E-18	2.19E-18	1.91E-18	2.26E-18	1.26E-17
Pt-199	2.08E-17	2.37E-17	2.05E-17	1.96E-17	3.84E-17	2.11E-17	1.95E-17	2.12E-17	5.91E-17
Pt-200	5.65E-18	6.61E-18	5.19E-18	4.52E-18	1.62E-17	5.52E-18	4.87E-18	5.68E-18	1.56E-17
Gold									
Au-193	1.52E-17	1.78E-17	1.39E-17	1.21E-17	4.26E-17	1.48E-17	1.31E-17	1.52E-17	1.95E-17
Au-194	1.12E-16	1.28E-16	1.12E-16	1.09E-16	1.88E-16	1.15E-16	1.08E-16	1.15E-16	1.33E-16
Au-195m	2.02E-17	2.32E-17	1.95E-17	1.81E-17	4.70E-17	2.03E-17	1.84E-17	2.06E-17	2.67E-17
Au-195	7.38E-18	8.81E-18	6.39E-18	5.12E-18	2.51E-17	7.00E-18	5.95E-18	7.30E-18	9.34E-18
Au-198m	5.79E-17	6.69E-17	5.49E-17	4.96E-17	1.52E-16	5.76E-17	5.17E-17	5.88E-17	7.58E-17
Au-198	4.13E-17	4.73E-17	4.07E-17	3.89E-17	7.86E-17	4.19E-17	3.88E-17	4.22E-17	6.85E-17
Au-199	8.89E-18	1.03E-17	8.40E-18	7.52E-18	2.43E-17	8.83E-18	7.89E-18	9.04E-18	1.43E-17
Au-200m	2.14E-16	2.45E-16	2.12E-16	2.03E-16	3.90E-16	2.18E-16	2.02E-16	2.19E-16	2.64E-16
Au-200	2.89E-17	3.28E-17	2.89E-17	2.83E-17	4.61E-17	2.96E-17	2.78E-17	2.96E-17	8.48E-17
Au-201	5.47E-18	6.27E-18	5.38E-18	5.15E-18	1.01E-17	5.55E-18	5.13E-18	5.58E-18	3.28E-17
Mercury									
Hg-193m	1.08E-16	1.23E-16	1.06E-16	1.02E-16	1.95E-16	1.10E-16	1.02E-16	1.10E-16	1.31E-16
Hg-193	1.92E-17	2.25E-17	1.77E-17	1.55E-17	5.37E-17	1.89E-17	1.67E-17	1.94E-17	2.57E-17
Hg-194	1.64E-21	6.26E-21	1.42E-23	3.39E-22	1.86E-21	3.89E-22	5.02E-22	1.61E-21	6.15E-20
Hg-195m	2.08E-17	2.40E-17	2.00E-17	1.86E-17	4.62E-17	2.09E-17	1.90E-17	2.12E-17	2.75E-17
Hg-195	2.00E-17	2.31E-17	1.91E-17	1.78E-17	4.28E-17	2.00E-17	1.82E-17	2.02E-17	2.42E-17

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.2. Dose Coefficients for Water Immersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	8.92E-18	1.04E-17	8.28E-18	7.20E-18	2.62E-17	8.77E-18	7.75E-18	9.03E-18	1.65E-17
Hg-197	6.10E-18	7.27E-18	5.30E-18	4.24E-18	2.08E-17	5.78E-18	4.93E-18	6.04E-18	7.66E-18
Hg-199m	1.83E-17	2.12E-17	1.72E-17	1.54E-17	4.86E-17	1.81E-17	1.62E-17	1.85E-17	4.01E-17
Hg-203	2.44E-17	2.79E-17	2.36E-17	2.21E-17	5.42E-17	2.45E-17	2.24E-17	2.48E-17	3.14E-17
Thallium									
Tl-194m	2.37E-16	2.71E-16	2.34E-16	2.26E-16	4.22E-16	2.41E-16	2.24E-16	2.42E-16	3.00E-16
Tl-194	7.92E-17	9.07E-17	7.77E-17	7.42E-17	1.49E-16	8.02E-17	7.41E-17	8.07E-17	9.51E-17
Tl-195	1.34E-16	1.52E-16	1.34E-16	1.32E-16	2.12E-16	1.38E-16	1.30E-16	1.38E-16	1.60E-16
Tl-197	4.15E-17	4.76E-17	4.04E-17	3.83E-17	8.21E-17	4.19E-17	3.86E-17	4.22E-17	5.11E-17
Tl-198m	1.22E-16	1.39E-16	1.20E-16	1.14E-16	2.26E-16	1.23E-16	1.14E-16	1.24E-16	1.53E-16
Tl-198	2.13E-16	2.42E-16	2.14E-16	2.10E-16	3.33E-16	2.19E-16	2.07E-16	2.19E-16	2.50E-16
Tl-199	2.46E-17	2.84E-17	2.34E-17	2.15E-17	5.80E-17	2.45E-17	2.22E-17	2.49E-17	3.12E-17
Tl-200	1.36E-16	1.55E-16	1.35E-16	1.32E-16	2.30E-16	1.39E-16	1.30E-16	1.40E-16	1.61E-16
Tl-201	8.53E-18	1.01E-17	7.60E-18	6.28E-18	2.77E-17	8.20E-18	7.08E-18	8.51E-18	1.08E-17
Tl-202	4.69E-17	5.39E-17	4.57E-17	4.30E-17	9.55E-17	4.73E-17	4.34E-17	4.78E-17	5.68E-17
Tl-204	1.24E-19	1.48E-19	1.07E-19	8.70E-20	4.11E-19	1.18E-19	1.00E-19	1.22E-19	1.32E-17
Tl-206	1.31E-19	1.55E-19	1.18E-19	1.05E-19	3.39E-19	1.28E-19	1.12E-19	1.30E-19	3.58E-17
Tl-207	3.34E-19	3.85E-19	3.22E-19	3.08E-19	6.27E-19	3.37E-19	3.08E-19	3.38E-19	3.27E-17
Tl-208	3.73E-16	4.17E-16	3.79E-16	3.78E-16	5.27E-16	3.87E-16	3.68E-16	3.84E-16	4.66E-16
Tl-209	2.16E-16	2.45E-16	2.17E-16	2.14E-16	3.39E-16	2.22E-16	2.10E-16	2.22E-16	2.97E-16
Lead									
Pb-195m	1.64E-16	1.87E-16	1.62E-16	1.55E-16	2.95E-16	1.67E-16	1.54E-16	1.67E-16	2.05E-16
Pb-198	4.41E-17	5.07E-17	4.25E-17	3.95E-17	9.79E-17	4.42E-17	4.03E-17	4.48E-17	5.55E-17
Pb-199	1.55E-16	1.76E-16	1.55E-16	1.51E-16	2.54E-16	1.59E-16	1.49E-16	1.59E-16	1.83E-16
Pb-200	2.02E-17	2.36E-17	1.89E-17	1.66E-17	5.66E-17	1.99E-17	1.77E-17	2.05E-17	2.68E-17
Pb-201	7.77E-17	8.88E-17	7.62E-17	7.27E-17	1.47E-16	7.87E-17	7.26E-17	7.92E-17	9.42E-17
Pb-202m	2.12E-16	2.41E-16	2.11E-16	2.05E-16	3.47E-16	2.17E-16	2.02E-16	2.16E-16	2.51E-16
Pb-202	8.97E-22	4.36E-21	6.43E-24	2.07E-22	1.12E-21	1.55E-22	3.50E-22	1.05E-21	6.29E-20
Pb-203	3.11E-17	3.59E-17	2.97E-17	2.73E-17	7.49E-17	3.11E-17	2.81E-17	3.16E-17	3.92E-17
Pb-205	1.03E-21	4.85E-21	7.81E-24	2.34E-22	1.27E-21	1.92E-22	3.89E-22	1.17E-21	6.76E-20
Pb-209	1.62E-20	1.98E-20	1.34E-20	1.13E-20	4.71E-20	1.53E-20	1.27E-20	1.57E-20	9.88E-18
Pb-210	1.44E-19	1.91E-19	9.78E-20	7.22E-20	4.50E-19	1.26E-19	9.44E-20	1.31E-19	3.00E-19
Pb-211	5.30E-18	6.05E-18	5.24E-18	5.07E-18	9.14E-18	5.40E-18	5.01E-18	5.41E-18	3.56E-17
Pb-212	1.49E-17	1.72E-17	1.42E-17	1.30E-17	3.73E-17	1.49E-17	1.34E-17	1.52E-17	2.35E-17
Pb-214	2.54E-17	2.91E-17	2.47E-17	2.32E-17	5.38E-17	2.56E-17	2.34E-17	2.59E-17	4.49E-17
Bismuth									
Bi-200	2.47E-16	2.82E-16	2.44E-16	2.36E-16	4.31E-16	2.52E-16	2.34E-16	2.52E-16	3.01E-16
Bi-201	1.39E-16	1.58E-16	1.38E-16	1.34E-16	2.30E-16	1.42E-16	1.32E-16	1.42E-16	1.79E-16
Bi-202	2.83E-16	3.22E-16	2.81E-16	2.74E-16	4.64E-16	2.89E-16	2.69E-16	2.89E-16	3.36E-16
Bi-203	2.53E-16	2.87E-16	2.55E-16	2.51E-16	3.85E-16	2.60E-16	2.46E-16	2.60E-16	2.98E-16
Bi-205	1.79E-16	2.03E-16	1.80E-16	1.77E-16	2.74E-16	1.84E-16	1.74E-16	1.84E-16	2.09E-16
Bi-206	3.43E-16	3.90E-16	3.41E-16	3.33E-16	5.53E-16	3.51E-16	3.28E-16	3.51E-16	4.06E-16
Bi-207	1.60E-16	1.82E-16	1.59E-16	1.55E-16	2.60E-16	1.64E-16	1.53E-16	1.64E-16	1.95E-16
Bi-210m	2.63E-17	3.01E-17	2.55E-17	2.40E-17	5.72E-17	2.65E-17	2.42E-17	2.68E-17	3.34E-17
Bi-210	6.41E-20	7.65E-20	5.64E-20	4.95E-20	1.74E-19	6.19E-20	5.34E-20	6.33E-20	2.44E-17
Bi-211	4.75E-18	5.45E-18	4.64E-18	4.39E-18	9.79E-18	4.80E-18	4.41E-18	4.85E-18	6.17E-18
Bi-212	1.95E-17	2.22E-17	1.96E-17	1.92E-17	3.02E-17	2.00E-17	1.88E-17	2.00E-17	5.47E-17
Bi-213	1.36E-17	1.56E-17	1.34E-17	1.28E-17	2.57E-17	1.38E-17	1.28E-17	1.39E-17	4.43E-17
Bi-214	1.61E-16	1.83E-16	1.63E-16	1.61E-16	2.38E-16	1.66E-16	1.57E-16	1.66E-16	2.32E-16
Polonium									
Po-203	1.72E-16	1.96E-16	1.72E-16	1.68E-16	2.77E-16	1.77E-16	1.65E-16	1.76E-16	2.09E-16
Po-205	1.66E-16	1.88E-16	1.65E-16	1.61E-16	2.65E-16	1.70E-16	1.58E-16	1.69E-16	1.95E-16
Po-207	1.39E-16	1.58E-16	1.38E-16	1.34E-16	2.26E-16	1.42E-16	1.32E-16	1.42E-16	1.64E-16
Po-210	8.86E-22	1.01E-21	8.80E-22	8.61E-22	1.39E-21	9.06E-22	8.43E-22	9.03E-22	1.04E-21
Po-211	8.10E-19	9.22E-19	8.05E-19	7.85E-19	1.30E-18	8.28E-19	7.71E-19	8.27E-19	9.59E-19
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	8.68E-21	9.86E-21	8.63E-21	8.43E-21	1.37E-20	8.88E-21	8.26E-21	8.85E-21	1.02E-20
Po-215	1.80E-20	2.06E-20	1.77E-20	1.70E-20	3.36E-20	1.82E-20	1.69E-20	1.84E-20	2.17E-20
Po-216	1.76E-21	2.00E-21	1.75E-21	1.71E-21	2.77E-21	1.81E-21	1.68E-21	1.80E-21	2.07E-21
Po-218	9.52E-22	1.08E-21	9.47E-22	9.27E-22	1.49E-21	9.75E-22	9.07E-22	9.71E-22	1.37E-21

Table III.2. Dose Coefficients for Water Immersion

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	1.38E-16	1.57E-16	1.38E-16	1.34E-16	2.28E-16	1.42E-16	1.32E-16	1.42E-16	1.65E-16
At-211	3.58E-18	4.23E-18	3.22E-18	2.66E-18	1.18E-17	3.45E-18	3.00E-18	3.59E-18	4.45E-18
At-215	1.97E-20	2.25E-20	1.94E-20	1.85E-20	3.78E-20	2.00E-20	1.85E-20	2.01E-20	2.39E-20
At-216	1.40E-19	1.66E-19	1.26E-19	1.04E-19	4.66E-19	1.35E-19	1.17E-19	1.41E-19	1.78E-19
At-217	3.15E-20	3.61E-20	3.11E-20	2.98E-20	5.87E-20	3.20E-20	2.96E-20	3.22E-20	3.89E-20
At-218	2.92E-19	3.71E-19	2.21E-19	1.66E-19	9.71E-19	2.64E-19	2.09E-19	2.75E-19	4.94E-19
Radon									
Rn-218	7.77E-20	8.87E-20	7.71E-20	7.47E-20	1.31E-19	7.92E-20	7.37E-20	7.94E-20	9.26E-20
Rn-219	5.73E-18	6.57E-18	5.60E-18	5.29E-18	1.20E-17	5.79E-18	5.32E-18	5.85E-18	7.10E-18
Rn-220	3.94E-20	4.51E-20	3.91E-20	3.78E-20	6.86E-20	4.02E-20	3.74E-20	4.03E-20	4.73E-20
Rn-222	4.07E-20	4.66E-20	4.03E-20	3.88E-20	7.25E-20	4.14E-20	3.85E-20	4.16E-20	4.90E-20
Francium									
Fr-219	3.55E-19	4.07E-19	3.48E-19	3.31E-19	7.06E-19	3.60E-19	3.32E-19	3.63E-19	4.34E-19
Fr-220	1.07E-18	1.25E-18	1.01E-18	8.97E-19	3.04E-18	1.06E-18	9.49E-19	1.09E-18	1.61E-18
Fr-221	3.16E-18	3.62E-18	3.03E-18	2.79E-18	7.73E-18	3.16E-18	2.86E-18	3.22E-18	4.09E-18
Fr-222	2.24E-19	2.63E-19	2.06E-19	1.86E-19	5.52E-19	2.20E-19	1.95E-19	2.24E-19	5.08E-17
Fr-223	5.16E-18	6.12E-18	4.59E-18	3.98E-18	1.41E-17	4.99E-18	4.33E-18	5.11E-18	2.78E-17
Radium									
Ra-222	9.40E-19	1.08E-18	9.19E-19	8.69E-19	1.96E-18	9.50E-19	8.74E-19	9.60E-19	1.16E-18
Ra-223	1.32E-17	1.53E-17	1.26E-17	1.13E-17	3.43E-17	1.32E-17	1.18E-17	1.35E-17	1.77E-17
Ra-224	1.01E-18	1.16E-18	9.79E-19	9.11E-19	2.36E-18	1.02E-18	9.28E-19	1.03E-18	1.30E-18
Ra-225	7.57E-19	9.94E-19	4.54E-19	3.28E-19	2.13E-18	6.46E-19	4.46E-19	6.49E-19	3.83E-18
Ra-226	6.82E-19	7.86E-19	6.50E-19	5.92E-19	1.77E-18	6.81E-19	6.13E-19	6.95E-19	9.31E-19
Ra-227	1.59E-17	1.84E-17	1.54E-17	1.46E-17	3.29E-17	1.60E-17	1.47E-17	1.62E-17	4.39E-17
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	4.49E-19	5.25E-19	4.27E-19	3.92E-19	1.08E-18	4.47E-19	4.04E-19	4.57E-19	6.40E-19
Ac-224	1.96E-17	2.28E-17	1.85E-17	1.65E-17	5.45E-17	1.95E-17	1.74E-17	2.00E-17	2.39E-17
Ac-225	1.58E-18	1.86E-18	1.47E-18	1.29E-18	4.63E-18	1.56E-18	1.38E-18	1.61E-18	2.05E-18
Ac-226	1.30E-17	1.50E-17	1.25E-17	1.14E-17	3.30E-17	1.30E-17	1.18E-17	1.33E-17	3.10E-17
Ac-227	1.30E-20	1.57E-20	1.16E-20	1.02E-20	3.77E-20	1.25E-20	1.09E-20	1.30E-20	2.23E-20
Ac-228	1.01E-16	1.15E-16	1.01E-16	9.89E-17	1.61E-16	1.04E-16	9.71E-17	1.04E-16	1.44E-16
Thorium									
Th-226	7.84E-19	9.16E-19	7.38E-19	6.54E-19	2.23E-18	7.77E-19	6.93E-19	7.99E-19	1.19E-18
Th-227	1.06E-17	1.22E-17	1.01E-17	9.34E-18	2.49E-17	1.06E-17	9.57E-18	1.07E-17	1.36E-17
Th-228	2.04E-19	2.45E-19	1.85E-19	1.62E-19	5.92E-19	1.98E-19	1.74E-19	2.05E-19	3.18E-19
Th-229	8.46E-18	9.95E-18	7.78E-18	6.71E-18	2.58E-17	8.28E-18	7.29E-18	8.56E-18	1.14E-17
Th-230	4.09E-20	5.43E-20	3.20E-20	2.73E-20	1.20E-19	3.68E-20	3.08E-20	3.94E-20	1.01E-19
Th-231	1.22E-18	1.55E-18	9.75E-19	8.28E-19	3.69E-18	1.13E-18	9.32E-19	1.18E-18	3.79E-18
Th-232	2.14E-20	3.13E-20	1.44E-20	1.24E-20	5.90E-20	1.80E-20	1.43E-20	1.99E-20	7.65E-20
Th-234	7.65E-19	9.16E-19	6.76E-19	5.58E-19	2.53E-18	7.34E-19	6.31E-19	7.64E-19	1.33E-18
Protactinium									
Pa-227	1.91E-18	2.27E-18	1.72E-18	1.44E-18	6.26E-18	1.85E-18	1.60E-18	1.92E-18	2.45E-18
Pa-228	1.18E-16	1.34E-16	1.17E-16	1.13E-16	2.00E-16	1.20E-16	1.12E-16	1.20E-16	1.41E-16
Pa-230	6.69E-17	7.63E-17	6.60E-17	6.38E-17	1.16E-16	6.82E-17	6.31E-17	6.82E-17	7.99E-17
Pa-231	3.75E-18	4.39E-18	3.54E-18	3.33E-18	8.06E-18	3.73E-18	3.37E-18	3.78E-18	5.18E-18
Pa-232	9.71E-17	1.10E-16	9.64E-17	9.40E-17	1.57E-16	9.93E-17	9.23E-17	9.91E-17	1.17E-16
Pa-233	2.01E-17	2.32E-17	1.95E-17	1.81E-17	4.61E-17	2.02E-17	1.84E-17	2.05E-17	3.01E-17
Pa-234m	1.49E-18	1.71E-18	1.47E-18	1.42E-18	2.61E-18	1.52E-18	1.41E-18	1.52E-18	5.92E-17
Pa-234	1.99E-16	2.26E-16	1.97E-16	1.92E-16	3.29E-16	2.03E-16	1.89E-16	2.03E-16	2.51E-16
Uranium									
U-230	1.19E-19	1.50E-19	1.00E-19	8.92E-20	3.26E-19	1.12E-19	9.61E-20	1.17E-19	2.33E-19
U-231	6.57E-18	7.83E-18	5.92E-18	5.04E-18	2.08E-17	6.38E-18	5.55E-18	6.61E-18	8.67E-18
U-232	3.55E-20	5.33E-20	2.20E-20	2.02E-20	8.77E-20	2.93E-20	2.26E-20	3.22E-20	1.31E-19
U-233	3.79E-20	5.02E-20	2.98E-20	2.73E-20	9.26E-20	3.46E-20	2.91E-20	3.64E-20	9.56E-20
U-234	2.03E-20	3.35E-20	9.87E-21	9.50E-21	4.54E-20	1.53E-20	1.09E-20	1.75E-20	9.55E-20
U-235	1.56E-17	1.80E-17	1.49E-17	1.35E-17	4.08E-17	1.56E-17	1.40E-17	1.59E-17	1.89E-17
U-236	1.42E-20	2.56E-20	4.94E-21	5.30E-21	2.72E-20	9.67E-21	6.16E-21	1.16E-20	8.19E-20
U-237	1.32E-17	1.55E-17	1.22E-17	1.07E-17	3.78E-17	1.29E-17	1.14E-17	1.33E-17	1.92E-17
U-238	1.03E-20	2.00E-20	2.29E-21	2.88E-21	1.72E-20	6.34E-21	3.52E-21	7.95E-21	6.83E-20
U-239	4.89E-18	5.79E-18	4.38E-18	3.70E-18	1.46E-17	4.72E-18	4.10E-18	4.87E-18	3.09E-17
U-240	1.14E-19	1.88E-19	4.20E-20	3.91E-20	2.41E-19	8.35E-20	4.97E-20	9.11E-20	3.52E-18

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	1.24E-16	1.41E-16	1.22E-16	1.18E-16	2.18E-16	1.26E-16	1.17E-16	1.26E-16	1.48E-16
Np-233	8.47E-18	9.96E-18	7.88E-18	6.80E-18	2.60E-17	8.34E-18	7.36E-18	8.61E-18	1.06E-17
Np-234	1.53E-16	1.74E-16	1.54E-16	1.52E-16	2.30E-16	1.58E-16	1.49E-16	1.58E-16	1.80E-16
Np-235	1.29E-19	1.93E-19	7.76E-20	7.23E-20	3.17E-19	1.06E-19	8.02E-20	1.16E-19	4.22E-19
Np-236a[1]	1.18E-17	1.39E-17	1.09E-17	9.50E-18	3.55E-17	1.16E-17	1.02E-17	1.20E-17	1.77E-17
Np-236b[2]	4.69E-18	5.50E-18	4.38E-18	3.83E-18	1.37E-17	4.63E-18	4.10E-18	4.76E-18	9.16E-18
Np-237	2.35E-18	2.86E-18	2.02E-18	1.71E-18	7.20E-18	2.24E-18	1.90E-18	2.32E-18	3.43E-18
Np-238	5.77E-17	6.55E-17	5.75E-17	5.66E-17	8.69E-17	5.92E-17	5.52E-17	5.89E-17	8.00E-17
Np-239	1.67E-17	1.94E-17	1.58E-17	1.43E-17	4.45E-17	1.66E-17	1.49E-17	1.70E-17	2.75E-17
Np-240m	3.44E-17	3.92E-17	3.41E-17	3.32E-17	5.71E-17	3.51E-17	3.27E-17	3.51E-17	8.38E-17
Np-240	1.34E-16	1.53E-16	1.33E-16	1.29E-16	2.29E-16	1.37E-16	1.27E-16	1.37E-16	1.78E-16
Plutonium									
Pu-234	6.27E-18	7.39E-18	5.79E-18	4.96E-18	1.99E-17	6.16E-18	5.41E-18	6.37E-18	7.83E-18
Pu-235	8.62E-18	1.01E-17	8.00E-18	6.95E-18	2.59E-17	8.49E-18	7.49E-18	8.75E-18	1.08E-17
Pu-236	1.94E-20	3.64E-20	4.30E-21	5.68E-21	3.03E-20	1.24E-20	6.64E-21	1.48E-20	1.12E-19
Pu-237	4.47E-18	5.31E-18	4.09E-18	3.49E-18	1.42E-17	4.37E-18	3.82E-18	4.53E-18	5.75E-18
Pu-238	1.53E-20	2.99E-20	2.43E-21	3.89E-21	2.16E-20	9.36E-21	4.60E-21	1.14E-20	9.55E-20
Pu-239	1.10E-20	1.74E-20	5.88E-21	5.94E-21	2.15E-20	8.75E-21	6.38E-21	9.60E-21	4.26E-20
Pu-240	1.49E-20	2.88E-20	2.49E-21	3.82E-21	2.15E-20	9.15E-21	4.55E-21	1.11E-20	9.13E-20
Pu-241	1.62E-22	1.96E-22	1.44E-22	1.25E-22	4.92E-22	1.56E-22	1.36E-22	1.62E-22	2.50E-22
Pu-242	1.25E-20	2.41E-20	2.21E-21	3.30E-21	1.83E-20	7.74E-21	3.90E-21	9.35E-21	7.60E-20
Pu-243	2.30E-18	2.73E-18	2.07E-18	1.75E-18	7.27E-18	2.23E-18	1.94E-18	2.31E-18	1.01E-17
Pu-244	9.63E-21	1.93E-20	9.83E-22	2.06E-21	1.24E-20	5.61E-21	2.52E-21	6.96E-21	6.32E-20
Pu-245	4.25E-17	4.86E-17	4.19E-17	4.02E-17	7.85E-17	4.32E-17	3.99E-17	4.34E-17	6.82E-17
Pu-246	1.32E-17	1.54E-17	1.23E-17	1.10E-17	3.59E-17	1.30E-17	1.16E-17	1.33E-17	1.79E-17
Americium									
Am-237	3.67E-17	4.23E-17	3.54E-17	3.29E-17	8.37E-17	3.69E-17	3.36E-17	3.74E-17	4.56E-17
Am-238	9.22E-17	1.05E-16	9.15E-17	8.89E-17	1.54E-16	9.43E-17	8.77E-17	9.42E-17	1.09E-16
Am-239	2.26E-17	2.64E-17	2.13E-17	1.89E-17	6.32E-17	2.24E-17	2.00E-17	2.30E-17	3.11E-17
Am-240	1.06E-16	1.21E-16	1.06E-16	1.03E-16	1.71E-16	1.09E-16	1.01E-16	1.09E-16	1.25E-16
Am-241	1.98E-18	2.48E-18	1.53E-18	1.18E-18	6.55E-18	1.80E-18	1.45E-18	1.88E-18	2.98E-18
Am-242m	8.78E-20	1.39E-19	3.87E-20	3.88E-20	1.81E-19	6.76E-20	4.40E-20	7.28E-20	3.13E-19
Am-242	1.37E-18	1.64E-18	1.23E-18	1.06E-18	4.21E-18	1.33E-18	1.15E-18	1.38E-18	9.65E-18
Am-243	5.00E-18	5.97E-18	4.33E-18	3.48E-18	1.69E-17	4.74E-18	4.03E-18	4.94E-18	6.31E-18
Am-244m	1.26E-19	1.61E-19	9.87E-20	8.98E-20	3.05E-19	1.17E-19	9.63E-20	1.20E-19	3.32E-17
Am-244	8.21E-17	9.36E-17	8.12E-17	7.90E-17	1.35E-16	8.38E-17	7.77E-17	8.37E-17	1.05E-16
Am-245	3.17E-18	3.68E-18	3.01E-18	2.72E-18	8.34E-18	3.16E-18	2.83E-18	3.23E-18	1.92E-17
Am-246m	1.07E-16	1.21E-16	1.06E-16	1.05E-16	1.63E-16	1.10E-16	1.02E-16	1.09E-16	1.54E-16
Am-246	7.00E-17	8.01E-17	6.88E-17	6.61E-17	1.28E-16	7.11E-17	6.56E-17	7.14E-17	1.11E-16
Curium									
Cm-238	7.15E-18	8.41E-18	6.63E-18	5.72E-18	2.23E-17	7.04E-18	6.20E-18	7.27E-18	8.88E-18
Cm-240	1.97E-20	3.77E-20	2.24E-21	4.27E-21	2.59E-20	1.21E-20	5.30E-21	1.41E-20	1.10E-19
Cm-241	4.94E-17	5.69E-17	4.82E-17	4.54E-17	1.02E-16	4.99E-17	4.58E-17	5.04E-17	6.41E-17
Cm-242	1.83E-20	3.47E-20	2.59E-21	4.38E-21	2.48E-20	1.15E-20	5.29E-21	1.33E-20	1.00E-19
Cm-243	1.28E-17	1.48E-17	1.21E-17	1.10E-17	3.35E-17	1.27E-17	1.14E-17	1.30E-17	1.85E-17
Cm-244	1.62E-20	3.12E-20	1.65E-21	3.41E-21	2.07E-20	9.83E-21	4.23E-21	1.15E-20	9.19E-20
Cm-245	8.69E-18	1.02E-17	8.08E-18	7.02E-18	2.64E-17	8.57E-18	7.56E-18	8.84E-18	1.14E-17
Cm-246	1.46E-20	2.81E-20	1.63E-21	3.16E-21	1.91E-20	8.96E-21	3.92E-21	1.05E-20	8.21E-20
Cm-247	3.20E-17	3.67E-17	3.15E-17	3.00E-17	6.23E-17	3.24E-17	3.00E-17	3.27E-17	3.86E-17
Cm-248	1.11E-20	2.14E-20	1.21E-21	2.38E-21	1.44E-20	6.80E-21	2.96E-21	7.96E-21	6.28E-20
Cm-249	1.99E-18	2.28E-18	1.97E-18	1.89E-18	3.53E-18	2.03E-18	1.88E-18	2.03E-18	1.80E-17
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	2.25E-17	2.62E-17	2.13E-17	1.91E-17	6.18E-17	2.24E-17	2.00E-17	2.30E-17	3.11E-17
Bk-246	9.78E-17	1.11E-16	9.68E-17	9.41E-17	1.63E-16	9.99E-17	9.26E-17	9.97E-17	1.15E-16
Bk-247	1.03E-17	1.20E-17	9.68E-18	8.56E-18	2.91E-17	1.02E-17	9.09E-18	1.05E-17	1.44E-17
Bk-249	1.92E-22	2.71E-22	1.02E-22	8.30E-23	4.79E-22	1.58E-22	1.05E-22	1.62E-22	4.29E-20
Bk-250	9.31E-17	1.05E-16	9.28E-17	9.13E-17	1.40E-16	9.55E-17	8.91E-17	9.50E-17	1.23E-16

[1] $T_{½}$ = 1.15E5 y

[2] $T_{½}$ = 22.5 h

Table III.2. Dose Coefficients for Water Immersion

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	2.30E-20	4.23E-20	2.68E-21	4.91E-21	3.02E-20	1.47E-20	6.27E-21	1.62E-20	1.10E-19
Cf-246	1.74E-20	3.08E-20	3.43E-21	4.72E-21	2.59E-20	1.17E-20	5.70E-21	1.28E-20	7.76E-20
Cf-248	1.58E-20	2.89E-20	1.88E-21	3.38E-21	2.08E-20	1.01E-20	4.32E-21	1.11E-20	7.46E-20
Cf-249	3.37E-17	3.87E-17	3.31E-17	3.14E-17	6.73E-17	3.41E-17	3.15E-17	3.45E-17	4.10E-17
Cf-250	1.50E-20	2.75E-20	1.78E-21	3.21E-21	1.98E-20	9.58E-21	4.10E-21	1.06E-20	7.10E-20
Cf-251	1.22E-17	1.42E-17	1.14E-17	1.02E-17	3.37E-17	1.21E-17	1.08E-17	1.24E-17	1.97E-17
Cf-252	1.60E-20	2.83E-20	3.24E-21	4.40E-21	2.41E-20	1.08E-20	5.30E-21	1.18E-20	7.11E-20
Cf-253	2.40E-21	3.23E-21	1.54E-21	1.27E-21	6.58E-21	2.07E-21	1.53E-21	2.14E-21	1.75E-18
Cf-254	4.89E-23	8.96E-23	5.83E-24	1.05E-23	6.44E-23	3.12E-23	1.34E-23	3.45E-23	2.31E-22
Einsteinium									
Es-250	4.07E-17	4.64E-17	4.00E-17	3.84E-17	7.44E-17	4.14E-17	3.82E-17	4.15E-17	4.81E-17
Es-251	9.06E-18	1.06E-17	8.43E-18	7.38E-18	2.71E-17	8.95E-18	7.90E-18	9.21E-18	1.16E-17
Es-253	4.33E-20	5.68E-20	3.29E-20	3.16E-20	8.52E-20	3.97E-20	3.27E-20	4.06E-20	9.41E-20
Es-254m	4.79E-17	5.47E-17	4.75E-17	4.62E-17	7.96E-17	4.89E-17	4.55E-17	4.89E-17	6.89E-17
Es-254	5.00E-19	7.15E-19	2.94E-19	2.74E-19	1.11E-18	4.20E-19	3.05E-19	4.38E-19	1.29E-18
Fermium									
Fm-252	1.68E-20	2.96E-20	2.33E-21	3.69E-21	2.31E-20	1.11E-20	4.81E-21	1.18E-20	6.95E-20
Fm-253	7.72E-18	9.04E-18	7.21E-18	6.36E-18	2.24E-17	7.64E-18	6.77E-18	7.85E-18	9.87E-18
Fm-254	2.06E-20	3.46E-20	5.02E-21	6.08E-21	3.34E-20	1.45E-20	7.39E-21	1.53E-20	7.86E-20
Fm-255	2.90E-19	4.31E-19	1.58E-19	1.45E-19	6.95E-19	2.35E-19	1.66E-19	2.51E-19	8.88E-19
Fm-257	1.02E-17	1.20E-17	9.53E-18	8.48E-18	2.89E-17	1.01E-17	8.97E-18	1.04E-17	1.43E-17
Mendelevium									
Md-257	1.09E-17	1.27E-17	1.04E-17	9.42E-18	2.82E-17	1.09E-17	9.79E-18	1.11E-17	1.36E-17
Md-258	1.46E-19	2.23E-19	6.05E-20	5.81E-20	3.12E-19	1.13E-19	6.92E-20	1.18E-19	4.21E-19

TABLE III.3

Dose Coefficients for Exposure to Contaminated Ground Surface

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units.

h_T: The tissue dose equivalent coefficient for organ or tissue T (Sv per Bq s m^{-2}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-2}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

To convert to conventional units (mrem per μCi y cm^{-2}), multiply table entries by 1.168×10^{21}.   The coefficients are valid for any soil density.

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium									
Be-7	5.13E-17	4.93E-17	4.67E-17	4.71E-17	7.24E-17	4.88E-17	4.57E-17	4.89E-17	5.83E-17
Be-10	4.78E-19	4.99E-19	3.22E-19	2.86E-19	1.19E-18	3.63E-19	3.26E-19	4.12E-19	3.06E-16
Carbon									
C-11	1.06E-15	1.02E-15	9.66E-16	9.75E-16	1.47E-15	1.01E-15	9.46E-16	1.01E-15	4.15E-15
C-14	2.22E-20	2.52E-20	8.65E-21	7.25E-21	4.63E-20	1.25E-20	1.03E-20	1.61E-20	7.46E-20
Nitrogen									
N-13	1.06E-15	1.02E-15	9.67E-16	9.76E-16	1.48E-15	1.01E-15	9.47E-16	1.01E-15	6.26E-15
Oxygen									
O-15	1.06E-15	1.02E-15	9.69E-16	9.78E-16	1.48E-15	1.01E-15	9.49E-16	1.01E-15	1.00E-14
Fluorine									
F-18	1.06E-15	1.02E-15	9.67E-16	9.77E-16	1.48E-15	1.01E-15	9.48E-16	1.01E-15	1.65E-15
Neon									
Ne-19	1.07E-15	1.02E-15	9.72E-16	9.81E-16	1.49E-15	1.02E-15	9.52E-16	1.02E-15	1.25E-14
Sodium									
Na-22	2.20E-15	2.10E-15	2.02E-15	2.06E-15	2.90E-15	2.05E-15	2.00E-15	2.10E-15	2.60E-15
Na-24	3.73E-15	3.55E-15	3.49E-15	3.60E-15	4.61E-15	3.29E-15	3.52E-15	3.61E-15	1.03E-14
Magnesium									
Mg-28	1.36E-15	1.30E-15	1.24E-15	1.27E-15	1.79E-15	1.25E-15	1.24E-15	1.30E-15	1.58E-15
Aluminum									
Al-26	2.58E-15	2.47E-15	2.40E-15	2.46E-15	3.34E-15	2.33E-15	2.39E-15	2.49E-15	7.88E-15
Al-28	1.67E-15	1.59E-15	1.57E-15	1.61E-15	2.08E-15	1.46E-15	1.57E-15	1.62E-15	1.51E-14
Silicon									
Si-31	3.26E-18	3.24E-18	2.69E-18	2.59E-18	6.44E-18	2.81E-18	2.65E-18	3.01E-18	6.86E-15
Si-32	4.09E-20	4.54E-20	1.88E-20	1.57E-20	9.30E-20	2.50E-20	2.11E-20	3.10E-20	1.20E-19
Phosphorus									
P-30	1.07E-15	1.03E-15	9.77E-16	9.87E-16	1.50E-15	1.02E-15	9.57E-16	1.02E-15	1.57E-14
P-32	3.18E-18	3.19E-18	2.54E-18	2.40E-18	6.90E-18	2.71E-18	2.51E-18	2.91E-18	8.26E-15
P-33	5.74E-20	6.31E-20	2.83E-20	2.38E-20	1.35E-19	3.65E-20	3.11E-20	4.46E-20	1.58E-19
Sulphur									
S-35	2.30E-20	2.59E-20	9.21E-21	7.71E-21	4.86E-20	1.31E-20	1.08E-20	1.68E-20	7.54E-20
Chlorine									
Cl-36	7.56E-19	7.72E-19	5.63E-19	5.22E-19	1.69E-18	6.16E-19	5.63E-19	6.73E-19	1.06E-15
Cl-38	1.38E-15	1.32E-15	1.30E-15	1.34E-15	1.73E-15	1.21E-15	1.31E-15	1.34E-15	1.40E-14
Cl-39	1.40E-15	1.34E-15	1.30E-15	1.33E-15	1.82E-15	1.27E-15	1.30E-15	1.35E-15	1.10E-14
Argon									
Ar-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar-39	3.94E-19	4.12E-19	2.63E-19	2.32E-19	9.82E-19	2.97E-19	2.67E-19	3.38E-19	2.24E-16
Ar-41	1.25E-15	1.19E-15	1.16E-15	1.20E-15	1.59E-15	1.15E-15	1.16E-15	1.20E-15	6.04E-15
Potassium									
K-38	3.03E-15	2.89E-15	2.82E-15	2.89E-15	3.91E-15	2.72E-15	2.82E-15	2.92E-15	1.65E-14
K-40	1.52E-16	1.45E-16	1.41E-16	1.45E-16	1.93E-16	1.36E-16	1.41E-16	1.46E-16	6.25E-15
K-42	2.76E-16	2.64E-16	2.57E-16	2.64E-16	3.55E-16	2.47E-16	2.57E-16	2.66E-16	1.41E-14
K-43	1.00E-15	9.63E-16	9.14E-16	9.25E-16	1.41E-15	9.51E-16	8.94E-16	9.55E-16	2.88E-15
K-44	2.11E-15	2.01E-15	1.97E-15	2.03E-15	2.65E-15	1.90E-15	1.97E-15	2.04E-15	1.51E-14
K-45	1.75E-15	1.67E-15	1.64E-15	1.68E-15	2.29E-15	1.55E-15	1.64E-15	1.69E-15	1.30E-14
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	5.93E-20	6.50E-20	2.96E-20	2.48E-20	1.40E-19	3.78E-20	3.23E-20	4.61E-20	1.61E-19
Ca-47	1.04E-15	9.94E-16	9.64E-16	9.92E-16	1.33E-15	9.55E-16	9.61E-16	1.00E-15	3.42E-15
Ca-49	2.71E-15	2.57E-15	2.54E-15	2.63E-15	3.30E-15	2.37E-15	2.58E-15	2.63E-15	1.30E-14
Scandium									
Sc-43	1.14E-15	1.09E-15	1.04E-15	1.05E-15	1.61E-15	1.08E-15	1.01E-15	1.08E-15	3.61E-15
Sc-44m	2.83E-16	2.75E-16	2.59E-16	2.61E-16	4.49E-16	2.62E-16	2.53E-16	2.72E-16	3.23E-16
Sc-44	2.16E-15	2.07E-15	1.98E-15	2.02E-15	2.87E-15	2.03E-15	1.96E-15	2.07E-15	9.47E-15
Sc-46	2.01E-15	1.92E-15	1.85E-15	1.90E-15	2.59E-15	1.89E-15	1.84E-15	1.93E-15	2.28E-15
Sc-47	1.07E-16	1.04E-16	9.84E-17	9.64E-17	2.30E-16	9.88E-17	9.56E-17	1.04E-16	1.95E-16
Sc-48	3.32E-15	3.16E-15	3.06E-15	3.15E-15	4.25E-15	3.08E-15	3.05E-15	3.18E-15	4.27E-15
Sc-49	5.31E-18	5.26E-18	4.44E-18	4.30E-18	1.03E-17	4.59E-18	4.39E-18	4.93E-18	9.74E-15

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	1.31E-16	1.31E-16	1.20E-16	1.04E-16	4.68E-16	1.19E-16	1.15E-16	1.32E-16	1.49E-16
Ti-45	9.05E-16	8.69E-16	8.24E-16	8.32E-16	1.26E-15	8.61E-16	8.08E-16	8.61E-16	4.37E-15
Vanadium									
V-47	1.04E-15	9.96E-16	9.44E-16	9.54E-16	1.44E-15	9.86E-16	9.25E-16	9.87E-16	1.09E-14
V-48	2.90E-15	2.77E-15	2.67E-15	2.74E-15	3.76E-15	2.70E-15	2.65E-15	2.78E-15	3.73E-15
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	4.39E-16	4.25E-16	4.02E-16	3.98E-16	8.10E-16	4.10E-16	3.90E-16	4.23E-16	4.98E-16
Cr-49	1.09E-15	1.05E-15	9.95E-16	9.97E-16	1.66E-15	1.04E-15	9.72E-16	1.04E-15	8.29E-15
Cr-51	3.23E-17	3.13E-17	2.94E-17	2.96E-17	5.02E-17	3.01E-17	2.86E-17	3.08E-17	3.68E-17
Manganese									
Mn-51	1.04E-15	1.00E-15	9.48E-16	9.58E-16	1.45E-15	9.91E-16	9.29E-16	9.91E-16	1.22E-14
Mn-52m	2.40E-15	2.30E-15	2.21E-15	2.26E-15	3.16E-15	2.22E-15	2.19E-15	2.30E-15	1.52E-14
Mn-52	3.44E-15	3.28E-15	3.17E-15	3.25E-15	4.44E-15	3.19E-15	3.14E-15	3.29E-15	3.95E-15
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	8.50E-16	8.12E-16	7.77E-16	7.96E-16	1.11E-15	8.07E-16	7.71E-16	8.12E-16	9.65E-16
Mn-56	1.64E-15	1.57E-15	1.52E-15	1.56E-15	2.10E-15	1.50E-15	1.52E-15	1.58E-15	1.02E-14
Iron									
Fe-52	7.61E-16	7.33E-16	6.94E-16	6.97E-16	1.17E-15	7.19E-16	6.77E-16	7.27E-16	1.87E-15
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-59	1.17E-15	1.12E-15	1.08E-15	1.11E-15	1.50E-15	1.08E-15	1.08E-15	1.12E-15	1.34E-15
Fe-60	2.08E-20	2.37E-20	7.68E-21	6.45E-21	4.21E-20	1.14E-20	9.31E-21	1.48E-20	7.20E-20
Cobalt									
Co-55	2.02E-15	1.94E-15	1.85E-15	1.89E-15	2.70E-15	1.90E-15	1.83E-15	1.93E-15	6.99E-15
Co-56	3.42E-15	3.26E-15	3.17E-15	3.26E-15	4.35E-15	3.12E-15	3.16E-15	3.29E-15	5.22E-15
Co-57	1.17E-16	1.14E-16	1.08E-16	1.04E-16	2.95E-16	1.10E-16	1.05E-16	1.15E-16	1.38E-16
Co-58m	1.48E-20	1.66E-20	3.21E-21	3.01E-21	2.21E-20	7.35E-21	5.03E-21	9.32E-21	3.24E-20
Co-58	9.97E-16	9.52E-16	9.10E-16	9.29E-16	1.32E-15	9.46E-16	8.99E-16	9.50E-16	1.14E-15
Co-60m	4.60E-18	4.45E-18	4.18E-18	4.04E-18	9.01E-18	4.13E-18	4.09E-18	4.42E-18	2.22E-17
Co-60	2.45E-15	2.34E-15	2.27E-15	2.33E-15	3.11E-15	2.25E-15	2.26E-15	2.35E-15	2.76E-15
Co-61	9.22E-17	9.07E-17	8.33E-17	7.56E-17	2.60E-16	8.40E-17	8.05E-17	9.02E-17	4.69E-15
Co-62m	2.62E-15	2.50E-15	2.43E-15	2.50E-15	3.32E-15	2.39E-15	2.42E-15	2.52E-15	1.43E-14
Nickel									
Ni-56	1.74E-15	1.66E-15	1.59E-15	1.62E-15	2.45E-15	1.63E-15	1.57E-15	1.66E-15	1.97E-15
Ni-57	1.87E-15	1.79E-15	1.73E-15	1.78E-15	2.43E-15	1.70E-15	1.73E-15	1.80E-15	2.89E-15
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	5.35E-16	5.11E-16	4.97E-16	5.11E-16	6.83E-16	4.87E-16	4.96E-16	5.15E-16	7.23E-15
Ni-66	4.55E-20	5.03E-20	2.16E-20	1.81E-20	1.05E-19	2.83E-20	2.40E-20	3.49E-20	1.30E-19
Copper									
Cu-60	3.78E-15	3.61E-15	3.50E-15	3.59E-15	4.88E-15	3.45E-15	3.48E-15	3.63E-15	1.44E-14
Cu-61	8.56E-16	8.21E-16	7.80E-16	7.89E-16	1.19E-15	8.11E-16	7.64E-16	8.15E-16	4.15E-15
Cu-62	1.06E-15	1.01E-15	9.61E-16	9.70E-16	1.47E-15	1.00E-15	9.41E-16	1.00E-15	1.48E-14
Cu-64	1.97E-16	1.89E-16	1.79E-16	1.81E-16	2.72E-16	1.87E-16	1.75E-16	1.87E-16	3.93E-16
Cu-66	9.20E-17	8.80E-17	8.39E-17	8.58E-17	1.23E-16	8.59E-17	8.34E-17	8.78E-17	1.19E-14
Cu-67	1.14E-16	1.11E-16	1.05E-16	1.02E-16	2.45E-16	1.05E-16	1.01E-16	1.11E-16	1.61E-16
Zinc									
Zn-62	4.54E-16	4.36E-16	4.10E-16	4.12E-16	6.52E-16	4.29E-16	4.01E-16	4.30E-16	5.52E-16
Zn-63	1.14E-15	1.10E-15	1.04E-15	1.05E-15	1.58E-15	1.09E-15	1.02E-15	1.09E-15	1.19E-14
Zn-65	5.78E-16	5.51E-16	5.31E-16	5.47E-16	7.39E-16	5.38E-16	5.29E-16	5.53E-16	6.52E-16
Zn-69m	4.32E-16	4.16E-16	3.94E-16	3.97E-16	6.21E-16	4.10E-16	3.85E-16	4.12E-16	5.64E-16
Zn-69	8.12E-19	8.36E-19	5.88E-19	5.35E-19	1.95E-18	6.46E-19	5.89E-19	7.18E-19	2.02E-15
Zn-71m	1.60E-15	1.54E-15	1.46E-15	1.48E-15	2.23E-15	1.52E-15	1.43E-15	1.53E-15	7.85E-15
Zn-72	1.45E-16	1.41E-16	1.33E-16	1.29E-16	3.30E-16	1.34E-16	1.29E-16	1.41E-16	1.72E-16
Gallium									
Ga-65	1.21E-15	1.17E-15	1.11E-15	1.11E-15	1.79E-15	1.15E-15	1.08E-15	1.16E-15	1.09E-14
Ga-66	2.31E-15	2.20E-15	2.14E-15	2.20E-15	2.96E-15	2.10E-15	2.14E-15	2.22E-15	1.09E-14
Ga-67	1.53E-16	1.49E-16	1.41E-16	1.38E-16	3.11E-16	1.43E-16	1.36E-16	1.49E-16	1.74E-16
Ga-68	9.89E-16	9.49E-16	9.01E-16	9.10E-16	1.37E-15	9.40E-16	8.83E-16	9.41E-16	1.00E-14
Ga-70	1.04E-17	1.01E-17	9.19E-18	9.24E-18	1.63E-17	9.48E-18	9.09E-18	9.82E-18	7.55E-15
Ga-72	2.60E-15	2.48E-15	2.41E-15	2.48E-15	3.31E-15	2.37E-15	2.41E-15	2.50E-15	7.19E-15
Ga-73	3.19E-16	3.09E-16	2.90E-16	2.90E-16	5.11E-16	2.96E-16	2.82E-16	3.05E-16	4.64E-15

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	7.04E-16	6.78E-16	6.38E-16	6.39E-16	1.07E-15	6.60E-16	6.23E-16	6.70E-16	1.31E-15
Ge-67	1.44E-15	1.39E-15	1.32E-15	1.33E-15	2.07E-15	1.36E-15	1.29E-15	1.38E-15	1.48E-14
Ge-68	2.56E-20	7.12E-20	9.89E-23	2.19E-21	1.34E-20	4.81E-21	1.22E-20	2.16E-20	2.90E-18
Ge-69	8.85E-16	8.46E-16	8.10E-16	8.26E-16	1.18E-15	8.33E-16	7.99E-16	8.44E-16	2.82E-15
Ge-71	2.59E-20	7.21E-20	1.00E-22	2.22E-21	1.36E-20	4.87E-21	1.24E-20	2.18E-20	2.93E-18
Ge-75	3.60E-17	3.51E-17	3.26E-17	3.27E-17	6.04E-17	3.32E-17	3.18E-17	3.44E-17	3.94E-15
Ge-77	1.10E-15	1.06E-15	1.01E-15	1.02E-15	1.58E-15	1.02E-15	9.88E-16	1.05E-15	8.23E-15
Ge-78	2.83E-16	2.75E-16	2.58E-16	2.59E-16	4.61E-16	2.62E-16	2.52E-16	2.71E-16	9.56E-16
Arsenic									
As-69	1.06E-15	1.02E-15	9.66E-16	9.74E-16	1.49E-15	1.01E-15	9.45E-16	1.01E-15	1.46E-14
As-70	4.07E-15	3.89E-15	3.75E-15	3.83E-15	5.32E-15	3.77E-15	3.71E-15	3.90E-15	1.47E-14
As-71	5.81E-16	5.60E-16	5.31E-16	5.34E-16	9.02E-16	5.46E-16	5.18E-16	5.56E-16	1.22E-15
As-72	1.84E-15	1.76E-15	1.68E-15	1.71E-15	2.47E-15	1.73E-15	1.65E-15	1.75E-15	1.33E-14
As-73	6.32E-18	6.51E-18	5.09E-18	3.89E-18	2.31E-17	5.23E-18	4.88E-18	5.95E-18	1.55E-17
As-74	7.85E-16	7.53E-16	7.15E-16	7.24E-16	1.07E-15	7.48E-16	7.01E-16	7.47E-16	3.23E-15
As-76	4.44E-16	4.25E-16	4.06E-16	4.13E-16	5.97E-16	4.17E-16	4.00E-16	4.24E-16	1.18E-14
As-77	9.39E-18	9.13E-18	8.47E-18	8.45E-18	1.57E-17	8.68E-18	8.25E-18	8.95E-18	5.63E-16
As-78	1.25E-15	1.19E-15	1.15E-15	1.18E-15	1.62E-15	1.15E-15	1.14E-15	1.20E-15	1.40E-14
Selenium									
Se-70	1.03E-15	9.93E-16	9.36E-16	9.40E-16	1.52E-15	9.75E-16	9.15E-16	9.81E-16	6.44E-15
Se-73m	2.53E-16	2.43E-16	2.30E-16	2.32E-16	3.54E-16	2.40E-16	2.25E-16	2.40E-16	2.22E-15
Se-73	1.12E-15	1.08E-15	1.02E-15	1.02E-15	1.72E-15	1.06E-15	9.98E-16	1.07E-15	5.40E-15
Se-75	3.91E-16	3.80E-16	3.58E-16	3.55E-16	7.20E-16	3.63E-16	3.48E-16	3.77E-16	4.76E-16
Se-77m	8.40E-17	8.22E-17	7.70E-17	7.56E-17	1.78E-16	7.73E-17	7.49E-17	8.18E-17	1.10E-16
Se-79	2.83E-20	3.18E-20	1.15E-20	9.59E-21	6.04E-20	1.62E-20	1.34E-20	2.07E-20	9.10E-20
Se-81m	1.37E-17	1.39E-17	1.22E-17	1.14E-17	3.74E-17	1.24E-17	1.19E-17	1.34E-17	4.41E-17
Se-81	1.20E-17	1.17E-17	1.06E-17	1.06E-17	1.95E-17	1.10E-17	1.04E-17	1.13E-17	7.07E-15
Se-83	2.40E-15	2.30E-15	2.21E-15	2.26E-15	3.20E-15	2.22E-15	2.19E-15	2.30E-15	7.37E-15
Bromine									
Br-74m	3.96E-15	3.78E-15	3.65E-15	3.73E-15	5.16E-15	3.65E-15	3.62E-15	3.79E-15	1.74E-14
Br-74	4.20E-15	4.00E-15	3.89E-15	3.99E-15	5.39E-15	3.82E-15	3.89E-15	4.04E-15	1.58E-14
Br-75	1.25E-15	1.21E-15	1.14E-15	1.15E-15	1.81E-15	1.18E-15	1.12E-15	1.20E-15	7.59E-15
Br-76	2.54E-15	2.43E-15	2.35E-15	2.40E-15	3.32E-15	2.33E-15	2.34E-15	2.44E-15	9.52E-15
Br-77	3.24E-16	3.13E-16	2.95E-16	2.98E-16	4.76E-16	3.05E-16	2.88E-16	3.09E-16	4.05E-16
Br-80m	2.15E-17	2.41E-17	1.11E-17	7.89E-18	5.64E-17	1.44E-17	1.19E-17	1.70E-17	8.46E-17
Br-80	8.30E-17	7.96E-17	7.55E-17	7.65E-17	1.13E-16	7.89E-17	7.40E-17	7.89E-17	2.80E-15
Br-82	2.67E-15	2.55E-15	2.45E-15	2.50E-15	3.51E-15	2.51E-15	2.42E-15	2.55E-15	3.05E-15
Br-83	8.61E-18	8.31E-18	7.69E-18	7.71E-18	1.27E-17	8.07E-18	7.54E-18	8.13E-18	2.09E-15
Br-84	1.66E-15	1.58E-15	1.54E-15	1.59E-15	2.08E-15	1.49E-15	1.55E-15	1.60E-15	1.28E-14
Krypton									
Kr-74	1.21E-15	1.16E-15	1.10E-15	1.10E-15	1.83E-15	1.14E-15	1.07E-15	1.15E-15	1.07E-14
Kr-76	4.40E-16	4.28E-16	3.98E-16	3.99E-16	7.00E-16	4.10E-16	3.88E-16	4.20E-16	5.50E-16
Kr-77	1.04E-15	1.01E-15	9.53E-16	9.56E-16	1.62E-15	9.90E-16	9.30E-16	9.99E-16	8.78E-15
Kr-79	2.60E-16	2.51E-16	2.36E-16	2.38E-16	3.75E-16	2.44E-16	2.30E-16	2.47E-16	3.60E-16
Kr-81m	1.29E-16	1.26E-16	1.17E-16	1.16E-16	2.47E-16	1.17E-16	1.15E-16	1.24E-16	1.60E-16
Kr-81	6.80E-18	7.72E-18	5.13E-18	5.25E-18	9.79E-18	5.34E-18	5.31E-18	6.15E-18	4.39E-17
Kr-83m	6.16E-19	1.05E-18	1.40E-20	6.21E-20	3.80E-19	8.51E-20	1.54E-19	3.80E-19	1.29E-17
Kr-85m	1.57E-16	1.53E-16	1.44E-16	1.42E-16	3.20E-16	1.45E-16	1.40E-16	1.52E-16	1.36E-15
Kr-85	2.82E-18	2.74E-18	2.45E-18	2.43E-18	4.47E-18	2.59E-18	2.41E-18	2.64E-18	8.00E-16
Kr-87	7.61E-16	7.27E-16	7.06E-16	7.22E-16	9.99E-16	6.86E-16	7.04E-16	7.32E-16	1.35E-14
Kr-88	1.80E-15	1.72E-15	1.69E-15	1.73E-15	2.28E-15	1.59E-15	1.69E-15	1.74E-15	4.43E-15
Rubidium									
Rb-79	1.40E-15	1.35E-15	1.28E-15	1.29E-15	2.02E-15	1.33E-15	1.25E-15	1.34E-15	1.08E-14
Rb-80	1.32E-15	1.26E-15	1.20E-15	1.21E-15	1.83E-15	1.25E-15	1.17E-15	1.25E-15	1.83E-14
Rb-81m	6.38E-18	7.67E-18	3.80E-18	3.61E-18	1.47E-17	4.04E-18	4.10E-18	5.43E-18	4.06E-17
Rb-81	6.36E-16	6.15E-16	5.79E-16	5.82E-16	9.52E-16	5.99E-16	5.65E-16	6.07E-16	1.98E-15
Rb-82m	2.94E-15	2.81E-15	2.69E-15	2.75E-15	3.86E-15	2.76E-15	2.66E-15	2.81E-15	3.98E-15
Rb-82	1.15E-15	1.10E-15	1.04E-15	1.05E-15	1.59E-15	1.09E-15	1.02E-15	1.09E-15	1.54E-14
Rb-83	5.18E-16	4.98E-16	4.70E-16	4.75E-16	7.12E-16	4.91E-16	4.61E-16	4.92E-16	6.37E-16
Rb-84	9.34E-16	8.94E-16	8.52E-16	8.70E-16	1.24E-15	8.84E-16	8.41E-16	8.90E-16	1.87E-15
Rb-86	9.74E-17	9.30E-17	8.92E-17	9.15E-17	1.27E-16	9.08E-17	8.88E-17	9.31E-17	7.72E-15
Rb-87	1.10E-19	1.19E-19	5.98E-20	5.05E-20	2.69E-19	7.36E-20	6.37E-20	8.80E-20	2.73E-19

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	6.16E-16	5.89E-16	5.75E-16	5.91E-16	7.85E-16	5.50E-16	5.76E-16	5.95E-16	1.67E-14
Rb-89	1.99E-15	1.90E-15	1.85E-15	1.90E-15	2.52E-15	1.81E-15	1.84E-15	1.91E-15	1.21E-14
Strontium									
Sr-80	3.15E-18	5.00E-18	2.34E-20	3.02E-19	1.81E-18	3.72E-19	6.80E-19	1.85E-18	4.91E-17
Sr-81	1.43E-15	1.38E-15	1.31E-15	1.32E-15	2.09E-15	1.36E-15	1.28E-15	1.37E-15	1.27E-14
Sr-82	3.10E-18	4.91E-18	2.30E-20	2.97E-19	1.78E-18	3.65E-19	6.69E-19	1.82E-18	4.83E-17
Sr-83	8.10E-16	7.78E-16	7.37E-16	7.50E-16	1.10E-15	7.60E-16	7.26E-16	7.71E-16	2.26E-15
Sr-85m	2.20E-16	2.14E-16	2.00E-16	2.00E-16	3.91E-16	2.01E-16	1.96E-16	2.12E-16	2.57E-16
Sr-85	5.27E-16	5.07E-16	4.77E-16	4.82E-16	7.28E-16	4.99E-16	4.68E-16	5.00E-16	6.76E-16
Sr-87m	3.31E-16	3.19E-16	3.00E-16	3.02E-16	4.88E-16	3.12E-16	2.93E-16	3.15E-16	4.02E-16
Sr-89	2.49E-18	2.51E-18	1.98E-18	1.86E-18	5.43E-18	2.11E-18	1.95E-18	2.27E-18	6.66E-15
Sr-90	3.33E-19	3.50E-19	2.19E-19	1.93E-19	8.31E-19	2.49E-19	2.23E-19	2.84E-19	1.40E-16
Sr-91	7.08E-16	6.76E-16	6.48E-16	6.64E-16	9.25E-16	6.67E-16	6.43E-16	6.77E-16	7.53E-15
Sr-92	1.30E-15	1.24E-15	1.21E-15	1.24E-15	1.64E-15	1.18E-15	1.20E-15	1.25E-15	1.86E-15
Yttrium									
Y-86m	2.20E-16	2.15E-16	2.02E-16	2.01E-16	3.92E-16	2.02E-16	1.97E-16	2.13E-16	2.91E-16
Y-86	3.54E-15	3.38E-15	3.26E-15	3.34E-15	4.60E-15	3.27E-15	3.24E-15	3.39E-15	6.46E-15
Y-87	4.71E-16	4.55E-16	4.25E-16	4.29E-16	6.58E-16	4.44E-16	4.16E-16	4.46E-16	5.90E-16
Y-88	2.56E-15	2.45E-15	2.39E-15	2.45E-15	3.23E-15	2.30E-15	2.39E-15	2.47E-15	2.92E-15
Y-90m	6.46E-16	6.24E-16	5.88E-16	5.91E-16	9.97E-16	6.07E-16	5.73E-16	6.16E-16	9.99E-16
Y-90	5.75E-18	5.72E-18	4.76E-18	4.57E-18	1.17E-17	5.02E-18	4.68E-18	5.32E-18	1.05E-14
Y-91m	5.50E-16	5.27E-16	5.01E-16	5.07E-16	7.52E-16	5.23E-16	4.91E-16	5.23E-16	9.52E-16
Y-91	6.11E-18	5.96E-18	5.31E-18	5.29E-18	1.01E-17	5.44E-18	5.25E-18	5.74E-18	6.92E-15
Y-92	2.65E-16	2.53E-16	2.43E-16	2.48E-16	3.50E-16	2.46E-16	2.41E-16	2.53E-16	1.39E-14
Y-93	9.51E-17	9.14E-17	8.74E-17	8.90E-17	1.33E-16	8.61E-17	8.66E-17	9.12E-17	1.23E-14
Y-94	1.12E-15	1.07E-15	1.03E-15	1.05E-15	1.45E-15	1.04E-15	1.02E-15	1.07E-15	1.63E-14
Y-95	8.27E-16	7.87E-16	7.71E-16	7.95E-16	1.04E-15	7.37E-16	7.76E-16	7.99E-16	1.38E-14
Zirconium									
Zr-86	2.88E-16	2.86E-16	2.48E-16	2.49E-16	4.70E-16	2.54E-16	2.44E-16	2.69E-16	4.22E-16
Zr-88	4.13E-16	4.01E-16	3.70E-16	3.73E-16	6.04E-16	3.85E-16	3.63E-16	3.91E-16	5.21E-16
Zr-89	1.18E-15	1.13E-15	1.08E-15	1.10E-15	1.55E-15	1.11E-15	1.07E-15	1.13E-15	2.13E-15
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	7.59E-16	7.25E-16	6.92E-16	7.06E-16	1.00E-15	7.22E-16	6.83E-16	7.23E-16	8.91E-16
Zr-97	1.82E-16	1.74E-16	1.67E-16	1.71E-16	2.43E-16	1.68E-16	1.65E-16	1.74E-16	8.27E-15
Niobium									
Nb-88	4.20E-15	4.02E-15	3.84E-15	3.91E-15	5.65E-15	3.95E-15	3.78E-15	4.01E-15	1.74E-14
Nb-89b[1]	1.38E-15	1.32E-15	1.27E-15	1.29E-15	1.84E-15	1.27E-15	1.25E-15	1.32E-15	1.26E-14
Nb-89a[2]	2.00E-15	1.92E-15	1.82E-15	1.84E-15	2.76E-15	1.90E-15	1.78E-15	1.90E-15	1.20E-14
Nb-90	3.99E-15	3.81E-15	3.71E-15	3.80E-15	5.16E-15	3.58E-15	3.70E-15	3.84E-15	8.73E-15
Nb-93m	1.72E-18	2.21E-18	4.95E-20	2.02E-19	1.28E-18	3.36E-19	3.28E-19	9.39E-19	9.70E-18
Nb-94	1.61E-15	1.54E-15	1.47E-15	1.50E-15	2.11E-15	1.53E-15	1.45E-15	1.53E-15	1.87E-15
Nb-95m	6.81E-17	6.85E-17	5.61E-17	5.67E-17	1.11E-16	5.75E-17	5.57E-17	6.26E-17	1.09E-16
Nb-95	7.85E-16	7.49E-16	7.16E-16	7.32E-16	1.03E-15	7.47E-16	7.08E-16	7.48E-16	9.05E-16
Nb-96	2.51E-15	2.40E-15	2.30E-15	2.35E-15	3.31E-15	2.37E-15	2.27E-15	2.39E-15	3.73E-15
Nb-97m	7.47E-16	7.14E-16	6.82E-16	6.96E-16	9.85E-16	7.11E-16	6.73E-16	7.12E-16	1.08E-15
Nb-97	6.78E-16	6.49E-16	6.18E-16	6.28E-16	9.06E-16	6.45E-16	6.07E-16	6.45E-16	5.56E-15
Nb-98	2.43E-15	2.32E-15	2.24E-15	2.29E-15	3.17E-15	2.27E-15	2.22E-15	2.33E-15	1.26E-14
Molybdenum									
Mo-90	8.36E-16	8.10E-16	7.54E-16	7.60E-16	1.30E-15	7.72E-16	7.39E-16	7.96E-16	2.20E-15
Mo-93m	2.21E-15	2.11E-15	2.04E-15	2.09E-15	2.88E-15	2.02E-15	2.03E-15	2.12E-15	2.52E-15
Mo-93	9.79E-18	1.26E-17	2.81E-19	1.15E-18	7.29E-18	1.91E-18	1.86E-18	5.34E-18	5.51E-17
Mo-99	1.55E-16	1.49E-16	1.40E-16	1.42E-16	2.21E-16	1.46E-16	1.38E-16	1.47E-16	3.76E-15
Mo-101	1.34E-15	1.29E-15	1.24E-15	1.27E-15	1.77E-15	1.23E-15	1.23E-15	1.29E-15	7.06E-15
Technetium									
Tc-93m	6.75E-16	6.46E-16	6.23E-16	6.38E-16	8.86E-16	6.02E-16	6.23E-16	6.48E-16	7.69E-16
Tc-93	1.40E-15	1.34E-15	1.30E-15	1.34E-15	1.76E-15	1.26E-15	1.30E-15	1.35E-15	1.62E-15
Tc-94m	1.87E-15	1.79E-15	1.71E-15	1.75E-15	2.48E-15	1.75E-15	1.69E-15	1.79E-15	1.07E-14
Tc-94	2.72E-15	2.60E-15	2.48E-15	2.54E-15	3.57E-15	2.58E-15	2.45E-15	2.59E-15	3.40E-15
Tc-95m	6.89E-16	6.64E-16	6.18E-16	6.29E-16	9.73E-16	6.41E-16	6.09E-16	6.53E-16	8.42E-16

[1] $T_{1/2}$ = 122 m

[2] $T_{1/2}$ = 66 m

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Technetium, cont'd									
Tc-95	8.15E-16	7.82E-16	7.33E-16	7.51E-16	1.06E-15	7.65E-16	7.27E-16	7.72E-16	9.83E-16
Tc-96m	5.27E-17	5.23E-17	4.18E-17	4.33E-17	6.53E-17	4.44E-17	4.24E-17	4.72E-17	8.27E-17
Tc-96	2.55E-15	2.44E-15	2.32E-15	2.38E-15	3.33E-15	2.41E-15	2.30E-15	2.43E-15	2.98E-15
Tc-97m	1.10E-17	1.32E-17	8.79E-19	1.65E-18	1.01E-17	3.21E-18	2.52E-18	6.18E-18	4.34E-17
Tc-97	1.19E-17	1.47E-17	4.88E-19	1.46E-18	9.49E-18	2.77E-18	2.36E-18	6.48E-18	5.57E-17
Tc-98	1.45E-15	1.39E-15	1.33E-15	1.35E-15	1.93E-15	1.38E-15	1.31E-15	1.38E-15	1.69E-15
Tc-99m	1.24E-16	1.20E-16	1.13E-16	1.10E-16	2.86E-16	1.14E-16	1.10E-16	1.21E-16	1.44E-16
Tc-99	9.74E-20	1.06E-19	5.29E-20	4.48E-20	2.38E-19	6.52E-20	5.65E-20	7.80E-20	2.43E-19
Tc-101	3.44E-16	3.33E-16	3.13E-16	3.15E-16	5.35E-16	3.21E-16	3.05E-16	3.28E-16	5.26E-15
Tc-104	1.93E-15	1.84E-15	1.78E-15	1.83E-15	2.55E-15	1.76E-15	1.77E-15	1.85E-15	1.65E-14
Ruthenium									
Ru-94	5.49E-16	5.31E-16	4.88E-16	4.97E-16	7.61E-16	5.08E-16	4.81E-16	5.18E-16	6.70E-16
Ru-97	2.43E-16	2.41E-16	2.10E-16	2.10E-16	4.13E-16	2.14E-16	2.06E-16	2.28E-16	3.22E-16
Ru-103	4.87E-16	4.68E-16	4.43E-16	4.48E-16	6.80E-16	4.63E-16	4.34E-16	4.63E-16	6.16E-16
Ru-105	8.07E-16	7.73E-16	7.36E-16	7.48E-16	1.10E-15	7.66E-16	7.23E-16	7.69E-16	4.48E-15
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	6.98E-16	6.73E-16	6.25E-16	6.36E-16	9.67E-16	6.43E-16	6.17E-16	6.60E-16	9.37E-16
Rh-99	6.23E-16	6.04E-16	5.53E-16	5.56E-16	9.52E-16	5.74E-16	5.43E-16	5.88E-16	8.42E-16
Rh-100	2.65E-15	2.53E-15	2.45E-15	2.51E-15	3.38E-15	2.39E-15	2.44E-15	2.54E-15	3.71E-15
Rh-101m	3.17E-16	3.11E-16	2.75E-16	2.78E-16	4.86E-16	2.85E-16	2.70E-16	2.96E-16	4.03E-16
Rh-101	2.71E-16	2.68E-16	2.33E-16	2.30E-16	5.27E-16	2.39E-16	2.28E-16	2.55E-16	3.56E-16
Rh-102m	5.05E-16	4.86E-16	4.51E-16	4.57E-16	6.94E-16	4.72E-16	4.44E-16	4.76E-16	2.28E-15
Rh-102	2.19E-15	2.10E-15	1.99E-15	2.03E-15	2.92E-15	2.06E-15	1.96E-15	2.08E-15	2.57E-15
Rh-103m	2.18E-18	2.54E-18	2.32E-19	3.38E-19	2.31E-18	7.86E-19	5.55E-19	1.25E-18	6.88E-18
Rh-105	7.98E-17	7.74E-17	7.26E-17	7.30E-17	1.25E-16	7.44E-17	7.07E-17	7.62E-17	1.76E-16
Rh-106m	2.93E-15	2.80E-15	2.69E-15	2.75E-15	3.88E-15	2.74E-15	2.66E-15	2.80E-15	5.20E-15
Rh-106	2.23E-16	2.14E-16	2.03E-16	2.05E-16	3.09E-16	2.11E-16	1.99E-16	2.12E-16	1.42E-14
Rh-107	3.22E-16	3.12E-16	2.93E-16	2.94E-16	4.98E-16	3.00E-16	2.85E-16	3.07E-16	4.63E-15
Palladium									
Pd-100	1.33E-16	1.37E-16	9.78E-17	8.90E-17	3.71E-16	1.05E-16	9.78E-17	1.20E-16	2.13E-16
Pd-101	3.52E-16	3.45E-16	2.94E-16	3.00E-16	4.81E-16	3.11E-16	2.93E-16	3.22E-16	5.66E-16
Pd-103	1.89E-17	2.21E-17	1.94E-18	2.94E-18	1.95E-17	6.78E-18	4.78E-18	1.09E-17	6.02E-17
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	1.58E-17	1.74E-17	5.86E-18	5.82E-18	2.69E-17	9.00E-18	7.27E-18	1.12E-17	2.87E-15
Silver									
Ag-102	3.33E-15	3.18E-15	3.06E-15	3.12E-15	4.38E-15	3.08E-15	3.03E-15	3.18E-15	1.28E-14
Ag-103	7.81E-16	7.52E-16	7.03E-16	7.12E-16	1.12E-15	7.25E-16	6.91E-16	7.41E-16	3.86E-15
Ag-104m	1.17E-15	1.12E-15	1.07E-15	1.09E-15	1.57E-15	1.09E-15	1.06E-15	1.12E-15	6.86E-15
Ag-104	2.71E-15	2.59E-15	2.47E-15	2.53E-15	3.56E-15	2.53E-15	2.45E-15	2.58E-15	3.97E-15
Ag-105	5.45E-16	5.30E-16	4.78E-16	4.83E-16	8.05E-16	4.99E-16	4.69E-16	5.11E-16	6.70E-16
Ag-106m	2.85E-15	2.73E-15	2.60E-15	2.65E-15	3.78E-15	2.66E-15	2.57E-15	2.72E-15	3.32E-15
Ag-106	7.43E-16	7.15E-16	6.70E-16	6.77E-16	1.03E-15	7.02E-16	6.57E-16	7.04E-16	6.96E-15
Ag-108m	1.68E-15	1.62E-15	1.52E-15	1.54E-15	2.30E-15	1.59E-15	1.49E-15	1.60E-15	2.00E-15
Ag-108	2.12E-17	2.05E-17	1.87E-17	1.88E-17	3.09E-17	1.97E-17	1.84E-17	1.99E-17	7.07E-15
Ag-109m	1.42E-17	1.57E-17	4.52E-18	4.53E-18	2.36E-17	7.57E-18	5.95E-18	9.71E-18	3.28E-17
Ag-110m	2.77E-15	2.65E-15	2.54E-15	2.60E-15	3.62E-15	2.61E-15	2.52E-15	2.65E-15	3.22E-15
Ag-110	4.04E-17	3.89E-17	3.62E-17	3.64E-17	5.92E-17	3.78E-17	3.55E-17	3.82E-17	1.27E-14
Ag-111	2.81E-17	2.72E-17	2.54E-17	2.54E-17	4.43E-17	2.61E-17	2.47E-17	2.67E-17	2.75E-15
Ag-112	6.60E-16	6.31E-16	6.08E-16	6.22E-16	8.65E-16	6.09E-16	6.03E-16	6.33E-16	1.38E-14
Ag-115	6.86E-16	6.58E-16	6.36E-16	6.50E-16	9.37E-16	6.19E-16	6.32E-16	6.61E-16	1.15E-14
Cadmium									
Cd-104	2.72E-16	2.67E-16	2.25E-16	2.25E-16	4.41E-16	2.42E-16	2.24E-16	2.50E-16	3.63E-16
Cd-107	4.40E-17	4.86E-17	1.38E-17	1.45E-17	6.29E-17	2.35E-17	1.84E-17	2.98E-17	1.02E-16
Cd-109	3.56E-17	4.02E-17	7.72E-18	8.29E-18	5.02E-17	1.67E-17	1.22E-17	2.25E-17	8.95E-17
Cd-113m	3.09E-19	3.24E-19	2.02E-19	1.78E-19	7.69E-19	2.30E-19	2.06E-19	2.63E-19	1.55E-16
Cd-113	8.74E-20	9.48E-20	4.74E-20	4.02E-20	2.13E-19	5.85E-20	5.06E-20	6.99E-20	2.19E-19
Cd-115m	2.45E-17	2.35E-17	2.22E-17	2.26E-17	3.40E-17	2.27E-17	2.20E-17	2.34E-17	7.00E-15
Cd-115	2.43E-16	2.34E-16	2.20E-16	2.22E-16	3.40E-16	2.30E-16	2.16E-16	2.31E-16	2.28E-15
Cd-117m	1.95E-15	1.87E-15	1.82E-15	1.87E-15	2.48E-15	1.77E-15	1.82E-15	1.88E-15	3.12E-15
Cd-117	1.07E-15	1.02E-15	9.87E-16	1.01E-15	1.42E-15	9.79E-16	9.80E-16	1.03E-15	5.15E-15

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	6.84E-16	6.62E-16	6.08E-16	6.17E-16	9.97E-16	6.25E-16	6.00E-16	6.46E-16	9.62E-16
In-110b[1]	3.11E-15	2.98E-15	2.83E-15	2.89E-15	4.08E-15	2.93E-15	2.80E-15	2.96E-15	3.64E-15
In-110a[2]	1.58E-15	1.52E-15	1.44E-15	1.46E-15	2.13E-15	1.48E-15	1.42E-15	1.51E-15	9.11E-15
In-111	4.14E-16	4.09E-16	3.59E-16	3.57E-16	7.50E-16	3.68E-16	3.52E-16	3.90E-16	5.09E-16
In-112	2.81E-16	2.71E-16	2.50E-16	2.52E-16	3.89E-16	2.63E-16	2.46E-16	2.64E-16	2.29E-15
In-113m	2.69E-16	2.61E-16	2.39E-16	2.40E-16	3.97E-16	2.50E-16	2.34E-16	2.54E-16	3.29E-16
In-114m	1.00E-16	9.89E-17	8.22E-17	8.27E-17	1.54E-16	8.83E-17	8.17E-17	9.15E-17	1.31E-16
In-114	2.87E-18	2.77E-18	2.53E-18	2.59E-18	3.77E-18	2.55E-18	2.54E-18	2.70E-18	1.86E-17
In-115m	1.69E-16	1.66E-16	1.46E-16	1.46E-16	2.59E-16	1.53E-16	1.43E-16	1.58E-16	2.73E-16
In-115	2.16E-19	2.28E-19	1.35E-19	1.17E-19	5.38E-19	1.56E-19	1.39E-19	1.81E-19	2.07E-17
In-116m	2.41E-15	2.30E-15	2.23E-15	2.29E-15	3.08E-15	2.21E-15	2.22E-15	2.32E-15	4.69E-15
In-117m	9.60E-17	9.44E-17	8.23E-17	8.20E-17	1.65E-16	8.59E-17	8.08E-17	8.96E-17	4.16E-15
In-117	7.13E-16	6.86E-16	6.48E-16	6.51E-16	1.08E-15	6.73E-16	6.32E-16	6.79E-16	1.65E-15
In-119m	2.01E-17	2.05E-17	1.35E-17	1.34E-17	3.22E-17	1.55E-17	1.40E-17	1.69E-17	1.15E-14
In-119	7.92E-16	7.58E-16	7.18E-16	7.34E-16	1.04E-15	7.50E-16	7.10E-16	7.53E-16	7.92E-15
Tin									
Sn-110	3.15E-16	3.10E-16	2.69E-16	2.69E-16	5.06E-16	2.80E-16	2.64E-16	2.93E-16	3.89E-16
Sn-111	5.22E-16	5.03E-16	4.66E-16	4.73E-16	7.08E-16	4.80E-16	4.61E-16	4.92E-16	3.22E-15
Sn-113	3.13E-17	3.45E-17	1.00E-17	9.75E-18	4.74E-17	1.75E-17	1.32E-17	2.13E-17	6.47E-17
Sn-117m	1.64E-16	1.64E-16	1.34E-16	1.30E-16	3.40E-16	1.41E-16	1.32E-16	1.51E-16	2.10E-16
Sn-119m	1.64E-17	1.84E-17	3.74E-18	3.42E-18	2.51E-17	8.27E-18	5.70E-18	1.04E-17	3.57E-17
Sn-121m	7.16E-18	7.90E-18	2.32E-18	1.83E-18	1.35E-17	4.13E-18	2.96E-18	4.89E-18	1.34E-17
Sn-121	1.29E-19	1.38E-19	7.44E-20	6.38E-20	3.18E-19	8.92E-20	7.81E-20	1.05E-19	3.01E-19
Sn-123m	1.40E-16	1.37E-16	1.26E-16	1.24E-16	2.99E-16	1.28E-16	1.23E-16	1.35E-16	4.74E-15
Sn-123	8.85E-18	8.55E-18	7.86E-18	7.94E-18	1.32E-17	8.07E-18	7.79E-18	8.37E-18	5.71E-15
Sn-125	3.14E-16	3.00E-16	2.89E-16	2.96E-16	4.08E-16	2.91E-16	2.87E-16	3.01E-16	9.21E-15
Sn-126	5.99E-17	6.08E-17	4.57E-17	4.06E-17	1.73E-16	4.96E-17	4.52E-17	5.47E-17	8.07E-17
Sn-127	1.88E-15	1.80E-15	1.73E-15	1.78E-15	2.45E-15	1.74E-15	1.72E-15	1.80E-15	6.48E-15
Sn-128	7.10E-16	6.93E-16	6.03E-16	6.01E-16	1.09E-15	6.46E-16	5.96E-16	6.57E-16	1.14E-15
Antimony									
Sb-115	9.49E-16	9.13E-16	8.52E-16	8.60E-16	1.32E-15	8.93E-16	8.36E-16	8.97E-16	3.88E-15
Sb-116m	3.15E-15	3.02E-15	2.87E-15	2.94E-15	4.21E-15	2.92E-15	2.85E-15	3.01E-15	4.59E-15
Sb-116	2.12E-15	2.03E-15	1.95E-15	2.00E-15	2.75E-15	1.95E-15	1.94E-15	2.03E-15	7.34E-15
Sb-117	1.94E-16	1.93E-16	1.57E-16	1.54E-16	3.78E-16	1.67E-16	1.55E-16	1.77E-16	2.53E-16
Sb-118m	2.58E-15	2.48E-15	2.34E-15	2.40E-15	3.43E-15	2.37E-15	2.33E-15	2.46E-15	2.99E-15
Sb-119	3.39E-17	3.80E-17	8.10E-18	7.22E-18	5.33E-17	1.74E-17	1.20E-17	2.17E-17	7.20E-17
Sb-120b[3]	2.46E-15	2.36E-15	2.24E-15	2.29E-15	3.40E-15	2.28E-15	2.23E-15	2.35E-15	2.84E-15
Sb-120a[4]	4.75E-16	4.59E-16	4.22E-16	4.25E-16	6.62E-16	4.44E-16	4.15E-16	4.47E-16	4.27E-15
Sb-122	4.59E-16	4.40E-16	4.18E-16	4.23E-16	6.26E-16	4.36E-16	4.10E-16	4.36E-16	6.72E-15
Sb-124n[5]	1.12E-19	1.26E-19	2.48E-20	2.31E-20	1.70E-19	5.63E-20	3.86E-20	7.12E-20	2.45E-19
Sb-124m[6]	3.64E-16	3.49E-16	3.32E-16	3.37E-16	4.95E-16	3.47E-16	3.25E-16	3.47E-16	1.19E-15
Sb-124	1.78E-15	1.70E-15	1.65E-15	1.69E-15	2.30E-15	1.63E-15	1.64E-15	1.71E-15	5.20E-15
Sb-125	4.53E-16	4.38E-16	4.00E-16	4.02E-16	6.50E-16	4.22E-16	3.93E-16	4.25E-16	5.97E-16
Sb-126m	1.60E-15	1.53E-15	1.46E-15	1.48E-15	2.18E-15	1.52E-15	1.43E-15	1.52E-15	8.61E-15
Sb-126	2.92E-15	2.79E-15	2.66E-15	2.71E-15	3.92E-15	2.77E-15	2.62E-15	2.78E-15	5.33E-15
Sb-127	7.10E-16	6.81E-16	6.47E-16	6.56E-16	9.73E-16	6.74E-16	6.35E-16	6.76E-16	2.85E-15
Sb-128b[7]	3.17E-15	3.03E-15	2.89E-15	2.95E-15	4.26E-15	3.00E-15	2.85E-15	3.02E-15	7.48E-15
Sb-128a[8]	2.04E-15	1.95E-15	1.86E-15	1.90E-15	2.76E-15	1.93E-15	1.83E-15	1.94E-15	1.28E-14
Sb-129	1.44E-15	1.37E-15	1.32E-15	1.35E-15	1.87E-15	1.34E-15	1.31E-15	1.38E-15	5.10E-15
Sb-130	3.30E-15	3.16E-15	3.02E-15	3.09E-15	4.47E-15	3.10E-15	2.99E-15	3.16E-15	1.11E-14
Sb-131	1.83E-15	1.75E-15	1.69E-15	1.74E-15	2.37E-15	1.69E-15	1.68E-15	1.76E-15	7.51E-15
Tellurium									
Te-116	8.71E-17	9.08E-17	5.19E-17	4.75E-17	1.84E-16	6.47E-17	5.49E-17	7.13E-17	1.35E-16
Te-121m	2.24E-16	2.21E-16	1.92E-16	1.91E-16	3.93E-16	1.98E-16	1.89E-16	2.10E-16	2.71E-16

[1] $T_{½}$ = 4.9 h
[2] $T_{½}$ = 69.1 m
[3] $T_{½}$ = 5.76 d
[4] $T_{½}$ = 15.89 m
[5] $T_{½}$ = 20.2 m
[6] $T_{½}$ = 93 s
[7] $T_{½}$ = 9.01 h
[8] $T_{½}$ = 10.4 m

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	6.08E-16	5.88E-16	5.35E-16	5.40E-16	8.43E-16	5.67E-16	5.27E-16	5.70E-16	7.49E-16
Te-123m	1.53E-16	1.51E-16	1.28E-16	1.24E-16	3.23E-16	1.34E-16	1.26E-16	1.43E-16	1.87E-16
Te-123	2.94E-17	3.27E-17	8.44E-18	6.87E-18	5.13E-17	1.63E-17	1.14E-17	1.95E-17	5.71E-17
Te-125m	5.24E-17	5.76E-17	1.78E-17	1.36E-17	1.01E-16	3.10E-17	2.22E-17	3.61E-17	9.45E-17
Te-127m	1.63E-17	1.79E-17	5.57E-18	4.34E-18	3.13E-17	9.66E-18	6.95E-18	1.13E-17	5.20E-17
Te-127	5.48E-18	5.33E-18	4.88E-18	4.87E-18	8.57E-18	5.09E-18	4.77E-18	5.18E-18	5.40E-16
Te-129m	4.33E-17	4.32E-17	3.22E-17	3.18E-17	6.49E-17	3.66E-17	3.27E-17	3.78E-17	2.27E-15
Te-129	6.51E-17	6.36E-17	5.52E-17	5.52E-17	9.63E-17	5.90E-17	5.46E-17	6.01E-17	5.74E-15
Te-131m	1.44E-15	1.38E-15	1.31E-15	1.34E-15	1.94E-15	1.34E-15	1.30E-15	1.37E-15	2.20E-15
Te-131	4.29E-16	4.13E-16	3.90E-16	3.92E-16	6.74E-16	4.01E-16	3.82E-16	4.10E-16	8.36E-15
Te-132	2.45E-16	2.43E-16	2.06E-16	2.01E-16	4.58E-16	2.15E-16	2.03E-16	2.28E-16	2.99E-16
Te-133m	2.32E-15	2.22E-15	2.13E-15	2.18E-15	3.09E-15	2.17E-15	2.11E-15	2.22E-15	1.01E-14
Te-133	9.34E-16	8.96E-16	8.57E-16	8.73E-16	1.29E-15	8.66E-16	8.46E-16	8.94E-16	1.01E-14
Te-134	9.12E-16	8.78E-16	8.24E-16	8.32E-16	1.35E-15	8.57E-16	8.08E-16	8.67E-16	2.16E-15
Iodine									
I-120m	5.24E-15	5.01E-15	4.82E-15	4.93E-15	6.87E-15	4.85E-15	4.78E-15	5.02E-15	1.81E-14
I-120	2.67E-15	2.55E-15	2.46E-15	2.51E-15	3.52E-15	2.46E-15	2.44E-15	2.56E-15	1.58E-14
I-121	4.36E-16	4.26E-16	3.81E-16	3.80E-16	6.96E-16	3.97E-16	3.73E-16	4.09E-16	1.16E-15
I-122	9.90E-16	9.51E-16	8.97E-16	9.06E-16	1.37E-15	9.36E-16	8.80E-16	9.40E-16	1.21E-14
I-123	1.82E-16	1.82E-16	1.46E-16	1.41E-16	3.69E-16	1.56E-16	1.44E-16	1.66E-16	2.33E-16
I-124	1.11E-15	1.06E-15	1.00E-15	1.02E-15	1.48E-15	1.02E-15	9.93E-16	1.05E-15	3.50E-15
I-125	6.22E-17	6.85E-17	2.08E-17	1.59E-17	1.19E-16	3.66E-17	2.61E-17	4.27E-17	1.13E-16
I-126	4.75E-16	4.58E-16	4.23E-16	4.27E-16	6.65E-16	4.45E-16	4.15E-16	4.47E-16	1.61E-15
I-128	9.28E-17	8.96E-17	8.30E-17	8.34E-17	1.35E-16	8.70E-17	8.14E-17	8.77E-17	8.78E-15
I-129	3.55E-17	3.84E-17	1.48E-17	1.07E-17	7.91E-17	2.28E-17	1.69E-17	2.58E-17	5.80E-17
I-130	2.20E-15	2.11E-15	2.01E-15	2.04E-15	2.96E-15	2.09E-15	1.97E-15	2.10E-15	4.29E-15
I-131	3.94E-16	3.81E-16	3.58E-16	3.60E-16	5.90E-16	3.71E-16	3.49E-16	3.76E-16	6.43E-16
I-132m	3.35E-16	3.23E-16	2.98E-16	3.01E-16	4.70E-16	3.13E-16	2.93E-16	3.15E-16	1.06E-15
I-132	2.32E-15	2.22E-15	2.12E-15	2.17E-15	3.06E-15	2.19E-15	2.10E-15	2.21E-15	7.54E-15
I-133	6.27E-16	6.01E-16	5.72E-16	5.80E-16	8.55E-16	5.94E-16	5.61E-16	5.97E-16	4.55E-15
I-134	2.64E-15	2.52E-15	2.42E-15	2.48E-15	3.45E-15	2.48E-15	2.40E-15	2.53E-15	9.85E-15
I-135	1.53E-15	1.46E-15	1.42E-15	1.46E-15	1.95E-15	1.40E-15	1.42E-15	1.47E-15	4.83E-15
Xenon									
Xe-120	4.59E-16	4.49E-16	3.86E-16	3.85E-16	7.11E-16	4.13E-16	3.82E-16	4.23E-16	6.44E-16
Xe-121	1.76E-15	1.69E-15	1.61E-15	1.64E-15	2.39E-15	1.60E-15	1.60E-15	1.69E-15	7.79E-15
Xe-122	8.06E-17	8.24E-17	5.46E-17	5.14E-17	1.45E-16	6.42E-17	5.60E-17	6.83E-17	1.12E-16
Xe-123	6.44E-16	6.23E-16	5.74E-16	5.78E-16	9.67E-16	5.88E-16	5.65E-16	6.09E-16	2.51E-15
Xe-125	2.87E-16	2.85E-16	2.38E-16	2.33E-16	5.13E-16	2.52E-16	2.35E-16	2.65E-16	3.56E-16
Xe-127	2.94E-16	2.91E-16	2.48E-16	2.43E-16	5.40E-16	2.59E-16	2.43E-16	2.73E-16	3.58E-16
Xe-129m	7.02E-17	7.52E-17	3.32E-17	2.62E-17	1.51E-16	4.72E-17	3.67E-17	5.29E-17	1.11E-16
Xe-131m	2.76E-17	2.97E-17	1.25E-17	9.79E-18	5.88E-17	1.83E-17	1.40E-17	2.06E-17	4.44E-17
Xe-133m	4.89E-17	5.06E-17	3.15E-17	2.87E-17	9.51E-17	3.76E-17	3.24E-17	4.07E-17	6.93E-17
Xe-133	5.20E-17	5.34E-17	3.71E-17	3.12E-17	1.51E-16	4.19E-17	3.70E-17	4.61E-17	6.93E-17
Xe-135m	4.48E-16	4.30E-16	4.04E-16	4.08E-16	6.23E-16	4.24E-16	3.96E-16	4.24E-16	1.41E-15
Xe-135	2.53E-16	2.47E-16	2.30E-16	2.30E-16	4.23E-16	2.33E-16	2.24E-16	2.42E-16	2.09E-15
Xe-138	1.07E-15	1.02E-15	9.97E-16	1.02E-15	1.41E-15	9.55E-16	9.94E-16	1.03E-15	7.65E-15
Cesium									
Cs-125	7.09E-16	6.83E-16	6.34E-16	6.38E-16	1.01E-15	6.65E-16	6.23E-16	6.69E-16	4.88E-15
Cs-126	1.14E-15	1.10E-15	1.04E-15	1.05E-15	1.61E-15	1.08E-15	1.02E-15	1.09E-15	1.48E-14
Cs-127	4.43E-16	4.31E-16	3.86E-16	3.85E-16	6.77E-16	4.07E-16	3.79E-16	4.14E-16	6.13E-16
Cs-128	9.42E-16	9.06E-16	8.53E-16	8.60E-16	1.32E-15	8.91E-16	8.36E-16	8.94E-16	1.02E-14
Cs-129	3.05E-16	3.00E-16	2.53E-16	2.49E-16	4.84E-16	2.73E-16	2.50E-16	2.79E-16	3.75E-16
Cs-130	5.43E-16	5.23E-16	4.85E-16	4.88E-16	7.66E-16	5.09E-16	4.76E-16	5.12E-16	5.43E-15
Cs-131	3.34E-17	3.63E-17	1.31E-17	9.52E-18	7.10E-17	2.10E-17	1.54E-17	2.39E-17	5.56E-17
Cs-132	7.37E-16	7.09E-16	6.54E-16	6.62E-16	1.01E-15	6.90E-16	6.44E-16	6.93E-16	9.10E-16
Cs-134m	3.01E-17	3.08E-17	2.06E-17	1.83E-17	7.16E-17	2.40E-17	2.08E-17	2.59E-17	4.14E-17
Cs-134	1.60E-15	1.53E-15	1.46E-15	1.48E-15	2.12E-15	1.52E-15	1.44E-15	1.52E-15	2.17E-15
Cs-135m	1.62E-15	1.55E-15	1.48E-15	1.51E-15	2.12E-15	1.54E-15	1.46E-15	1.54E-15	2.37E-15
Cs-135	4.38E-20	4.85E-20	2.02E-20	1.69E-20	1.00E-19	2.68E-20	2.26E-20	3.33E-20	1.27E-19
Cs-136	2.18E-15	2.09E-15	2.00E-15	2.04E-15	2.95E-15	2.05E-15	1.98E-15	2.09E-15	2.54E-15

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	3.31E-19	3.47E-19	2.22E-19	1.97E-19	8.15E-19	2.51E-19	2.25E-19	2.85E-19	2.75E-16
Cs-138	2.27E-15	2.17E-15	2.11E-15	2.17E-15	2.90E-15	2.06E-15	2.11E-15	2.19E-15	1.52E-14
Barium									
Ba-126	1.78E-16	1.76E-16	1.45E-16	1.42E-16	2.95E-16	1.57E-16	1.44E-16	1.62E-16	2.66E-16
Ba-128	8.77E-17	8.91E-17	6.29E-17	5.88E-17	1.65E-16	7.14E-17	6.34E-17	7.60E-17	1.17E-16
Ba-131m	8.09E-17	8.07E-17	6.46E-17	5.84E-17	2.16E-16	6.99E-17	6.33E-17	7.46E-17	9.99E-17
Ba-131	4.83E-16	4.71E-16	4.19E-16	4.15E-16	7.84E-16	4.43E-16	4.12E-16	4.52E-16	5.89E-16
Ba-133m	7.44E-17	7.49E-17	5.64E-17	5.32E-17	1.40E-16	6.23E-17	5.62E-17	6.59E-17	9.65E-17
Ba-133	4.28E-16	4.21E-16	3.63E-16	3.55E-16	7.50E-16	3.84E-16	3.57E-16	3.97E-16	5.13E-16
Ba-135m	6.82E-17	6.89E-17	5.06E-17	4.73E-17	1.31E-16	5.65E-17	5.06E-17	6.00E-17	8.86E-17
Ba-137m	6.17E-16	5.90E-16	5.61E-16	5.70E-16	8.27E-16	5.87E-16	5.51E-16	5.86E-16	1.65E-15
Ba-139	4.79E-17	4.69E-17	4.27E-17	4.17E-17	9.73E-17	4.33E-17	4.17E-17	4.59E-17	1.03E-14
Ba-140	1.91E-16	1.85E-16	1.70E-16	1.71E-16	2.81E-16	1.79E-16	1.67E-16	1.80E-16	1.95E-15
Ba-141	8.52E-16	8.20E-16	7.80E-16	7.91E-16	1.23E-15	7.88E-16	7.68E-16	8.15E-16	1.06E-14
Ba-142	1.05E-15	1.01E-15	9.61E-16	9.80E-16	1.44E-15	9.79E-16	9.52E-16	1.01E-15	4.80E-15
Lanthanum									
La-131	7.01E-16	6.78E-16	6.23E-16	6.22E-16	1.07E-15	6.52E-16	6.11E-16	6.61E-16	2.96E-15
La-132	1.99E-15	1.91E-15	1.83E-15	1.86E-15	2.67E-15	1.84E-15	1.81E-15	1.90E-15	7.53E-15
La-134	7.31E-16	7.03E-16	6.60E-16	6.65E-16	1.03E-15	6.89E-16	6.47E-16	6.93E-16	8.96E-15
La-135	4.67E-17	4.89E-17	2.62E-17	2.15E-17	1.01E-16	3.42E-17	2.77E-17	3.71E-17	6.89E-17
La-137	3.43E-17	3.68E-17	1.57E-17	1.11E-17	8.17E-17	2.29E-17	1.74E-17	2.57E-17	5.34E-17
La-138	1.21E-15	1.16E-15	1.11E-15	1.14E-15	1.56E-15	1.10E-15	1.11E-15	1.16E-15	1.39E-15
La-140	2.24E-15	2.14E-15	2.08E-15	2.13E-15	2.89E-15	2.03E-15	2.07E-15	2.16E-15	8.24E-15
La-141	4.74E-17	4.54E-17	4.35E-17	4.44E-17	6.43E-17	4.27E-17	4.33E-17	4.54E-17	1.08E-14
La-142	2.54E-15	2.42E-15	2.37E-15	2.44E-15	3.19E-15	2.27E-15	2.38E-15	2.46E-15	1.17E-14
La-143	1.01E-16	9.70E-17	9.32E-17	9.52E-17	1.36E-16	9.17E-17	9.28E-17	9.71E-17	1.34E-14
Cerium									
Ce-134	3.64E-17	3.88E-17	1.79E-17	1.26E-17	9.16E-17	2.49E-17	1.93E-17	2.79E-17	5.50E-17
Ce-135	1.84E-15	1.76E-15	1.67E-15	1.69E-15	2.58E-15	1.74E-15	1.63E-15	1.75E-15	2.73E-15
Ce-137m	6.04E-17	6.11E-17	4.46E-17	4.05E-17	1.26E-16	4.98E-17	4.44E-17	5.31E-17	7.82E-17
Ce-137	4.57E-17	4.77E-17	2.61E-17	2.07E-17	1.05E-16	3.35E-17	2.73E-17	3.65E-17	6.64E-17
Ce-139	1.69E-16	1.68E-16	1.38E-16	1.31E-16	3.70E-16	1.46E-16	1.36E-16	1.56E-16	2.06E-16
Ce-141	7.71E-17	7.56E-17	6.80E-17	6.48E-17	1.80E-16	6.98E-17	6.60E-17	7.38E-17	1.32E-16
Ce-143	2.98E-16	2.90E-16	2.60E-16	2.56E-16	4.99E-16	2.72E-16	2.54E-16	2.79E-16	3.99E-15
Ce-144	2.17E-17	2.15E-17	1.80E-17	1.64E-17	5.64E-17	1.90E-17	1.75E-17	2.03E-17	2.61E-17
Praseodymium									
Pr-136	2.12E-15	2.03E-15	1.94E-15	1.97E-15	2.86E-15	1.98E-15	1.91E-15	2.02E-15	1.02E-14
Pr-137	5.23E-16	5.05E-16	4.66E-16	4.67E-16	7.57E-16	4.88E-16	4.58E-16	4.93E-16	2.95E-15
Pr-138m	2.52E-15	2.41E-15	2.29E-15	2.34E-15	3.41E-15	2.37E-15	2.27E-15	2.40E-15	5.02E-15
Pr-138	8.56E-16	8.22E-16	7.75E-16	7.82E-16	1.20E-15	8.10E-16	7.60E-16	8.13E-16	1.23E-14
Pr-139	1.34E-16	1.32E-16	1.09E-16	1.05E-16	2.29E-16	1.18E-16	1.08E-16	1.22E-16	5.53E-16
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	6.00E-17	5.75E-17	5.56E-17	5.70E-17	7.89E-17	5.33E-17	5.56E-17	5.78E-17	9.15E-15
Pr-143	7.93E-19	8.16E-19	5.75E-19	5.23E-19	1.91E-18	6.31E-19	5.75E-19	7.01E-19	2.00E-15
Pr-144m	1.62E-17	1.69E-17	9.29E-18	6.79E-18	4.36E-17	1.18E-17	9.57E-18	1.30E-17	2.67E-17
Pr-144	3.96E-17	3.81E-17	3.61E-17	3.66E-17	5.65E-17	3.56E-17	3.58E-17	3.78E-17	1.27E-14
Pr-145	1.65E-17	1.60E-17	1.47E-17	1.47E-17	2.52E-17	1.53E-17	1.45E-17	1.56E-17	7.90E-15
Pr-147	8.84E-16	8.51E-16	7.97E-16	8.01E-16	1.31E-15	8.18E-16	7.83E-16	8.39E-16	9.59E-15
Neodymium									
Nd-136	3.13E-16	3.07E-16	2.64E-16	2.53E-16	5.93E-16	2.82E-16	2.59E-16	2.90E-16	6.17E-16
Nd-138	5.30E-17	5.46E-17	3.45E-17	2.81E-17	1.31E-16	4.10E-17	3.48E-17	4.45E-17	7.17E-17
Nd-139m	1.60E-15	1.53E-15	1.44E-15	1.47E-15	2.23E-15	1.49E-15	1.43E-15	1.52E-15	2.40E-15
Nd-139	4.25E-16	4.10E-16	3.77E-16	3.77E-16	6.27E-16	3.96E-16	3.70E-16	4.00E-16	2.87E-15
Nd-141m	7.80E-16	7.45E-16	7.10E-16	7.25E-16	1.03E-15	7.41E-16	7.01E-16	7.42E-16	1.90E-15
Nd-141	8.54E-17	8.53E-17	6.46E-17	5.91E-17	1.69E-16	7.17E-17	6.44E-17	7.55E-17	1.58E-16
Nd-147	1.48E-16	1.45E-16	1.28E-16	1.23E-16	2.90E-16	1.36E-16	1.25E-16	1.39E-16	1.10E-15
Nd-149	3.96E-16	3.84E-16	3.56E-16	3.53E-16	6.76E-16	3.67E-16	3.47E-16	3.77E-16	5.04E-15
Nd-151	9.22E-16	8.84E-16	8.42E-16	8.53E-16	1.36E-15	8.57E-16	8.31E-16	8.82E-16	7.87E-15
Promethium									
Pm-141	7.67E-16	7.36E-16	6.95E-16	7.01E-16	1.08E-15	7.17E-16	6.83E-16	7.28E-16	7.77E-15
Pm-142	9.11E-16	8.75E-16	8.28E-16	8.35E-16	1.28E-15	8.61E-16	8.12E-16	8.66E-16	1.35E-14
Pm-143	3.32E-16	3.21E-16	2.90E-16	2.89E-16	4.99E-16	3.07E-16	2.85E-16	3.10E-16	4.04E-16

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Promethium, cont'd									
Pm-144	1.62E-15	1.56E-15	1.47E-15	1.48E-15	2.24E-15	1.54E-15	1.44E-15	1.54E-15	1.96E-15
Pm-145	3.96E-17	4.13E-17	2.38E-17	1.70E-17	1.17E-16	2.92E-17	2.41E-17	3.26E-17	5.49E-17
Pm-146	7.82E-16	7.51E-16	7.05E-16	7.11E-16	1.10E-15	7.38E-16	6.91E-16	7.41E-16	1.25E-15
Pm-147	4.37E-20	4.79E-20	2.20E-20	1.86E-20	1.02E-19	2.80E-20	2.40E-20	3.41E-20	1.20E-19
Pm-148m	2.06E-15	1.97E-15	1.88E-15	1.91E-15	2.80E-15	1.95E-15	1.84E-15	1.96E-15	2.62E-15
Pm-148	5.71E-16	5.46E-16	5.27E-16	5.40E-16	7.42E-16	5.26E-16	5.24E-16	5.48E-16	8.36E-15
Pm-149	1.19E-17	1.16E-17	1.07E-17	1.07E-17	1.95E-17	1.10E-17	1.04E-17	1.13E-17	2.97E-15
Pm-150	1.41E-15	1.35E-15	1.30E-15	1.33E-15	1.88E-15	1.30E-15	1.29E-15	1.36E-15	1.05E-14
Pm-151	3.31E-16	3.20E-16	2.97E-16	2.96E-16	5.46E-16	3.08E-16	2.90E-16	3.15E-16	2.07E-15
Samarium									
Sm-141m	2.00E-15	1.92E-15	1.83E-15	1.85E-15	2.80E-15	1.86E-15	1.80E-15	1.91E-15	6.48E-15
Sm-141	1.43E-15	1.37E-15	1.30E-15	1.32E-15	1.98E-15	1.33E-15	1.28E-15	1.36E-15	8.93E-15
Sm-142	1.05E-16	1.03E-16	8.41E-17	7.80E-17	2.07E-16	9.15E-17	8.29E-17	9.49E-17	3.93E-16
Sm-145	8.10E-17	8.39E-17	5.18E-17	3.72E-17	2.52E-16	6.12E-17	5.17E-17	6.84E-17	1.09E-16
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	8.66E-21	1.00E-20	1.01E-21	1.39E-21	9.63E-21	3.33E-21	2.30E-21	5.03E-21	2.53E-20
Sm-153	6.71E-17	6.72E-17	5.37E-17	4.51E-17	2.06E-16	5.73E-17	5.19E-17	6.22E-17	7.12E-16
Sm-155	1.05E-16	1.02E-16	9.40E-17	8.74E-17	2.81E-16	9.61E-17	9.06E-17	1.02E-16	6.24E-15
Sm-156	1.22E-16	1.20E-16	1.08E-16	1.04E-16	2.67E-16	1.10E-16	1.05E-16	1.17E-16	4.31E-16
Europium									
Eu-145	1.44E-15	1.38E-15	1.32E-15	1.35E-15	1.94E-15	1.33E-15	1.31E-15	1.38E-15	1.87E-15
Eu-146	2.53E-15	2.42E-15	2.31E-15	2.35E-15	3.40E-15	2.37E-15	2.28E-15	2.42E-15	3.34E-15
Eu-147	5.11E-16	4.94E-16	4.54E-16	4.51E-16	8.30E-16	4.71E-16	4.46E-16	4.83E-16	6.17E-16
Eu-148	2.23E-15	2.13E-15	2.03E-15	2.05E-15	3.05E-15	2.09E-15	1.99E-15	2.12E-15	2.67E-15
Eu-149	7.19E-17	7.23E-17	5.45E-17	4.71E-17	1.76E-16	5.99E-17	5.35E-17	6.41E-17	9.07E-17
Eu-150b[1]	1.54E-15	1.48E-15	1.39E-15	1.41E-15	2.23E-15	1.44E-15	1.37E-15	1.46E-15	2.00E-15
Eu-150a[2]	4.93E-17	4.78E-17	4.37E-17	4.34E-17	7.83E-17	4.52E-17	4.28E-17	4.65E-17	2.40E-15
Eu-152m	3.01E-16	2.89E-16	2.72E-16	2.75E-16	4.31E-16	2.82E-16	2.69E-16	2.86E-16	6.11E-15
Eu-152	1.16E-15	1.11E-15	1.05E-15	1.07E-15	1.63E-15	1.07E-15	1.04E-15	1.10E-15	1.75E-15
Eu-154	1.24E-15	1.18E-15	1.14E-15	1.16E-15	1.69E-15	1.15E-15	1.13E-15	1.19E-15	2.91E-15
Eu-155	6.09E-17	6.01E-17	5.34E-17	4.71E-17	1.90E-16	5.48E-17	5.12E-17	5.90E-17	7.04E-17
Eu-156	1.28E-15	1.23E-15	1.19E-15	1.22E-15	1.66E-15	1.17E-15	1.19E-15	1.23E-15	5.05E-15
Eu-157	2.76E-16	2.69E-16	2.43E-16	2.35E-16	5.09E-16	2.54E-16	2.37E-16	2.61E-16	3.35E-15
Eu-158	1.06E-15	1.01E-15	9.69E-16	9.91E-16	1.41E-15	9.82E-16	9.63E-16	1.01E-15	1.10E-14
Gadolinium									
Gd-145	2.16E-15	2.07E-15	2.01E-15	2.06E-15	2.82E-15	1.95E-15	2.00E-15	2.08E-15	8.38E-15
Gd-146	2.63E-16	2.61E-16	2.18E-16	1.93E-16	7.28E-16	2.29E-16	2.11E-16	2.46E-16	3.14E-16
Gd-147	1.36E-15	1.31E-15	1.24E-15	1.25E-15	1.98E-15	1.27E-15	1.21E-15	1.30E-15	1.62E-15
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	4.36E-16	4.24E-16	3.86E-16	3.78E-16	7.77E-16	4.01E-16	3.76E-16	4.12E-16	5.19E-16
Gd-151	7.10E-17	7.17E-17	5.39E-17	4.54E-17	1.93E-16	5.85E-17	5.26E-17	6.38E-17	8.96E-17
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	1.15E-16	1.16E-16	9.02E-17	7.43E-17	3.60E-16	9.70E-17	8.72E-17	1.06E-16	1.41E-16
Gd-159	5.34E-17	5.23E-17	4.65E-17	4.43E-17	1.05E-16	4.85E-17	4.52E-17	5.02E-17	1.84E-15
Terbium									
Tb-147	1.61E-15	1.54E-15	1.47E-15	1.50E-15	2.22E-15	1.51E-15	1.45E-15	1.54E-15	7.55E-15
Tb-149	1.59E-15	1.53E-15	1.46E-15	1.49E-15	2.19E-15	1.46E-15	1.45E-15	1.53E-15	3.65E-15
Tb-150	1.69E-15	1.62E-15	1.55E-15	1.57E-15	2.30E-15	1.58E-15	1.53E-15	1.62E-15	7.52E-15
Tb-151	9.19E-16	8.88E-16	8.26E-16	8.22E-16	1.47E-15	8.54E-16	8.07E-16	8.73E-16	1.13E-15
Tb-153	2.39E-16	2.35E-16	2.06E-16	1.93E-16	5.21E-16	2.13E-16	2.00E-16	2.25E-16	2.88E-16
Tb-154	2.21E-15	2.11E-15	2.05E-15	2.10E-15	2.94E-15	1.98E-15	2.05E-15	2.13E-15	3.00E-15
Tb-155	1.47E-16	1.46E-16	1.23E-16	1.09E-16	3.99E-16	1.29E-16	1.19E-16	1.38E-16	1.77E-16
Tb-156m[3]	2.83E-17	2.85E-17	2.21E-17	1.64E-17	1.03E-16	2.32E-17	2.10E-17	2.61E-17	3.42E-17
Tb-156n[4]	4.02E-18	4.07E-18	3.10E-18	2.41E-18	1.37E-17	3.32E-18	2.99E-18	3.68E-18	4.95E-18
Tb-156	1.82E-15	1.75E-15	1.67E-15	1.69E-15	2.59E-15	1.68E-15	1.65E-15	1.74E-15	2.11E-15
Tb-157	3.05E-18	3.13E-18	2.12E-18	1.52E-18	1.03E-17	2.38E-18	2.07E-18	2.67E-18	3.93E-18
Tb-158	8.11E-16	7.77E-16	7.33E-16	7.40E-16	1.18E-15	7.57E-16	7.25E-16	7.72E-16	1.17E-15

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	1.13E-15	1.08E-15	1.03E-15	1.06E-15	1.54E-15	1.05E-15	1.02E-15	1.08E-15	1.88E-15
Tb-161	3.97E-17	4.10E-17	2.72E-17	2.15E-17	1.24E-16	3.06E-17	2.70E-17	3.47E-17	8.88E-17
Dysprosium									
Dy-155	5.88E-16	5.68E-16	5.30E-16	5.28E-16	9.59E-16	5.37E-16	5.20E-16	5.60E-16	7.27E-16
Dy-157	3.71E-16	3.62E-16	3.30E-16	3.22E-16	6.62E-16	3.40E-16	3.20E-16	3.51E-16	4.29E-16
Dy-159	5.22E-17	5.33E-17	3.78E-17	2.74E-17	1.81E-16	4.14E-17	3.65E-17	4.65E-17	6.59E-17
Dy-165	2.85E-17	2.77E-17	2.50E-17	2.39E-17	5.81E-17	2.60E-17	2.43E-17	2.69E-17	4.41E-15
Dy-166	4.27E-17	4.28E-17	3.49E-17	2.83E-17	1.41E-16	3.64E-17	3.35E-17	4.01E-17	5.18E-17
Holmium									
Ho-155	4.03E-16	3.90E-16	3.60E-16	3.55E-16	6.77E-16	3.75E-16	3.51E-16	3.82E-16	2.89E-15
Ho-157	5.10E-16	4.96E-16	4.52E-16	4.40E-16	9.39E-16	4.67E-16	4.40E-16	4.83E-16	8.95E-16
Ho-159	3.77E-16	3.69E-16	3.31E-16	3.12E-16	8.43E-16	3.40E-16	3.21E-16	3.58E-16	4.40E-16
Ho-161	7.05E-17	7.25E-17	4.85E-17	3.72E-17	2.24E-16	5.45E-17	4.78E-17	6.15E-17	9.59E-17
Ho-162m	5.78E-16	5.57E-16	5.22E-16	5.20E-16	9.29E-16	5.29E-16	5.13E-16	5.51E-16	6.65E-16
Ho-162	1.73E-16	1.69E-16	1.51E-16	1.43E-16	3.50E-16	1.55E-16	1.47E-16	1.63E-16	4.19E-16
Ho-164m	5.11E-17	5.20E-17	3.83E-17	2.83E-17	1.80E-16	4.12E-17	3.69E-17	4.63E-17	6.35E-17
Ho-164	3.32E-17	3.37E-17	2.54E-17	1.91E-17	1.16E-16	2.71E-17	2.44E-17	3.03E-17	8.46E-16
Ho-166m	1.78E-15	1.71E-15	1.63E-15	1.65E-15	2.56E-15	1.68E-15	1.60E-15	1.70E-15	2.11E-15
Ho-166	3.15E-17	3.07E-17	2.81E-17	2.68E-17	6.63E-17	2.79E-17	2.74E-17	3.01E-17	7.71E-15
Ho-167	3.76E-16	3.65E-16	3.41E-16	3.40E-16	6.14E-16	3.51E-16	3.32E-16	3.59E-16	1.07E-15
Erbium									
Er-161	9.26E-16	8.88E-16	8.42E-16	8.50E-16	1.35E-15	8.64E-16	8.30E-16	8.83E-16	1.13E-15
Er-165	4.20E-17	4.25E-17	3.21E-17	2.37E-17	1.51E-16	3.41E-17	3.08E-17	3.84E-17	5.14E-17
Er-169	1.00E-19	1.08E-19	5.59E-20	4.76E-20	2.46E-19	6.82E-20	5.93E-20	8.10E-20	2.46E-19
Er-171	3.90E-16	3.79E-16	3.53E-16	3.48E-16	7.09E-16	3.61E-16	3.43E-16	3.73E-16	3.34E-15
Er-172	5.42E-16	5.21E-16	4.91E-16	4.91E-16	8.18E-16	5.11E-16	4.79E-16	5.15E-16	6.32E-16
Thulium									
Tm-162	1.71E-15	1.64E-15	1.58E-15	1.61E-15	2.33E-15	1.55E-15	1.57E-15	1.64E-15	5.30E-15
Tm-166	1.82E-15	1.74E-15	1.68E-15	1.71E-15	2.51E-15	1.66E-15	1.67E-15	1.75E-15	2.42E-15
Tm-167	1.50E-16	1.48E-16	1.30E-16	1.19E-16	3.74E-16	1.33E-16	1.26E-16	1.43E-16	1.76E-16
Tm-170	6.14E-18	6.13E-18	5.25E-18	4.42E-18	2.06E-17	5.36E-18	5.03E-18	5.91E-18	2.12E-15
Tm-171	6.73E-19	6.76E-19	5.60E-19	4.35E-19	2.50E-18	5.72E-19	5.33E-19	6.41E-19	7.91E-19
Tm-172	4.63E-16	4.43E-16	4.30E-16	4.40E-16	6.18E-16	4.20E-16	4.28E-16	4.46E-16	5.72E-15
Tm-173	4.03E-16	3.89E-16	3.66E-16	3.68E-16	6.05E-16	3.80E-16	3.58E-16	3.84E-16	2.29E-15
Tm-175	1.07E-15	1.03E-15	9.81E-16	9.96E-16	1.47E-15	1.01E-15	9.65E-16	1.02E-15	5.87E-15
Ytterbium									
Yb-162	1.39E-16	1.37E-16	1.21E-16	1.09E-16	3.89E-16	1.24E-16	1.16E-16	1.33E-16	1.60E-16
Yb-166	9.11E-17	9.15E-17	7.48E-17	5.80E-17	3.32E-16	7.70E-17	7.12E-17	8.61E-17	1.08E-16
Yb-167	2.71E-16	2.66E-16	2.37E-16	2.10E-16	7.81E-16	2.41E-16	2.27E-16	2.60E-16	3.16E-16
Yb-169	3.17E-16	3.13E-16	2.78E-16	2.50E-16	8.60E-16	2.82E-16	2.66E-16	3.04E-16	3.66E-16
Yb-175	4.09E-17	3.97E-17	3.71E-17	3.67E-17	7.01E-17	3.82E-17	3.61E-17	3.91E-17	5.21E-17
Yb-177	1.87E-16	1.80E-16	1.72E-16	1.74E-16	2.89E-16	1.74E-16	1.70E-16	1.80E-16	4.49E-15
Yb-178	3.64E-17	3.53E-17	3.30E-17	3.31E-17	5.61E-17	3.42E-17	3.22E-17	3.47E-17	3.05E-16
Lutetium									
Lu-169	1.03E-15	9.86E-16	9.42E-16	9.49E-16	1.55E-15	9.41E-16	9.31E-16	9.86E-16	1.30E-15
Lu-170	2.32E-15	2.22E-15	2.16E-15	2.21E-15	3.06E-15	2.08E-15	2.16E-15	2.24E-15	3.08E-15
Lu-171	7.16E-16	6.89E-16	6.44E-16	6.40E-16	1.15E-15	6.71E-16	6.30E-16	6.80E-16	8.55E-16
Lu-172	1.89E-15	1.81E-15	1.73E-15	1.76E-15	2.66E-15	1.76E-15	1.71E-15	1.81E-15	2.31E-15
Lu-173	1.34E-16	1.33E-16	1.16E-16	1.01E-16	3.87E-16	1.18E-16	1.11E-16	1.28E-16	1.57E-16
Lu-174m	6.36E-17	6.35E-17	5.34E-17	4.36E-17	2.12E-16	5.47E-17	5.11E-17	6.04E-17	7.71E-17
Lu-174	1.26E-16	1.23E-16	1.12E-16	1.04E-16	2.86E-16	1.12E-16	1.08E-16	1.20E-16	1.45E-16
Lu-176m	1.51E-17	1.50E-17	1.33E-17	1.14E-17	5.01E-17	1.34E-17	1.27E-17	1.47E-17	4.30E-15
Lu-176	4.97E-16	4.84E-16	4.53E-16	4.48E-16	8.94E-16	4.59E-16	4.40E-16	4.78E-16	7.15E-16
Lu-177m	1.02E-15	9.90E-16	9.24E-16	9.06E-16	1.93E-15	9.41E-16	8.96E-16	9.77E-16	1.16E-15
Lu-177	3.50E-17	3.42E-17	3.18E-17	3.07E-17	7.71E-17	3.20E-17	3.09E-17	3.39E-17	5.64E-17
Lu-178m	1.13E-15	1.10E-15	1.03E-15	1.02E-15	1.97E-15	1.06E-15	1.00E-15	1.09E-15	5.51E-15
Lu-178	1.39E-16	1.33E-16	1.29E-16	1.31E-16	2.02E-16	1.26E-16	1.28E-16	1.34E-16	8.63E-15
Lu-179	3.26E-17	3.19E-17	2.95E-17	2.93E-17	6.06E-17	2.98E-17	2.88E-17	3.13E-17	4.72E-15

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-2})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	5.62E-16	5.44E-16	5.07E-16	4.94E-16	1.05E-15	5.24E-16	4.92E-16	5.37E-16	6.60E-16
Hf-172	1.20E-16	1.21E-16	9.82E-17	8.04E-17	4.06E-16	1.02E-16	9.44E-17	1.13E-16	1.50E-16
Hf-173	4.11E-16	4.00E-16	3.72E-16	3.56E-16	8.96E-16	3.78E-16	3.59E-16	3.96E-16	4.78E-16
Hf-175	3.80E-16	3.70E-16	3.43E-16	3.34E-16	7.01E-16	3.52E-16	3.32E-16	3.63E-16	4.36E-16
Hf-177m	2.29E-15	2.23E-15	2.08E-15	2.06E-15	4.03E-15	2.13E-15	2.02E-15	2.20E-15	2.65E-15
Hf-178m	2.42E-15	2.34E-15	2.20E-15	2.20E-15	3.85E-15	2.28E-15	2.15E-15	2.31E-15	2.88E-15
Hf-179m	9.21E-16	8.93E-16	8.36E-16	8.25E-16	1.63E-15	8.59E-16	8.12E-16	8.82E-16	1.06E-15
Hf-180m	1.03E-15	1.00E-15	9.40E-16	9.32E-16	1.75E-15	9.66E-16	9.13E-16	9.89E-16	1.21E-15
Hf-181	5.72E-16	5.51E-16	5.20E-16	5.18E-16	9.24E-16	5.40E-16	5.07E-16	5.46E-16	6.82E-16
Hf-182m	9.52E-16	9.18E-16	8.66E-16	8.65E-16	1.54E-15	8.93E-16	8.45E-16	9.10E-16	1.37E-15
Hf-182	2.43E-16	2.36E-16	2.21E-16	2.20E-16	4.26E-16	2.24E-16	2.15E-16	2.33E-16	2.77E-16
Hf-183	7.68E-16	7.37E-16	7.01E-16	7.08E-16	1.13E-15	7.25E-16	6.89E-16	7.34E-16	5.06E-15
Hf-184	2.50E-16	2.44E-16	2.26E-16	2.20E-16	4.94E-16	2.31E-16	2.19E-16	2.40E-16	2.17E-15
Tantalum									
Ta-172	1.55E-15	1.48E-15	1.42E-15	1.44E-15	2.24E-15	1.43E-15	1.40E-15	1.48E-15	6.58E-15
Ta-173	5.94E-16	5.73E-16	5.39E-16	5.33E-16	1.01E-15	5.52E-16	5.26E-16	5.68E-16	3.80E-15
Ta-174	6.36E-16	6.14E-16	5.79E-16	5.74E-16	1.08E-15	5.91E-16	5.65E-16	6.09E-16	3.75E-15
Ta-175	9.14E-16	8.79E-16	8.41E-16	8.43E-16	1.44E-15	8.31E-16	8.28E-16	8.79E-16	1.09E-15
Ta-176	2.05E-15	1.96E-15	1.90E-15	1.94E-15	2.75E-15	1.85E-15	1.90E-15	1.97E-15	2.75E-15
Ta-177	6.82E-17	6.77E-17	5.91E-17	4.96E-17	2.24E-16	5.99E-17	5.65E-17	6.57E-17	8.00E-17
Ta-178b[1]	1.04E-15	1.01E-15	9.48E-16	9.30E-16	1.93E-15	9.71E-16	9.19E-16	1.00E-15	1.20E-15
Ta-178a[2]	1.08E-16	1.06E-16	9.61E-17	8.74E-17	2.75E-16	9.58E-17	9.28E-17	1.04E-16	1.27E-16
Ta-179	3.28E-17	3.29E-17	2.78E-17	2.18E-17	1.23E-16	2.81E-17	2.65E-17	3.16E-17	3.91E-17
Ta-180m	4.93E-17	4.93E-17	4.22E-17	3.37E-17	1.81E-16	4.27E-17	4.02E-17	4.76E-17	1.20E-16
Ta-180	5.68E-16	5.54E-16	5.15E-16	5.05E-16	1.07E-15	5.24E-16	4.99E-16	5.45E-16	6.51E-16
Ta-182m	2.48E-16	2.44E-16	2.25E-16	2.12E-16	6.01E-16	2.26E-16	2.17E-16	2.41E-16	2.86E-16
Ta-182	1.28E-15	1.22E-15	1.18E-15	1.20E-15	1.82E-15	1.18E-15	1.17E-15	1.23E-15	1.63E-15
Ta-183	2.94E-16	2.87E-16	2.65E-16	2.54E-16	6.49E-16	2.69E-16	2.56E-16	2.83E-16	5.49E-16
Ta-184	1.64E-15	1.58E-15	1.50E-15	1.52E-15	2.41E-15	1.54E-15	1.47E-15	1.57E-15	5.44E-15
Ta-185	1.95E-16	1.91E-16	1.76E-16	1.68E-16	4.42E-16	1.78E-16	1.71E-16	1.89E-16	7.49E-15
Ta-186	1.60E-15	1.54E-15	1.46E-15	1.47E-15	2.39E-15	1.50E-15	1.43E-15	1.53E-15	1.22E-14
Tungsten									
W-176	1.75E-16	1.73E-16	1.56E-16	1.34E-16	5.90E-16	1.57E-16	1.48E-16	1.71E-16	2.01E-16
W-177	9.10E-16	8.77E-16	8.29E-16	8.20E-16	1.58E-15	8.48E-16	8.09E-16	8.73E-16	1.18E-15
W-178	1.34E-17	1.34E-17	1.15E-17	9.14E-18	5.01E-17	1.16E-17	1.10E-17	1.30E-17	1.69E-17
W-179	6.47E-17	6.62E-17	4.81E-17	3.77E-17	2.16E-16	5.22E-17	4.71E-17	5.86E-17	8.44E-17
W-181	4.06E-17	4.06E-17	3.49E-17	2.77E-17	1.51E-16	3.51E-17	3.32E-17	3.93E-17	4.79E-17
W-185	2.12E-19	2.22E-19	1.43E-19	1.25E-19	5.64E-19	1.61E-19	1.45E-19	1.84E-19	1.57E-18
W-187	4.92E-16	4.73E-16	4.48E-16	4.50E-16	7.40E-16	4.67E-16	4.38E-16	4.69E-16	2.03E-15
W-188	2.02E-18	1.98E-18	1.80E-18	1.76E-18	3.83E-18	1.83E-18	1.75E-18	1.92E-18	2.48E-18
Rhenium									
Re-177	6.14E-16	5.92E-16	5.62E-16	5.57E-16	1.03E-15	5.63E-16	5.51E-16	5.90E-16	3.63E-15
Re-178	1.18E-15	1.13E-15	1.08E-15	1.10E-15	1.74E-15	1.08E-15	1.07E-15	1.13E-15	6.37E-15
Re-180	1.20E-15	1.15E-15	1.09E-15	1.11E-15	1.74E-15	1.13E-15	1.08E-15	1.15E-15	2.31E-15
Re-181	7.83E-16	7.55E-16	7.13E-16	7.10E-16	1.28E-15	7.32E-16	6.96E-16	7.49E-16	9.24E-16
Re-182b[3]	1.87E-15	1.79E-15	1.71E-15	1.72E-15	2.96E-15	1.72E-15	1.69E-15	1.79E-15	2.23E-15
Re-182a[4]	1.16E-15	1.11E-15	1.07E-15	1.08E-15	1.75E-15	1.07E-15	1.06E-15	1.12E-15	1.49E-15
Re-184m	3.91E-16	3.77E-16	3.55E-16	3.50E-16	7.07E-16	3.63E-16	3.47E-16	3.75E-16	4.64E-16
Re-184	9.04E-16	8.65E-16	8.24E-16	8.32E-16	1.34E-15	8.52E-16	8.13E-16	8.64E-16	1.10E-15
Re-186m	1.54E-17	1.58E-17	1.26E-17	9.99E-18	5.46E-17	1.30E-17	1.21E-17	1.46E-17	3.48E-17
Re-186	2.09E-17	2.05E-17	1.89E-17	1.74E-17	5.75E-17	1.91E-17	1.81E-17	2.04E-17	2.56E-15
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	7.69E-17	7.65E-17	6.84E-17	5.78E-17	2.71E-16	6.85E-17	6.53E-17	7.56E-17	9.91E-17
Re-188	6.15E-17	5.95E-17	5.59E-17	5.54E-17	1.11E-16	5.70E-17	5.46E-17	5.91E-17	8.89E-15
Re-189	6.98E-17	6.83E-17	6.35E-17	6.20E-17	1.41E-16	6.40E-17	6.16E-17	6.74E-17	2.10E-15
Osmium									
Os-180	6.33E-17	6.38E-17	5.29E-17	4.51E-17	2.03E-16	5.42E-17	5.12E-17	6.02E-17	1.17E-16

[1] $T_{½}$ = 2.2 h
[2] $T_{½}$ = 9.31 m
[3] $T_{½}$ = 64.0 h
[4] $T_{½}$ = 12.7 h

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	1.22E-15	1.17E-15	1.12E-15	1.12E-15	1.85E-15	1.13E-15	1.10E-15	1.17E-15	1.68E-15
Os-182	4.44E-16	4.30E-16	4.02E-16	3.95E-16	8.02E-16	4.15E-16	3.91E-16	4.25E-16	5.88E-16
Os-185	7.38E-16	7.08E-16	6.72E-16	6.75E-16	1.10E-15	6.99E-16	6.58E-16	7.04E-16	9.50E-16
Os-189m	4.13E-20	9.90E-20	2.30E-22	3.62E-21	2.19E-20	6.57E-21	1.60E-20	3.13E-20	3.05E-18
Os-190m	1.64E-15	1.57E-15	1.49E-15	1.50E-15	2.39E-15	1.55E-15	1.46E-15	1.56E-15	2.01E-15
Os-191m	7.30E-18	7.39E-18	6.42E-18	5.30E-18	2.69E-17	6.40E-18	6.16E-18	7.19E-18	1.31E-17
Os-191	7.48E-17	7.41E-17	6.78E-17	6.04E-17	2.35E-16	6.79E-17	6.49E-17	7.38E-17	9.88E-17
Os-193	7.52E-17	7.31E-17	6.83E-17	6.66E-17	1.45E-16	7.02E-17	6.63E-17	7.23E-17	2.81E-15
Os-194	1.32E-18	1.42E-18	8.64E-19	6.24E-19	4.23E-18	9.84E-19	8.63E-19	1.14E-18	4.60E-18
Iridium									
Ir-182	1.37E-15	1.31E-15	1.25E-15	1.26E-15	2.04E-15	1.28E-15	1.22E-15	1.31E-15	9.34E-15
Ir-184	1.89E-15	1.82E-15	1.74E-15	1.76E-15	2.75E-15	1.75E-15	1.72E-15	1.82E-15	3.99E-15
Ir-185	5.70E-16	5.49E-16	5.28E-16	5.27E-16	9.44E-16	5.07E-16	5.22E-16	5.52E-16	8.40E-16
Ir-186a[1]	1.62E-15	1.56E-15	1.49E-15	1.51E-15	2.40E-15	1.50E-15	1.47E-15	1.56E-15	2.10E-15
Ir-186b[2]	9.72E-16	9.33E-16	8.89E-16	8.95E-16	1.47E-15	9.10E-16	8.73E-16	9.30E-16	2.76E-15
Ir-187	3.67E-16	3.54E-16	3.33E-16	3.28E-16	6.55E-16	3.42E-16	3.24E-16	3.51E-16	4.93E-16
Ir-188	1.51E-15	1.45E-15	1.40E-15	1.43E-15	2.11E-15	1.36E-15	1.40E-15	1.46E-15	1.84E-15
Ir-189	7.87E-17	7.83E-17	7.02E-17	6.18E-17	2.44E-16	7.03E-17	6.74E-17	7.69E-17	1.03E-16
Ir-190n[3]	1.60E-15	1.54E-15	1.46E-15	1.46E-15	2.44E-15	1.51E-15	1.42E-15	1.53E-15	1.97E-15
Ir-190m[4]	5.24E-20	1.19E-19	2.37E-22	4.59E-21	2.76E-20	7.70E-21	1.86E-20	3.81E-20	3.14E-18
Ir-190	1.48E-15	1.42E-15	1.35E-15	1.35E-15	2.31E-15	1.39E-15	1.31E-15	1.41E-15	1.80E-15
Ir-191m	7.01E-17	6.93E-17	6.36E-17	5.69E-17	2.18E-16	6.37E-17	6.09E-17	6.91E-17	9.31E-17
Ir-192m	1.59E-16	1.55E-16	1.46E-16	1.43E-16	3.38E-16	1.47E-16	1.42E-16	1.55E-16	1.80E-16
Ir-192	8.42E-16	8.13E-16	7.67E-16	7.71E-16	1.28E-15	7.91E-16	7.47E-16	8.03E-16	1.21E-15
Ir-194m	2.41E-15	2.32E-15	2.20E-15	2.22E-15	3.43E-15	2.29E-15	2.15E-15	2.30E-15	2.95E-15
Ir-194	9.60E-17	9.26E-17	8.74E-17	8.83E-17	1.43E-16	8.93E-17	8.56E-17	9.16E-17	9.33E-15
Ir-195m	4.25E-16	4.13E-16	3.85E-16	3.79E-16	7.70E-16	3.96E-16	3.74E-16	4.07E-16	1.43E-15
Ir-195	5.60E-17	5.59E-17	5.02E-17	4.40E-17	1.85E-16	5.03E-17	4.82E-17	5.52E-17	2.44E-15
Platinum									
Pt-186	7.59E-16	7.28E-16	6.91E-16	6.95E-16	1.13E-15	7.20E-16	6.77E-16	7.24E-16	9.05E-16
Pt-188	2.00E-16	1.96E-16	1.81E-16	1.71E-16	4.79E-16	1.83E-16	1.75E-16	1.94E-16	2.42E-16
Pt-189	3.26E-16	3.17E-16	2.96E-16	2.86E-16	6.64E-16	3.03E-16	2.88E-16	3.14E-16	4.59E-16
Pt-191	3.06E-16	2.99E-16	2.77E-16	2.63E-16	6.89E-16	2.83E-16	2.68E-16	2.96E-16	4.00E-16
Pt-193m	1.05E-17	1.06E-17	9.33E-18	7.89E-18	3.77E-17	9.27E-18	8.96E-18	1.04E-17	1.82E-17
Pt-193	1.71E-19	3.62E-19	8.04E-22	1.52E-20	9.08E-20	2.36E-20	5.53E-20	1.19E-19	8.51E-18
Pt-195m	6.96E-17	6.97E-17	6.22E-17	5.37E-17	2.39E-16	6.22E-17	5.96E-17	6.87E-17	1.02E-16
Pt-197m	8.02E-17	7.90E-17	7.24E-17	6.79E-17	1.94E-16	7.33E-17	6.99E-17	7.77E-17	1.26E-16
Pt-197	2.30E-17	2.30E-17	2.09E-17	1.91E-17	6.78E-17	2.08E-17	2.01E-17	2.27E-17	3.33E-16
Pt-199	2.09E-16	2.02E-16	1.91E-16	1.92E-16	3.09E-16	1.98E-16	1.86E-16	2.00E-16	5.67E-15
Pt-200	5.78E-17	5.72E-17	5.24E-17	4.86E-17	1.54E-16	5.26E-17	5.05E-17	5.65E-17	2.90E-16
Gold									
Au-193	1.56E-16	1.54E-16	1.42E-16	1.31E-16	4.16E-16	1.43E-16	1.37E-16	1.53E-16	1.93E-16
Au-194	1.04E-15	9.99E-16	9.61E-16	9.74E-16	1.52E-15	9.46E-16	9.50E-16	1.00E-15	1.35E-15
Au-195m	2.00E-16	1.96E-16	1.83E-16	1.81E-16	3.65E-16	1.84E-16	1.78E-16	1.93E-16	2.42E-16
Au-195	7.91E-17	7.91E-17	7.11E-17	6.09E-17	2.79E-16	7.08E-17	6.81E-17	7.84E-17	1.09E-16
Au-198m	5.69E-16	5.57E-16	5.21E-16	5.05E-16	1.24E-15	5.23E-16	5.05E-16	5.53E-16	6.66E-16
Au-198	4.21E-16	4.05E-16	3.83E-16	3.85E-16	6.16E-16	3.98E-16	3.74E-16	4.01E-16	2.53E-15
Au-199	8.66E-17	8.48E-17	7.94E-17	7.68E-17	1.97E-16	7.95E-17	7.69E-17	8.45E-17	1.04E-16
Au-200m	2.14E-15	2.06E-15	1.95E-15	1.97E-15	3.09E-15	2.02E-15	1.91E-15	2.04E-15	2.79E-15
Au-200	2.74E-16	2.62E-16	2.52E-16	2.58E-16	3.69E-16	2.53E-16	2.50E-16	2.63E-16	8.43E-15
Au-201	5.61E-17	5.40E-17	5.08E-17	5.10E-17	8.45E-17	5.29E-17	4.97E-17	5.33E-17	3.95E-15
Mercury									
Hg-193m	1.04E-15	1.00E-15	9.55E-16	9.61E-16	1.60E-15	9.63E-16	9.37E-16	9.99E-16	1.34E-15
Hg-193	1.97E-16	1.94E-16	1.78E-16	1.66E-16	5.08E-16	1.79E-16	1.72E-16	1.92E-16	3.78E-16
Hg-194	3.16E-19	5.98E-19	1.73E-21	2.87E-20	1.72E-19	3.99E-20	8.72E-20	2.05E-19	1.04E-17
Hg-195m	2.10E-16	2.05E-16	1.91E-16	1.87E-16	3.95E-16	1.94E-16	1.85E-16	2.02E-16	2.93E-16
Hg-195	2.01E-16	1.95E-16	1.83E-16	1.77E-16	4.07E-16	1.86E-16	1.78E-16	1.94E-16	2.82E-16

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	8.87E-17	8.72E-17	8.11E-17	7.60E-17	2.35E-16	8.15E-17	7.80E-17	8.70E-17	1.15E-16
Hg-197	6.45E-17	6.46E-17	5.84E-17	5.02E-17	2.29E-16	5.79E-17	5.60E-17	6.42E-17	9.10E-17
Hg-199m	1.82E-16	1.78E-16	1.67E-16	1.59E-16	4.21E-16	1.68E-16	1.61E-16	1.77E-16	2.29E-16
Hg-203	2.41E-16	2.35E-16	2.20E-16	2.20E-16	4.11E-16	2.23E-16	2.14E-16	2.32E-16	2.79E-16
Thallium									
Tl-194m	2.39E-15	2.29E-15	2.17E-15	2.19E-15	3.45E-15	2.26E-15	2.13E-15	2.27E-15	5.37E-15
Tl-194	7.98E-16	7.68E-16	7.27E-16	7.28E-16	1.24E-15	7.54E-16	7.10E-16	7.62E-16	9.81E-16
Tl-195	1.23E-15	1.18E-15	1.14E-15	1.16E-15	1.73E-15	1.12E-15	1.13E-15	1.18E-15	1.94E-15
Tl-197	4.06E-16	3.92E-16	3.72E-16	3.68E-16	7.18E-16	3.76E-16	3.63E-16	3.91E-16	6.59E-16
Tl-198m	1.23E-15	1.18E-15	1.12E-15	1.12E-15	1.85E-15	1.16E-15	1.09E-15	1.17E-15	1.58E-15
Tl-198	1.94E-15	1.86E-15	1.80E-15	1.83E-15	2.65E-15	1.76E-15	1.78E-15	1.87E-15	2.39E-15
Tl-199	2.48E-16	2.42E-16	2.26E-16	2.19E-16	5.18E-16	2.30E-16	2.19E-16	2.40E-16	3.13E-16
Tl-200	1.31E-15	1.25E-15	1.20E-15	1.22E-15	1.88E-15	1.21E-15	1.18E-15	1.25E-15	1.64E-15
Tl-201	8.80E-17	8.77E-17	8.01E-17	7.11E-17	2.85E-16	7.96E-17	7.68E-17	8.73E-17	1.15E-16
Tl-202	4.80E-16	4.64E-16	4.37E-16	4.32E-16	8.08E-16	4.52E-16	4.26E-16	4.59E-16	5.70E-16
Tl-204	1.55E-18	1.57E-18	1.30E-18	1.13E-18	4.96E-18	1.33E-18	1.26E-18	1.48E-18	9.54E-16
Tl-206	2.19E-18	2.21E-18	1.73E-18	1.62E-18	4.91E-18	1.84E-18	1.71E-18	1.99E-18	5.89E-15
Tl-207	4.04E-18	3.96E-18	3.44E-18	3.40E-18	6.99E-18	3.62E-18	3.40E-18	3.76E-18	5.21E-15
Tl-208	3.09E-15	2.94E-15	2.88E-15	2.96E-15	3.90E-15	2.75E-15	2.90E-15	2.98E-15	9.77E-15
Tl-209	1.97E-15	1.88E-15	1.83E-15	1.87E-15	2.69E-15	1.78E-15	1.82E-15	1.90E-15	9.87E-15
Lead									
Pb-195m	1.63E-15	1.56E-15	1.49E-15	1.50E-15	2.40E-15	1.53E-15	1.45E-15	1.55E-15	3.11E-15
Pb-198	4.41E-16	4.29E-16	4.02E-16	3.96E-16	8.24E-16	4.11E-16	3.91E-16	4.25E-16	5.67E-16
Pb-199	1.45E-15	1.39E-15	1.34E-15	1.36E-15	2.06E-15	1.33E-15	1.32E-15	1.39E-15	1.79E-15
Pb-200	2.03E-16	1.99E-16	1.85E-16	1.75E-16	5.11E-16	1.86E-16	1.78E-16	1.98E-16	2.65E-16
Pb-201	7.65E-16	7.38E-16	6.99E-16	7.02E-16	1.21E-15	7.16E-16	6.84E-16	7.33E-16	9.73E-16
Pb-202m	2.08E-15	1.99E-15	1.90E-15	1.94E-15	2.81E-15	1.97E-15	1.88E-15	1.99E-15	2.49E-15
Pb-202	1.87E-19	4.14E-19	8.68E-22	1.65E-20	9.92E-20	2.74E-20	6.49E-20	1.34E-19	1.14E-17
Pb-203	3.12E-16	3.05E-16	2.84E-16	2.77E-16	6.25E-16	2.87E-16	2.75E-16	3.01E-16	3.78E-16
Pb-205	2.12E-19	4.59E-19	1.03E-21	1.88E-20	1.13E-19	3.06E-20	7.15E-20	1.50E-19	1.22E-17
Pb-209	3.50E-19	3.67E-19	2.34E-19	2.07E-19	8.69E-19	2.64E-19	2.37E-19	3.01E-19	2.94E-16
Pb-210	3.02E-18	3.59E-18	1.64E-18	1.27E-18	8.31E-18	1.87E-18	1.76E-18	2.48E-18	1.98E-17
Pb-211	5.33E-17	5.12E-17	4.84E-17	4.91E-17	7.54E-17	5.03E-17	4.76E-17	5.08E-17	4.64E-15
Pb-212	1.47E-16	1.44E-16	1.34E-16	1.32E-16	3.01E-16	1.35E-16	1.31E-16	1.43E-16	1.88E-16
Pb-214	2.54E-16	2.47E-16	2.32E-16	2.31E-16	4.24E-16	2.37E-16	2.25E-16	2.44E-16	9.10E-16
Bismuth									
Bi-200	2.43E-15	2.33E-15	2.22E-15	2.25E-15	3.50E-15	2.29E-15	2.18E-15	2.32E-15	4.15E-15
Bi-201	1.35E-15	1.29E-15	1.23E-15	1.25E-15	1.93E-15	1.27E-15	1.22E-15	1.29E-15	4.69E-15
Bi-202	2.73E-15	2.61E-15	2.50E-15	2.54E-15	3.78E-15	2.56E-15	2.47E-15	2.61E-15	3.75E-15
Bi-203	2.31E-15	2.21E-15	2.14E-15	2.19E-15	3.10E-15	2.11E-15	2.13E-15	2.23E-15	3.32E-15
Bi-205	1.64E-15	1.57E-15	1.52E-15	1.55E-15	2.21E-15	1.49E-15	1.51E-15	1.58E-15	2.03E-15
Bi-206	3.28E-15	3.14E-15	3.01E-15	3.07E-15	4.50E-15	3.06E-15	2.98E-15	3.14E-15	4.25E-15
Bi-207	1.55E-15	1.48E-15	1.42E-15	1.44E-15	2.15E-15	1.45E-15	1.40E-15	1.48E-15	3.18E-15
Bi-210m	2.61E-16	2.53E-16	2.38E-16	2.38E-16	4.36E-16	2.42E-16	2.31E-16	2.50E-16	3.13E-16
Bi-210	1.17E-18	1.20E-18	8.80E-19	8.11E-19	2.74E-18	9.54E-19	8.76E-19	1.05E-18	3.42E-15
Bi-211	4.79E-17	4.64E-17	4.37E-17	4.37E-17	7.64E-17	4.49E-17	4.25E-17	4.58E-17	5.55E-17
Bi-212	1.87E-16	1.79E-16	1.71E-16	1.75E-16	2.46E-16	1.74E-16	1.70E-16	1.79E-16	5.35E-15
Bi-213	1.39E-16	1.34E-16	1.26E-16	1.27E-16	2.06E-16	1.31E-16	1.24E-16	1.32E-16	4.23E-15
Bi-214	1.46E-15	1.40E-15	1.36E-15	1.39E-15	1.88E-15	1.33E-15	1.35E-15	1.41E-15	8.48E-15
Polonium									
Po-203	1.63E-15	1.56E-15	1.50E-15	1.53E-15	2.27E-15	1.51E-15	1.48E-15	1.56E-15	2.95E-15
Po-205	1.57E-15	1.50E-15	1.44E-15	1.47E-15	2.19E-15	1.46E-15	1.43E-15	1.51E-15	2.20E-15
Po-207	1.33E-15	1.28E-15	1.22E-15	1.25E-15	1.88E-15	1.25E-15	1.21E-15	1.28E-15	1.89E-15
Po-210	8.69E-21	8.30E-21	7.94E-21	8.12E-21	1.14E-20	8.26E-21	7.86E-21	8.29E-21	1.11E-20
Po-211	7.98E-18	7.63E-18	7.29E-18	7.44E-18	1.06E-17	7.57E-18	7.19E-18	7.61E-18	1.12E-17
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	8.52E-20	8.13E-20	7.78E-20	7.96E-20	1.12E-19	8.10E-20	7.70E-20	8.13E-20	1.09E-19
Po-215	1.83E-19	1.76E-19	1.67E-19	1.68E-19	2.65E-19	1.74E-19	1.63E-19	1.74E-19	2.15E-19
Po-216	1.73E-20	1.65E-20	1.58E-20	1.62E-20	2.27E-20	1.64E-20	1.56E-20	1.65E-20	2.20E-20
Po-218	9.31E-21	8.88E-21	8.50E-21	8.70E-21	1.22E-20	8.83E-21	8.43E-21	8.88E-21	1.17E-20

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	1.31E-15	1.26E-15	1.21E-15	1.23E-15	1.86E-15	1.22E-15	1.19E-15	1.26E-15	1.70E-15
At-211	3.65E-17	3.64E-17	3.32E-17	2.97E-17	1.18E-16	3.32E-17	3.19E-17	3.62E-17	5.47E-17
At-215	2.00E-19	1.93E-19	1.82E-19	1.83E-19	2.95E-19	1.89E-19	1.78E-19	1.91E-19	2.30E-19
At-216	1.41E-18	1.40E-18	1.30E-18	1.16E-18	4.59E-18	1.29E-18	1.24E-18	1.41E-18	1.96E-18
At-217	3.17E-19	3.05E-19	2.89E-19	2.91E-19	4.70E-19	3.00E-19	2.82E-19	3.03E-19	4.11E-19
At-218	4.74E-18	5.34E-18	3.17E-18	2.49E-18	1.49E-17	3.36E-18	3.21E-18	4.18E-18	2.32E-17
Radon									
Rn-218	7.84E-19	7.50E-19	7.14E-19	7.24E-19	1.06E-18	7.47E-19	7.00E-19	7.45E-19	1.05E-18
Rn-219	5.74E-17	5.56E-17	5.23E-17	5.25E-17	9.18E-17	5.37E-17	5.09E-17	5.49E-17	6.64E-17
Rn-220	4.00E-19	3.84E-19	3.65E-19	3.69E-19	5.51E-19	3.81E-19	3.57E-19	3.81E-19	5.21E-19
Rn-222	4.15E-19	3.98E-19	3.78E-19	3.81E-19	5.79E-19	3.95E-19	3.70E-19	3.95E-19	5.20E-19
Francium									
Fr-219	3.59E-18	3.47E-18	3.27E-18	3.28E-18	5.57E-18	3.38E-18	3.19E-18	3.43E-18	4.34E-18
Fr-220	1.10E-17	1.10E-17	9.55E-18	9.24E-18	2.52E-17	9.67E-18	9.35E-18	1.05E-17	2.11E-17
Fr-221	3.08E-17	3.02E-17	2.81E-17	2.79E-17	5.86E-17	2.82E-17	2.74E-17	2.98E-17	3.67E-17
Fr-222	3.68E-18	3.68E-18	2.98E-18	2.83E-18	7.79E-18	3.16E-18	2.93E-18	3.38E-18	8.43E-15
Fr-223	6.03E-17	6.08E-17	5.00E-17	4.50E-17	1.58E-16	5.16E-17	4.86E-17	5.65E-17	2.72E-15
Radium									
Ra-222	9.42E-18	9.13E-18	8.58E-18	8.61E-18	1.48E-17	8.79E-18	8.35E-18	9.00E-18	1.08E-17
Ra-223	1.32E-16	1.29E-16	1.20E-16	1.16E-16	2.90E-16	1.22E-16	1.16E-16	1.28E-16	1.67E-16
Ra-224	9.94E-18	9.70E-18	9.07E-18	9.05E-18	1.76E-17	9.13E-18	8.84E-18	9.57E-18	1.16E-17
Ra-225	1.63E-17	1.74E-17	9.40E-18	6.74E-18	4.72E-17	1.15E-17	9.63E-18	1.33E-17	3.25E-17
Ra-226	6.64E-18	6.52E-18	6.06E-18	5.95E-18	1.36E-17	6.06E-18	5.90E-18	6.44E-18	8.12E-18
Ra-227	1.71E-16	1.68E-16	1.46E-16	1.46E-16	2.73E-16	1.53E-16	1.44E-16	1.59E-16	3.34E-15
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	5.07E-18	5.32E-18	4.07E-18	4.03E-18	9.30E-18	4.22E-18	4.07E-18	4.66E-18	1.62E-17
Ac-224	1.94E-16	1.91E-16	1.76E-16	1.69E-16	4.51E-16	1.77E-16	1.70E-16	1.89E-16	2.54E-16
Ac-225	1.66E-17	1.67E-17	1.42E-17	1.36E-17	4.08E-17	1.45E-17	1.39E-17	1.58E-17	3.08E-17
Ac-226	1.29E-16	1.27E-16	1.16E-16	1.15E-16	2.56E-16	1.17E-16	1.13E-16	1.24E-16	1.84E-15
Ac-227	1.89E-19	2.12E-19	1.14E-19	1.13E-19	3.71E-19	1.25E-19	1.21E-19	1.57E-19	7.43E-19
Ac-228	9.71E-16	9.30E-16	8.88E-16	9.08E-16	1.30E-15	9.03E-16	8.80E-16	9.28E-16	4.75E-15
Thorium									
Th-226	8.18E-18	8.22E-18	6.98E-18	6.76E-18	1.86E-17	7.13E-18	6.85E-18	7.75E-18	1.46E-17
Th-227	1.09E-16	1.08E-16	9.60E-17	9.46E-17	2.03E-16	9.78E-17	9.38E-17	1.04E-16	1.56E-16
Th-228	2.71E-18	2.99E-18	1.81E-18	1.77E-18	5.67E-18	1.92E-18	1.87E-18	2.35E-18	9.74E-18
Th-229	8.95E-17	9.03E-17	7.64E-17	7.18E-17	2.34E-16	7.79E-17	7.45E-17	8.54E-17	1.57E-16
Th-230	1.05E-18	1.33E-18	3.52E-19	3.74E-19	1.65E-18	4.46E-19	4.59E-19	7.50E-19	7.17E-18
Th-231	2.42E-17	2.75E-17	1.12E-17	1.08E-17	4.78E-17	1.41E-17	1.28E-17	1.85E-17	8.58E-17
Th-232	8.47E-19	1.12E-18	1.74E-19	2.09E-19	1.06E-18	2.68E-19	2.86E-19	5.51E-19	6.86E-18
Th-234	8.90E-18	9.15E-18	7.11E-18	6.40E-18	2.63E-17	7.34E-18	6.97E-18	8.32E-18	1.72E-17
Protactinium									
Pa-227	2.08E-17	2.11E-17	1.76E-17	1.60E-17	6.14E-17	1.79E-17	1.71E-17	1.99E-17	3.69E-17
Pa-228	1.14E-15	1.09E-15	1.03E-15	1.05E-15	1.64E-15	1.05E-15	1.02E-15	1.09E-15	1.55E-15
Pa-230	6.56E-16	6.30E-16	5.95E-16	6.04E-16	9.60E-16	6.15E-16	5.88E-16	6.26E-16	8.54E-16
Pa-231	4.65E-17	4.83E-17	3.41E-17	3.44E-17	7.16E-17	3.69E-17	3.47E-17	4.07E-17	1.07E-16
Pa-232	9.51E-16	9.11E-16	8.64E-16	8.83E-16	1.28E-15	8.94E-16	8.56E-16	9.06E-16	1.26E-15
Pa-233	2.05E-16	2.01E-16	1.83E-16	1.82E-16	3.66E-16	1.88E-16	1.78E-16	1.95E-16	2.70E-16
Pa-234m	1.61E-17	1.56E-17	1.43E-17	1.44E-17	2.52E-17	1.47E-17	1.41E-17	1.53E-17	9.39E-15
Pa-234	1.93E-15	1.85E-15	1.76E-15	1.79E-15	2.68E-15	1.80E-15	1.74E-15	1.84E-15	3.89E-15
Uranium									
U-230	2.42E-18	2.87E-18	1.03E-18	1.08E-18	3.83E-18	1.24E-18	1.21E-18	1.80E-18	1.17E-17
U-231	7.76E-17	8.02E-17	5.91E-17	5.55E-17	1.99E-16	6.27E-17	5.89E-17	7.07E-17	1.60E-16
U-232	1.62E-18	2.09E-18	2.71E-19	3.61E-19	1.78E-18	4.89E-19	4.93E-19	1.01E-18	1.10E-17
U-233	1.04E-18	1.28E-18	3.20E-19	3.61E-19	1.33E-18	4.42E-19	4.30E-19	7.16E-19	5.94E-18
U-234	1.25E-18	1.64E-18	1.40E-19	2.21E-19	1.22E-18	3.21E-19	3.28E-19	7.48E-19	9.09E-18
U-235	1.53E-16	1.51E-16	1.38E-16	1.36E-16	3.14E-16	1.39E-16	1.35E-16	1.48E-16	1.94E-16
U-236	1.12E-18	1.49E-18	8.56E-20	1.67E-19	9.84E-19	2.54E-19	2.64E-19	6.50E-19	8.45E-18
U-237	1.41E-16	1.41E-16	1.20E-16	1.13E-16	3.45E-16	1.23E-16	1.17E-16	1.33E-16	2.07E-16
U-238	9.65E-19	1.29E-18	5.59E-20	1.28E-19	8.09E-19	2.04E-19	2.14E-19	5.51E-19	7.42E-18
U-239	5.32E-17	5.32E-17	4.63E-17	4.17E-17	1.57E-16	4.70E-17	4.49E-17	5.15E-17	3.64E-15
U-240	7.02E-18	8.73E-18	9.78E-19	1.26E-18	8.22E-18	2.21E-18	1.94E-18	4.23E-18	3.74E-17

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	1.22E-15	1.17E-15	1.10E-15	1.12E-15	1.77E-15	1.14E-15	1.09E-15	1.16E-15	1.67E-15
Np-233	8.71E-17	8.63E-17	7.61E-17	7.18E-17	2.30E-16	7.80E-17	7.40E-17	8.39E-17	1.30E-16
Np-234	1.39E-15	1.33E-15	1.28E-15	1.32E-15	1.84E-15	1.25E-15	1.28E-15	1.33E-15	2.03E-15
Np-235	5.92E-18	7.44E-18	9.59E-19	1.31E-18	6.45E-18	1.89E-18	1.77E-18	3.65E-18	3.45E-17
Np-236a[1]	1.30E-16	1.32E-16	1.05E-16	1.00E-16	3.11E-16	1.09E-16	1.03E-16	1.20E-16	2.38E-16
Np-236b[2]	4.90E-17	4.86E-17	4.22E-17	4.01E-17	1.22E-16	4.35E-17	4.12E-17	4.67E-17	1.12E-16
Np-237	3.38E-17	3.61E-17	2.18E-17	2.02E-17	7.96E-17	2.45E-17	2.25E-17	2.87E-17	8.36E-17
Np-238	5.55E-16	5.31E-16	5.04E-16	5.19E-16	7.15E-16	5.18E-16	5.03E-16	5.29E-16	2.47E-15
Np-239	1.71E-16	1.69E-16	1.50E-16	1.46E-16	3.65E-16	1.53E-16	1.46E-16	1.63E-16	2.63E-16
Np-240m	3.46E-16	3.34E-16	3.10E-16	3.16E-16	4.66E-16	3.21E-16	3.06E-16	3.27E-16	7.44E-15
Np-240	1.33E-15	1.28E-15	1.20E-15	1.22E-15	1.87E-15	1.25E-15	1.19E-15	1.27E-15	3.12E-15
Plutonium									
Pu-234	6.54E-17	6.53E-17	5.60E-17	5.27E-17	1.76E-16	5.77E-17	5.47E-17	6.26E-17	1.01E-16
Pu-235	9.11E-17	9.09E-17	7.72E-17	7.32E-17	2.32E-16	7.98E-17	7.56E-17	8.65E-17	1.44E-16
Pu-236	1.73E-18	2.23E-18	1.09E-19	2.38E-19	1.47E-18	4.09E-19	3.85E-19	9.81E-19	1.10E-17
Pu-237	4.99E-17	5.07E-17	4.01E-17	3.77E-17	1.31E-16	4.19E-17	3.96E-17	4.65E-17	9.06E-17
Pu-238	1.49E-18	1.93E-18	7.87E-20	1.94E-19	1.22E-18	3.40E-19	3.20E-19	8.38E-19	9.64E-18
Pu-239	6.14E-19	7.77E-19	7.87E-20	1.20E-19	5.81E-19	1.78E-19	1.68E-19	3.67E-19	3.67E-18
Pu-240	1.43E-18	1.85E-18	7.81E-20	1.87E-19	1.18E-18	3.28E-19	3.08E-19	8.03E-19	9.18E-18
Pu-241	2.31E-21	2.51E-21	1.42E-21	1.39E-21	4.81E-21	1.57E-21	1.49E-21	1.93E-21	7.06E-21
Pu-242	1.18E-18	1.53E-18	6.60E-20	1.57E-19	9.84E-19	2.73E-19	2.57E-19	6.67E-19	7.61E-18
Pu-243	2.53E-17	2.55E-17	2.13E-17	1.95E-17	7.24E-17	2.19E-17	2.07E-17	2.41E-17	1.18E-16
Pu-244	9.98E-19	1.30E-18	4.65E-20	1.25E-19	8.05E-19	2.23E-19	2.10E-19	5.58E-19	6.49E-18
Pu-245	4.25E-16	4.10E-16	3.84E-16	3.88E-16	6.31E-16	3.97E-16	3.77E-16	4.04E-16	2.03E-15
Pu-246	1.41E-16	1.40E-16	1.20E-16	1.15E-16	3.17E-16	1.24E-16	1.17E-16	1.33E-16	1.94E-16
Americium									
Am-237	3.72E-16	3.63E-16	3.31E-16	3.29E-16	6.73E-16	3.41E-16	3.24E-16	3.54E-16	4.94E-16
Am-238	8.90E-16	8.54E-16	8.09E-16	8.24E-16	1.27E-15	8.27E-16	8.02E-16	8.50E-16	1.31E-15
Am-239	2.34E-16	2.32E-16	2.02E-16	1.95E-16	5.29E-16	2.07E-16	1.97E-16	2.22E-16	3.39E-16
Am-240	1.03E-15	9.89E-16	9.35E-16	9.56E-16	1.42E-15	9.64E-16	9.30E-16	9.84E-16	1.39E-15
Am-241	3.25E-17	3.52E-17	2.01E-17	1.68E-17	9.30E-17	2.21E-17	2.06E-17	2.75E-17	8.32E-17
Am-242m	5.08E-18	6.21E-18	6.54E-19	9.41E-19	5.31E-18	1.64E-18	1.38E-18	3.02E-18	2.41E-17
Am-242	1.82E-17	1.91E-17	1.22E-17	1.18E-17	4.08E-17	1.35E-17	1.25E-17	1.57E-17	2.55E-16
Am-243	5.49E-17	5.54E-17	4.76E-17	4.13E-17	1.86E-16	4.78E-17	4.60E-17	5.35E-17	7.60E-17
Am-244m	3.48E-18	3.86E-18	1.58E-18	1.59E-18	5.72E-18	2.04E-18	1.82E-18	2.61E-18	5.34E-15
Am-244	8.24E-16	7.93E-16	7.35E-16	7.51E-16	1.12E-15	7.68E-16	7.29E-16	7.79E-16	1.57E-15
Am-245	3.27E-17	3.23E-17	2.84E-17	2.78E-17	6.81E-17	2.92E-17	2.78E-17	3.10E-17	1.25E-15
Am-246m	1.02E-15	9.76E-16	9.32E-16	9.57E-16	1.33E-15	9.53E-16	9.27E-16	9.75E-16	5.72E-15
Am-246	7.17E-16	6.94E-16	6.33E-16	6.42E-16	1.04E-15	6.61E-16	6.24E-16	6.74E-16	3.92E-15
Curium									
Cm-238	7.44E-17	7.39E-17	6.36E-17	6.03E-17	1.94E-16	6.56E-17	6.21E-17	7.10E-17	1.10E-16
Cm-240	1.87E-18	2.36E-18	1.11E-19	2.46E-19	1.61E-18	4.79E-19	4.10E-19	1.05E-18	1.03E-17
Cm-241	5.13E-16	4.99E-16	4.54E-16	4.54E-16	8.37E-16	4.75E-16	4.45E-16	4.85E-16	7.52E-16
Cm-242	1.70E-18	2.14E-18	1.05E-19	2.28E-19	1.47E-18	4.38E-19	3.75E-19	9.56E-19	9.38E-18
Cm-243	1.32E-16	1.31E-16	1.14E-16	1.12E-16	2.73E-16	1.17E-16	1.12E-16	1.25E-16	1.90E-16
Cm-244	1.57E-18	1.98E-18	9.00E-20	2.04E-19	1.34E-18	3.98E-19	3.41E-19	8.78E-19	8.70E-18
Cm-245	9.21E-17	9.22E-17	7.73E-17	7.38E-17	2.29E-16	7.99E-17	7.58E-17	8.70E-17	1.46E-16
Cm-246	1.40E-18	1.77E-18	8.26E-20	1.84E-19	1.20E-18	3.58E-19	3.06E-19	7.85E-19	7.74E-18
Cm-247	3.26E-16	3.15E-16	2.96E-16	2.97E-16	4.86E-16	3.07E-16	2.89E-16	3.10E-16	3.79E-16
Cm-248	1.07E-18	1.35E-18	6.26E-20	1.40E-19	9.18E-19	2.73E-19	2.33E-19	6.00E-19	5.92E-18
Cm-249	2.04E-17	1.96E-17	1.84E-17	1.86E-17	2.93E-17	1.93E-17	1.81E-17	1.94E-17	1.47E-15
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	2.31E-16	2.28E-16	2.01E-16	1.96E-16	5.10E-16	2.07E-16	1.97E-16	2.20E-16	3.14E-16
Bk-246	9.62E-16	9.23E-16	8.68E-16	8.85E-16	1.35E-15	9.00E-16	8.60E-16	9.15E-16	1.25E-15
Bk-247	1.04E-16	1.02E-16	9.33E-17	8.91E-17	2.52E-16	9.45E-17	9.03E-17	1.01E-16	1.29E-16
Bk-249	9.86E-21	1.14E-20	3.25E-21	2.81E-21	1.84E-20	5.09E-21	4.14E-21	6.85E-21	3.80E-20
Bk-250	8.91E-16	8.51E-16	8.13E-16	8.36E-16	1.15E-15	8.34E-16	8.10E-16	8.51E-16	2.40E-15

[1] $T_{½}$ = 1.15E5 y

[2] $T_{½}$ = 22.5 h

Table III.3. Dose Coefficients for Exposure to Contaminated Ground Surface

	Dose Coefficient h_T (Sv per Bq s m^{-2})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	2.00E-18	2.46E-18	1.55E-19	2.79E-19	1.87E-18	5.95E-19	4.66E-19	1.14E-18	9.25E-18
Cf-246	1.38E-18	1.69E-18	1.21E-19	2.05E-19	1.32E-18	4.20E-19	3.32E-19	7.88E-19	6.30E-18
Cf-248	1.36E-18	1.67E-18	1.06E-19	1.91E-19	1.28E-18	4.06E-19	3.18E-19	7.74E-19	6.29E-18
Cf-249	3.46E-16	3.35E-16	3.10E-16	3.12E-16	5.24E-16	3.22E-16	3.03E-16	3.28E-16	4.13E-16
Cf-250	1.30E-18	1.59E-18	1.01E-19	1.82E-19	1.22E-18	3.87E-19	3.03E-19	7.37E-19	5.99E-18
Cf-251	1.30E-16	1.30E-16	1.08E-16	1.06E-16	2.81E-16	1.12E-16	1.07E-16	1.22E-16	1.97E-16
Cf-252	1.26E-18	1.54E-18	1.12E-19	1.88E-19	1.21E-18	3.86E-19	3.05E-19	7.22E-19	5.75E-18
Cf-253	8.86E-20	9.99E-20	3.53E-20	3.16E-20	1.77E-19	4.93E-20	4.18E-20	6.45E-20	2.80E-19
Cf-254	4.23E-21	5.19E-21	3.29E-22	5.92E-22	3.96E-21	1.26E-21	9.87E-22	2.40E-21	1.95E-20
Einsteinium									
Es-250	3.96E-16	3.82E-16	3.56E-16	3.61E-16	6.18E-16	3.66E-16	3.53E-16	3.78E-16	5.38E-16
Es-251	9.70E-17	9.68E-17	8.03E-17	7.72E-17	2.32E-16	8.38E-17	7.90E-17	9.09E-17	1.44E-16
Es-253	1.20E-18	1.38E-18	3.83E-19	4.24E-19	1.47E-18	5.89E-19	5.06E-19	8.18E-19	4.14E-18
Es-254m	4.86E-16	4.66E-16	4.37E-16	4.45E-16	6.53E-16	4.59E-16	4.31E-16	4.60E-16	1.77E-15
Es-254	1.99E-17	2.35E-17	4.37E-18	5.00E-18	2.54E-17	8.07E-18	6.78E-18	1.27E-17	7.85E-17
Fermium									
Fm-252	1.31E-18	1.58E-18	1.28E-19	1.97E-19	1.34E-18	4.33E-19	3.27E-19	7.56E-19	5.32E-18
Fm-253	8.22E-17	8.18E-17	6.85E-17	6.62E-17	1.90E-16	7.14E-17	6.74E-17	7.70E-17	1.18E-16
Fm-254	1.42E-18	1.70E-18	1.61E-19	2.32E-19	1.50E-18	4.85E-19	3.70E-19	8.28E-19	5.66E-18
Fm-255	1.33E-17	1.61E-17	2.36E-18	2.93E-18	1.61E-17	4.71E-18	4.10E-18	8.22E-18	6.07E-17
Fm-257	1.10E-16	1.10E-16	9.06E-17	8.81E-17	2.45E-16	9.46E-17	8.94E-17	1.03E-16	1.65E-16
Mendelevium									
Md-257	1.14E-16	1.13E-16	9.83E-17	9.63E-17	2.35E-16	1.03E-16	9.63E-17	1.08E-16	1.54E-16
Md-258	7.35E-18	8.63E-18	1.27E-18	1.50E-18	9.31E-18	2.91E-18	2.25E-18	4.51E-18	2.55E-17

TABLE III.4

Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units. The coefficients are for soil at a density of 1.6×10^3 kg m^{-3}.

h_T: The tissue dose equivalent coefficient for organ or tissue T (Sv per Bq s m^{-3}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-3}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

To convert to a source per unit mass basis (Sv per Bq s kg^{-1}), multiply table entries by 1.6×10^3 (kg m^{-3}).

To convert to conventional units (mrem per µCi y cm^{-3}), multiply table entries by 1.168×10^{23}.

To convert to conventional units for a source per unit mass basis (mrem per µCi y g^{-1}), multiply table entries by 1.868×10^{23}.

Radionuclide dose coefficients for soil contaminated to a finite depth cannot be scaled to account for a different soil density.

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium									
Be-7	3.21E-19	3.29E-19	3.07E-19	3.04E-19	4.67E-19	3.17E-19	2.96E-19	3.15E-19	3.61E-19
Be-10	2.07E-21	2.21E-21	1.71E-21	1.51E-21	5.51E-21	1.70E-21	1.62E-21	1.94E-21	2.73E-20
Carbon									
C-11	6.62E-18	6.79E-18	6.35E-18	6.28E-18	9.49E-18	6.56E-18	6.11E-18	6.50E-18	8.23E-18
C-14	5.31E-23	6.02E-23	3.02E-23	2.38E-23	1.36E-22	3.35E-23	3.03E-23	4.30E-23	8.85E-23
Nitrogen									
N-13	6.63E-18	6.79E-18	6.35E-18	6.29E-18	9.51E-18	6.56E-18	6.12E-18	6.51E-18	9.37E-18
Oxygen									
O-15	6.64E-18	6.81E-18	6.37E-18	6.30E-18	9.53E-18	6.58E-18	6.13E-18	6.52E-18	1.31E-17
Fluorine									
F-18	6.63E-18	6.80E-18	6.36E-18	6.30E-18	9.51E-18	6.57E-18	6.12E-18	6.52E-18	7.51E-18
Neon									
Ne-19	6.66E-18	6.83E-18	6.39E-18	6.32E-18	9.57E-18	6.60E-18	6.15E-18	6.54E-18	1.73E-17
Sodium									
Na-22	1.38E-17	1.41E-17	1.34E-17	1.34E-17	1.86E-17	1.37E-17	1.29E-17	1.36E-17	1.54E-17
Na-24	2.42E-17	2.42E-17	2.34E-17	2.39E-17	3.01E-17	2.32E-17	2.27E-17	2.38E-17	2.91E-17
Magnesium									
Mg-28	8.40E-18	8.63E-18	8.17E-18	8.22E-18	1.12E-17	8.34E-18	7.88E-18	8.31E-18	9.46E-18
Aluminum									
Al-26	1.65E-17	1.67E-17	1.59E-17	1.60E-17	2.16E-17	1.59E-17	1.54E-17	1.62E-17	2.02E-17
Al-28	1.07E-17	1.08E-17	1.04E-17	1.06E-17	1.35E-17	1.03E-17	1.01E-17	1.06E-17	2.72E-17
Silicon									
Si-31	1.79E-20	1.87E-20	1.65E-20	1.58E-20	3.53E-20	1.65E-20	1.57E-20	1.74E-20	3.56E-18
Si-32	1.15E-22	1.28E-22	7.46E-23	6.00E-23	3.13E-22	7.93E-23	7.28E-23	9.78E-23	1.74E-22
Phosphorus									
P-30	6.70E-18	6.87E-18	6.42E-18	6.36E-18	9.64E-18	6.63E-18	6.18E-18	6.58E-18	2.68E-17
P-32	1.70E-20	1.78E-20	1.53E-20	1.43E-20	3.72E-20	1.52E-20	1.45E-20	1.64E-20	5.15E-18
P-33	1.75E-22	1.93E-22	1.19E-22	9.73E-23	4.83E-22	1.25E-22	1.16E-22	1.51E-22	2.53E-22
Sulphur									
S-35	5.65E-23	6.39E-23	3.31E-23	2.61E-23	1.47E-22	3.63E-23	3.29E-23	4.62E-23	9.25E-23
Chlorine									
Cl-36	3.70E-21	3.90E-21	3.24E-21	2.99E-21	8.43E-21	3.25E-21	3.08E-21	3.53E-21	1.70E-19
Cl-38	8.95E-18	8.98E-18	8.68E-18	8.84E-18	1.12E-17	8.56E-18	8.43E-18	8.81E-18	3.15E-17
Cl-39	8.83E-18	9.03E-18	8.62E-18	8.69E-18	1.17E-17	8.69E-18	8.32E-18	8.75E-18	1.74E-17
Argon									
Ar-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar-39	1.69E-21	1.80E-21	1.39E-21	1.22E-21	4.50E-21	1.38E-21	1.32E-21	1.57E-21	2.06E-20
Ar-41	7.85E-18	8.04E-18	7.69E-18	7.77E-18	1.01E-17	7.82E-18	7.43E-18	7.79E-18	1.06E-17
Potassium									
K-38	1.94E-17	1.96E-17	1.87E-17	1.89E-17	2.54E-17	1.87E-17	1.81E-17	1.91E-17	3.60E-17
K-40	9.60E-19	9.77E-19	9.36E-19	9.48E-19	1.23E-18	9.41E-19	9.06E-19	9.50E-19	4.06E-18
K-42	1.75E-18	1.78E-18	1.70E-18	1.72E-18	2.26E-18	1.70E-18	1.65E-18	1.73E-18	2.15E-17
K-43	6.26E-18	6.44E-18	6.02E-18	5.97E-18	9.12E-18	6.19E-18	5.79E-18	6.16E-18	7.52E-18
K-44	1.35E-17	1.36E-17	1.32E-17	1.34E-17	1.72E-17	1.32E-17	1.27E-17	1.33E-17	3.51E-17
K-45	1.12E-17	1.13E-17	1.09E-17	1.10E-17	1.49E-17	1.08E-17	1.06E-17	1.11E-17	2.28E-17
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	1.82E-22	2.01E-22	1.26E-22	1.03E-22	5.05E-22	1.31E-22	1.21E-22	1.59E-22	2.63E-22
Ca-47	6.52E-18	6.68E-18	6.38E-18	6.44E-18	8.47E-18	6.50E-18	6.17E-18	6.47E-18	8.69E-18
Ca-49	1.79E-17	1.76E-17	1.73E-17	1.77E-17	2.19E-17	1.70E-17	1.68E-17	1.75E-17	2.74E-17
Scandium									
Sc-43	7.12E-18	7.31E-18	6.82E-18	6.74E-18	1.04E-17	7.01E-18	6.56E-18	6.99E-18	8.70E-18
Sc-44m	1.79E-18	1.86E-18	1.72E-18	1.70E-18	2.99E-18	1.71E-18	1.64E-18	1.77E-18	2.02E-18
Sc-44	1.35E-17	1.38E-17	1.31E-17	1.31E-17	1.84E-17	1.35E-17	1.26E-17	1.33E-17	1.88E-17
Sc-46	1.25E-17	1.29E-17	1.22E-17	1.23E-17	1.65E-17	1.26E-17	1.18E-17	1.24E-17	1.41E-17
Sc-47	6.83E-19	7.09E-19	6.48E-19	6.21E-19	1.52E-18	6.23E-19	6.13E-19	6.77E-19	7.66E-19
Sc-48	2.06E-17	2.12E-17	2.02E-17	2.04E-17	2.71E-17	2.08E-17	1.95E-17	2.05E-17	2.34E-17
Sc-49	2.99E-20	3.10E-20	2.76E-20	2.64E-20	5.79E-20	2.75E-20	2.63E-20	2.90E-20	7.43E-18

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	7.54E-19	7.92E-19	6.93E-19	5.80E-19	2.59E-18	6.66E-19	6.43E-19	7.51E-19	8.36E-19
Ti-45	5.65E-18	5.79E-18	5.42E-18	5.36E-18	8.10E-18	5.60E-18	5.22E-18	5.55E-18	7.38E-18
Vanadium									
V-47	6.47E-18	6.64E-18	6.21E-18	6.15E-18	9.29E-18	6.41E-18	5.98E-18	6.36E-18	1.43E-17
V-48	1.81E-17	1.86E-17	1.77E-17	1.77E-17	2.40E-17	1.81E-17	1.70E-17	1.79E-17	2.04E-17
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	2.78E-18	2.87E-18	2.64E-18	2.56E-18	5.32E-18	2.61E-18	2.52E-18	2.74E-18	3.10E-18
Cr-49	6.81E-18	6.98E-18	6.51E-18	6.40E-18	1.06E-17	6.68E-18	6.25E-18	6.69E-18	1.13E-17
Cr-51	2.04E-19	2.11E-19	1.94E-19	1.92E-19	3.33E-19	1.95E-19	1.87E-19	2.01E-19	2.30E-19
Manganese									
Mn-51	6.50E-18	6.66E-18	6.23E-18	6.17E-18	9.34E-18	6.44E-18	6.00E-18	6.39E-18	1.68E-17
Mn-52m	1.51E-17	1.54E-17	1.46E-17	1.47E-17	2.03E-17	1.49E-17	1.41E-17	1.49E-17	3.03E-17
Mn-52	2.15E-17	2.20E-17	2.09E-17	2.11E-17	2.84E-17	2.15E-17	2.02E-17	2.13E-17	2.41E-17
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	5.24E-18	5.42E-18	5.13E-18	5.13E-18	7.07E-18	5.34E-18	4.94E-18	5.21E-18	5.95E-18
Mn-56	1.04E-17	1.06E-17	1.01E-17	1.02E-17	1.35E-17	1.02E-17	9.76E-18	1.02E-17	2.02E-17
Iron									
Fe-52	4.77E-18	4.91E-18	4.56E-18	4.49E-18	7.61E-18	4.64E-18	4.38E-18	4.70E-18	5.55E-18
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-59	7.30E-18	7.51E-18	7.16E-18	7.22E-18	9.54E-18	7.33E-18	6.91E-18	7.26E-18	8.22E-18
Fe-60	4.72E-23	5.39E-23	2.57E-23	2.01E-23	1.18E-22	2.89E-23	2.60E-23	3.76E-23	8.12E-23
Cobalt									
Co-55	1.26E-17	1.29E-17	1.22E-17	1.22E-17	1.73E-17	1.26E-17	1.18E-17	1.25E-17	1.64E-17
Co-56	2.17E-17	2.20E-17	2.11E-17	2.13E-17	2.80E-17	2.14E-17	2.04E-17	2.14E-17	2.47E-17
Co-57	7.47E-19	7.65E-19	7.03E-19	6.57E-19	1.92E-18	6.74E-19	6.60E-19	7.41E-19	8.16E-19
Co-58m	2.20E-23	2.63E-23	4.05E-24	4.16E-24	2.81E-23	7.86E-24	6.38E-24	1.34E-23	4.45E-23
Co-58	6.16E-18	6.36E-18	6.00E-18	5.99E-18	8.40E-18	6.24E-18	5.77E-18	6.10E-18	6.97E-18
Co-60m	2.73E-20	2.82E-20	2.59E-20	2.49E-20	4.99E-20	2.61E-20	2.48E-20	2.69E-20	3.98E-20
Co-60	1.53E-17	1.57E-17	1.50E-17	1.52E-17	1.98E-17	1.53E-17	1.45E-17	1.52E-17	1.72E-17
Co-61	5.28E-19	5.55E-19	4.93E-19	4.40E-19	1.42E-18	4.91E-19	4.62E-19	5.23E-19	2.40E-18
Co-62m	1.65E-17	1.68E-17	1.61E-17	1.63E-17	2.12E-17	1.64E-17	1.56E-17	1.63E-17	3.03E-17
Nickel									
Ni-56	1.08E-17	1.12E-17	1.05E-17	1.05E-17	1.58E-17	1.08E-17	1.01E-17	1.07E-17	1.22E-17
Ni-57	1.18E-17	1.20E-17	1.15E-17	1.16E-17	1.56E-17	1.16E-17	1.11E-17	1.17E-17	1.33E-17
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	3.37E-18	3.44E-18	3.29E-18	3.33E-18	4.37E-18	3.33E-18	3.18E-18	3.34E-18	8.96E-18
Ni-66	1.33E-22	1.47E-22	8.85E-23	7.17E-23	3.65E-22	9.33E-23	8.61E-23	1.14E-22	1.97E-22
Copper									
Cu-60	2.39E-17	2.43E-17	2.32E-17	2.34E-17	3.15E-17	2.35E-17	2.24E-17	2.36E-17	3.59E-17
Cu-61	5.34E-18	5.48E-18	5.13E-18	5.08E-18	7.69E-18	5.29E-18	4.94E-18	5.25E-18	7.22E-18
Cu-62	6.58E-18	6.75E-18	6.31E-18	6.25E-18	9.46E-18	6.52E-18	6.08E-18	6.47E-18	2.38E-17
Cu-64	1.23E-18	1.26E-18	1.18E-18	1.17E-18	1.75E-18	1.21E-18	1.13E-18	1.21E-18	1.40E-18
Cu-66	5.65E-19	5.84E-19	5.52E-19	5.53E-19	7.74E-19	5.70E-19	5.32E-19	5.61E-19	1.28E-17
Cu-67	7.20E-19	7.49E-19	6.82E-19	6.52E-19	1.60E-18	6.59E-19	6.46E-19	7.14E-19	8.07E-19
Zinc									
Zn-62	2.79E-18	2.87E-18	2.67E-18	2.64E-18	4.07E-18	2.76E-18	2.57E-18	2.74E-18	3.16E-18
Zn-63	7.13E-18	7.31E-18	6.85E-18	6.79E-18	1.01E-17	7.07E-18	6.59E-18	7.01E-18	1.76E-17
Zn-65	3.58E-18	3.69E-18	3.52E-18	3.54E-18	4.71E-18	3.62E-18	3.40E-18	3.57E-18	4.04E-18
Zn-69m	2.71E-18	2.78E-18	2.59E-18	2.56E-18	4.03E-18	2.66E-18	2.49E-18	2.66E-18	3.05E-18
Zn-69	3.84E-21	4.07E-21	3.30E-21	2.99E-21	9.59E-21	3.28E-21	3.13E-21	3.65E-21	4.84E-19
Zn-71m	9.99E-18	1.03E-17	9.61E-18	9.54E-18	1.44E-17	9.90E-18	9.25E-18	9.84E-18	1.44E-17
Zn-72	9.18E-19	9.49E-19	8.67E-19	8.23E-19	2.16E-18	8.33E-19	8.18E-19	9.10E-19	1.02E-18
Gallium									
Ga-65	7.57E-18	7.76E-18	7.26E-18	7.16E-18	1.15E-17	7.46E-18	6.97E-18	7.45E-18	1.62E-17
Ga-66	1.48E-17	1.49E-17	1.43E-17	1.45E-17	1.92E-17	1.45E-17	1.38E-17	1.46E-17	3.05E-17
Ga-67	9.65E-19	9.99E-19	9.16E-19	8.79E-19	2.01E-18	9.00E-19	8.69E-19	9.55E-19	1.08E-18
Ga-68	6.17E-18	6.33E-18	5.92E-18	5.87E-18	8.83E-18	6.12E-18	5.70E-18	6.07E-18	1.34E-17
Ga-70	6.18E-20	6.41E-20	5.94E-20	5.87E-20	9.77E-20	6.07E-20	5.70E-20	6.11E-20	4.52E-18
Ga-72	1.65E-17	1.67E-17	1.60E-17	1.62E-17	2.13E-17	1.62E-17	1.55E-17	1.63E-17	2.18E-17
Ga-73	2.00E-18	2.07E-18	1.91E-18	1.88E-18	3.34E-18	1.91E-18	1.83E-18	1.97E-18	3.91E-18

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	4.36E-18	4.49E-18	4.16E-18	4.10E-18	6.77E-18	4.25E-18	4.00E-18	4.29E-18	5.05E-18
Ge-67	9.04E-18	9.27E-18	8.69E-18	8.62E-18	1.33E-17	8.89E-18	8.36E-18	8.90E-18	2.71E-17
Ge-68	5.68E-24	1.48E-23	1.35E-26	3.75E-25	2.28E-24	5.32E-25	1.65E-24	4.26E-24	4.59E-22
Ge-69	5.51E-18	5.66E-18	5.34E-18	5.34E-18	7.57E-18	5.51E-18	5.14E-18	5.44E-18	6.90E-18
Ge-71	5.75E-24	1.49E-23	1.36E-26	3.80E-25	2.31E-24	5.39E-25	1.67E-24	4.31E-24	4.65E-22
Ge-75	2.26E-19	2.35E-19	2.15E-19	2.11E-19	3.99E-19	2.13E-19	2.06E-19	2.23E-19	1.64E-18
Ge-77	6.88E-18	7.10E-18	6.64E-18	6.61E-18	1.03E-17	6.74E-18	6.38E-18	6.80E-18	1.29E-17
Ge-78	1.79E-18	1.87E-18	1.71E-18	1.69E-18	3.09E-18	1.70E-18	1.64E-18	1.77E-18	2.12E-18
Arsenic									
As-69	6.62E-18	6.79E-18	6.34E-18	6.28E-18	9.61E-18	6.54E-18	6.11E-18	6.50E-18	2.36E-17
As-70	2.55E-17	2.61E-17	2.48E-17	2.49E-17	3.41E-17	2.53E-17	2.39E-17	2.52E-17	3.73E-17
As-71	3.65E-18	3.76E-18	3.50E-18	3.45E-18	5.88E-18	3.54E-18	3.35E-18	3.60E-18	4.21E-18
As-72	1.14E-17	1.17E-17	1.11E-17	1.10E-17	1.58E-17	1.14E-17	1.06E-17	1.13E-17	2.49E-17
As-73	2.91E-20	3.15E-20	2.38E-20	1.78E-20	1.02E-19	2.37E-20	2.19E-20	2.73E-20	3.54E-20
As-74	4.89E-18	5.02E-18	4.70E-18	4.67E-18	6.89E-18	4.87E-18	4.53E-18	4.81E-18	6.44E-18
As-76	2.77E-18	2.84E-18	2.68E-18	2.67E-18	3.82E-18	2.76E-18	2.58E-18	2.73E-18	1.56E-17
As-77	5.83E-20	6.05E-20	5.55E-20	5.44E-20	1.01E-19	5.55E-20	5.31E-20	5.75E-20	1.42E-19
As-78	7.84E-18	8.00E-18	7.61E-18	7.65E-18	1.04E-17	7.77E-18	7.35E-18	7.74E-18	2.70E-17
Selenium									
Se-70	6.40E-18	6.58E-18	6.12E-18	6.03E-18	9.63E-18	6.29E-18	5.88E-18	6.29E-18	9.95E-18
Se-73m	1.58E-18	1.62E-18	1.51E-18	1.50E-18	2.28E-18	1.56E-18	1.45E-18	1.55E-18	3.00E-18
Se-73	6.99E-18	7.19E-18	6.68E-18	6.56E-18	1.09E-17	6.84E-18	6.41E-18	6.87E-18	9.62E-18
Se-75	2.48E-18	2.57E-18	2.36E-18	2.29E-18	4.77E-18	2.32E-18	2.25E-18	2.45E-18	2.78E-18
Se-77m	5.35E-19	5.55E-19	5.07E-19	4.87E-19	1.18E-18	4.88E-19	4.80E-19	5.30E-19	5.98E-19
Se-79	7.04E-23	7.95E-23	4.15E-23	3.27E-23	1.84E-22	4.54E-23	4.12E-23	5.77E-23	1.14E-22
Se-81m	8.27E-20	8.46E-20	7.72E-20	7.03E-20	2.34E-19	7.39E-20	7.22E-20	8.20E-20	9.56E-20
Se-81	7.26E-20	7.53E-20	6.90E-20	6.77E-20	1.21E-19	6.99E-20	6.61E-20	7.14E-20	4.00E-18
Se-83	1.51E-17	1.55E-17	1.47E-17	1.47E-17	2.07E-17	1.49E-17	1.41E-17	1.49E-17	2.00E-17
Bromine									
Br-74m	2.51E-17	2.54E-17	2.43E-17	2.44E-17	3.34E-17	2.47E-17	2.34E-17	2.47E-17	4.73E-17
Br-74	2.71E-17	2.71E-17	2.61E-17	2.64E-17	3.52E-17	2.63E-17	2.53E-17	2.66E-17	4.32E-17
Br-75	7.85E-18	8.08E-18	7.53E-18	7.45E-18	1.18E-17	7.70E-18	7.24E-18	7.73E-18	1.26E-17
Br-76	1.62E-17	1.64E-17	1.56E-17	1.57E-17	2.15E-17	1.58E-17	1.51E-17	1.59E-17	2.66E-17
Br-77	2.02E-18	2.09E-18	1.94E-18	1.92E-18	3.10E-18	1.98E-18	1.87E-18	2.00E-18	2.29E-18
Br-80m	6.08E-20	6.94E-20	3.22E-20	2.28E-20	1.53E-19	3.73E-20	3.25E-20	4.77E-20	9.49E-20
Br-80	5.15E-19	5.29E-19	4.96E-19	4.92E-19	7.26E-19	5.14E-19	4.78E-19	5.07E-19	1.46E-18
Br-82	1.66E-17	1.71E-17	1.62E-17	1.62E-17	2.24E-17	1.67E-17	1.56E-17	1.64E-17	1.87E-17
Br-83	5.25E-20	5.39E-20	5.00E-20	4.92E-20	7.88E-20	5.16E-20	4.81E-20	5.14E-20	5.68E-19
Br-84	1.07E-17	1.07E-17	1.03E-17	1.05E-17	1.35E-17	1.04E-17	1.00E-17	1.05E-17	2.79E-17
Krypton									
Kr-74	7.54E-18	7.75E-18	7.22E-18	7.10E-18	1.18E-17	7.38E-18	6.93E-18	7.42E-18	1.58E-17
Kr-76	2.74E-18	2.84E-18	2.61E-18	2.57E-18	4.51E-18	2.63E-18	2.50E-18	2.70E-18	3.10E-18
Kr-77	6.55E-18	6.72E-18	6.26E-18	6.15E-18	1.05E-17	6.39E-18	6.01E-18	6.44E-18	1.25E-17
Kr-79	1.62E-18	1.67E-18	1.55E-18	1.54E-18	2.44E-18	1.59E-18	1.49E-18	1.59E-18	1.83E-18
Kr-81m	8.15E-19	8.52E-19	7.75E-19	7.53E-19	1.65E-18	7.50E-19	7.38E-19	8.08E-19	9.20E-19
Kr-81	3.59E-20	3.77E-20	3.39E-20	3.35E-20	6.15E-20	3.36E-20	3.26E-20	3.53E-20	4.88E-20
Kr-83m	2.47E-22	4.10E-22	2.42E-23	3.27E-23	2.08E-22	4.41E-23	5.92E-23	1.55E-22	3.46E-21
Kr-85m	9.98E-19	1.03E-18	9.47E-19	9.12E-19	2.12E-18	9.20E-19	8.98E-19	9.88E-19	1.36E-18
Kr-85	1.67E-20	1.72E-20	1.57E-20	1.54E-20	2.66E-20	1.61E-20	1.51E-20	1.63E-20	1.34E-19
Kr-87	4.87E-18	4.92E-18	4.70E-18	4.74E-18	6.50E-18	4.70E-18	4.54E-18	4.79E-18	2.30E-17
Kr-88	1.16E-17	1.17E-17	1.13E-17	1.14E-17	1.48E-17	1.11E-17	1.09E-17	1.14E-17	1.53E-17
Rubidium									
Rb-79	8.75E-18	8.99E-18	8.40E-18	8.31E-18	1.30E-17	8.65E-18	8.08E-18	8.62E-18	1.74E-17
Rb-80	8.21E-18	8.42E-18	7.88E-18	7.80E-18	1.17E-17	8.14E-18	7.59E-18	8.07E-18	4.01E-17
Rb-81m	2.55E-20	2.69E-20	2.30E-20	2.01E-20	7.94E-20	2.20E-20	2.15E-20	2.50E-20	3.77E-20
Rb-81	3.97E-18	4.09E-18	3.81E-18	3.76E-18	6.19E-18	3.88E-18	3.66E-18	3.91E-18	4.86E-18
Rb-82m	1.83E-17	1.88E-17	1.78E-17	1.78E-17	2.47E-17	1.83E-17	1.71E-17	1.81E-17	2.08E-17
Rb-82	7.14E-18	7.32E-18	6.85E-18	6.79E-18	1.02E-17	7.08E-18	6.60E-18	7.02E-18	2.71E-17
Rb-83	3.22E-18	3.30E-18	3.09E-18	3.06E-18	4.58E-18	3.19E-18	2.97E-18	3.16E-18	3.63E-18
Rb-84	5.77E-18	5.96E-18	5.62E-18	5.61E-18	7.90E-18	5.83E-18	5.41E-18	5.72E-18	6.76E-18
Rb-86	6.01E-19	6.20E-19	5.89E-19	5.91E-19	8.05E-19	6.07E-19	5.68E-19	5.98E-19	5.90E-18
Rb-87	3.71E-22	4.05E-22	2.70E-22	2.24E-22	1.04E-21	2.77E-22	2.59E-22	3.30E-22	5.11E-22

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	3.94E-18	3.98E-18	3.82E-18	3.88E-18	5.05E-18	3.82E-18	3.70E-18	3.88E-18	3.58E-17
Rb-89	1.26E-17	1.28E-17	1.23E-17	1.24E-17	1.62E-17	1.24E-17	1.19E-17	1.24E-17	2.57E-17
Strontium									
Sr-80	1.13E-21	1.90E-21	6.86E-24	9.87E-23	5.68E-22	8.60E-23	1.86E-22	6.55E-22	1.48E-20
Sr-81	8.95E-18	9.19E-18	8.59E-18	8.49E-18	1.35E-17	8.81E-18	8.25E-18	8.81E-18	2.15E-17
Sr-82	1.11E-21	1.87E-21	6.74E-24	9.71E-23	5.58E-22	8.46E-23	1.83E-22	6.44E-22	1.45E-20
Sr-83	5.02E-18	5.16E-18	4.86E-18	4.84E-18	7.02E-18	5.00E-18	4.68E-18	4.96E-18	6.16E-18
Sr-85m	1.39E-18	1.45E-18	1.33E-18	1.30E-18	2.63E-18	1.30E-18	1.27E-18	1.38E-18	1.57E-18
Sr-85	3.27E-18	3.35E-18	3.13E-18	3.10E-18	4.68E-18	3.24E-18	3.02E-18	3.21E-18	3.69E-18
Sr-87m	2.07E-18	2.13E-18	1.98E-18	1.95E-18	3.19E-18	2.02E-18	1.90E-18	2.04E-18	2.34E-18
Sr-89	1.31E-20	1.38E-20	1.18E-20	1.11E-20	2.90E-20	1.18E-20	1.12E-20	1.27E-20	3.66E-18
Sr-90	1.40E-21	1.50E-21	1.14E-21	1.00E-21	3.76E-21	1.14E-21	1.09E-21	1.31E-21	1.22E-20
Sr-91	4.38E-18	4.52E-18	4.28E-18	4.29E-18	5.89E-18	4.43E-18	4.12E-18	4.35E-18	1.03E-17
Sr-92	8.17E-18	8.35E-18	7.99E-18	8.08E-18	1.05E-17	8.08E-18	7.73E-18	8.10E-18	9.37E-18
Yttrium									
Y-86m	1.40E-18	1.46E-18	1.33E-18	1.31E-18	2.62E-18	1.30E-18	1.27E-18	1.38E-18	1.60E-18
Y-86	2.22E-17	2.27E-17	2.16E-17	2.17E-17	2.95E-17	2.20E-17	2.08E-17	2.19E-17	2.64E-17
Y-87	2.91E-18	2.99E-18	2.79E-18	2.76E-18	4.23E-18	2.88E-18	2.69E-18	2.86E-18	3.30E-18
Y-88	1.63E-17	1.65E-17	1.58E-17	1.60E-17	2.08E-17	1.59E-17	1.53E-17	1.61E-17	1.80E-17
Y-90m	4.05E-18	4.18E-18	3.87E-18	3.81E-18	6.53E-18	3.92E-18	3.72E-18	3.99E-18	4.58E-18
Y-90	3.19E-20	3.33E-20	2.93E-20	2.79E-20	6.52E-20	2.94E-20	2.79E-20	3.10E-20	9.79E-18
Y-91m	3.42E-18	3.51E-18	3.29E-18	3.27E-18	4.83E-18	3.41E-18	3.17E-18	3.37E-18	3.91E-18
Y-91	3.56E-20	3.69E-20	3.38E-20	3.32E-20	5.88E-20	3.43E-20	3.24E-20	3.50E-20	4.00E-18
Y-92	1.64E-18	1.69E-18	1.60E-18	1.61E-18	2.22E-18	1.64E-18	1.54E-18	1.63E-18	2.18E-17
Y-93	5.97E-19	6.11E-19	5.77E-19	5.78E-19	8.54E-19	5.79E-19	5.56E-19	5.89E-19	1.51E-17
Y-94	6.96E-18	7.15E-18	6.80E-18	6.84E-18	9.23E-18	6.98E-18	6.56E-18	6.90E-18	3.20E-17
Y-95	5.34E-18	5.35E-18	5.18E-18	5.26E-18	6.74E-18	5.16E-18	5.01E-18	5.25E-18	2.78E-17
Zirconium									
Zr-86	1.72E-18	1.79E-18	1.63E-18	1.60E-18	3.02E-18	1.61E-18	1.56E-18	1.69E-18	1.99E-18
Zr-88	2.56E-18	2.63E-18	2.44E-18	2.41E-18	3.92E-18	2.49E-18	2.35E-18	2.51E-18	2.90E-18
Zr-89	7.28E-18	7.52E-18	7.10E-18	7.11E-18	9.88E-18	7.37E-18	6.84E-18	7.22E-18	8.47E-18
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	4.69E-18	4.84E-18	4.56E-18	4.55E-18	6.38E-18	4.75E-18	4.39E-18	4.64E-18	5.31E-18
Zr-97	1.14E-18	1.16E-18	1.10E-18	1.11E-18	1.55E-18	1.13E-18	1.06E-18	1.12E-18	6.92E-18
Niobium									
Nb-88	2.61E-17	2.68E-17	2.53E-17	2.53E-17	3.61E-17	2.61E-17	2.44E-17	2.58E-17	4.43E-17
Nb-89b[1]	8.70E-18	8.84E-18	8.38E-18	8.40E-18	1.19E-17	8.52E-18	8.09E-18	8.55E-18	2.48E-17
Nb-89a[2]	1.25E-17	1.28E-17	1.20E-17	1.19E-17	1.77E-17	1.24E-17	1.15E-17	1.23E-17	2.24E-17
Nb-90	2.55E-17	2.57E-17	2.47E-17	2.49E-17	3.34E-17	2.47E-17	2.39E-17	2.51E-17	3.03E-17
Nb-93m	1.03E-21	1.41E-21	2.52E-23	1.13E-22	6.72E-22	1.38E-22	1.59E-22	5.59E-22	5.28E-21
Nb-94	9.93E-18	1.03E-17	9.69E-18	9.69E-18	1.35E-17	1.01E-17	9.33E-18	9.85E-18	1.13E-17
Nb-95m	3.92E-19	4.11E-19	3.71E-19	3.64E-19	7.18E-19	3.63E-19	3.54E-19	3.87E-19	4.60E-19
Nb-95	4.84E-18	5.00E-18	4.72E-18	4.72E-18	6.58E-18	4.92E-18	4.54E-18	4.80E-18	5.49E-18
Nb-96	1.56E-17	1.60E-17	1.52E-17	1.52E-17	2.11E-17	1.57E-17	1.46E-17	1.54E-17	1.77E-17
Nb-97m	4.62E-18	4.76E-18	4.49E-18	4.49E-18	6.28E-18	4.68E-18	4.32E-18	4.57E-18	5.31E-18
Nb-97	4.20E-18	4.32E-18	4.07E-18	4.05E-18	5.79E-18	4.23E-18	3.92E-18	4.15E-18	6.69E-18
Nb-98	1.52E-17	1.56E-17	1.48E-17	1.48E-17	2.03E-17	1.52E-17	1.42E-17	1.50E-17	2.60E-17
Molybdenum									
Mo-90	5.18E-18	5.34E-18	4.97E-18	4.90E-18	8.41E-18	5.01E-18	4.76E-18	5.11E-18	6.24E-18
Mo-93m	1.39E-17	1.42E-17	1.35E-17	1.36E-17	1.85E-17	1.37E-17	1.30E-17	1.37E-17	1.55E-17
Mo-93	5.87E-21	8.04E-21	1.42E-22	6.39E-22	3.81E-21	7.81E-22	9.02E-22	3.18E-21	3.00E-20
Mo-99	9.52E-19	9.84E-19	9.22E-19	9.15E-19	1.41E-18	9.51E-19	8.85E-19	9.42E-19	2.43E-18
Mo-101	8.45E-18	8.64E-18	8.22E-18	8.26E-18	1.13E-17	8.34E-18	7.93E-18	8.36E-18	1.36E-17
Technetium									
Tc-93m	4.33E-18	4.35E-18	4.16E-18	4.21E-18	5.79E-18	4.14E-18	4.03E-18	4.25E-18	4.74E-18
Tc-93	8.80E-18	8.97E-18	8.59E-18	8.70E-18	1.12E-17	8.66E-18	8.32E-18	8.71E-18	9.82E-18
Tc-94m	1.17E-17	1.20E-17	1.13E-17	1.13E-17	1.59E-17	1.16E-17	1.09E-17	1.15E-17	2.15E-17
Tc-94	1.68E-17	1.73E-17	1.64E-17	1.64E-17	2.27E-17	1.70E-17	1.57E-17	1.66E-17	1.91E-17
Tc-95m	4.21E-18	4.36E-18	4.08E-18	4.05E-18	6.23E-18	4.18E-18	3.91E-18	4.17E-18	4.80E-18

[1] $T_{½}$ = 122 m

[2] $T_{½}$ = 66 m

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Technetium, cont'd									
Tc-95	4.96E-18	5.13E-18	4.83E-18	4.83E-18	6.72E-18	5.03E-18	4.65E-18	4.92E-18	5.65E-18
Tc-96m	2.85E-19	2.95E-19	2.73E-19	2.75E-19	3.79E-19	2.83E-19	2.64E-19	2.80E-19	3.37E-19
Tc-96	1.57E-17	1.62E-17	1.53E-17	1.53E-17	2.12E-17	1.59E-17	1.48E-17	1.56E-17	1.78E-17
Tc-97m	1.00E-20	1.24E-20	2.10E-21	2.53E-21	1.16E-20	3.18E-21	2.99E-21	6.26E-21	3.21E-20
Tc-97	8.07E-21	1.06E-20	2.79E-22	9.26E-22	5.61E-21	1.29E-21	1.30E-21	4.35E-21	3.45E-20
Tc-98	9.00E-18	9.27E-18	8.74E-18	8.71E-18	1.23E-17	9.09E-18	8.41E-18	8.90E-18	1.02E-17
Tc-99m	7.84E-19	8.07E-19	7.40E-19	7.00E-19	1.88E-18	7.10E-19	6.97E-19	7.76E-19	8.64E-19
Tc-99	3.29E-22	3.59E-22	2.39E-22	1.99E-22	9.20E-22	2.46E-22	2.30E-22	2.92E-22	4.53E-22
Tc-101	2.16E-18	2.24E-18	2.07E-18	2.04E-18	3.54E-18	2.08E-18	1.98E-18	2.13E-18	4.49E-18
Tc-104	1.22E-17	1.24E-17	1.19E-17	1.19E-17	1.65E-17	1.19E-17	1.14E-17	1.21E-17	3.62E-17
Ruthenium									
Ru-94	3.34E-18	3.45E-18	3.22E-18	3.20E-18	4.85E-18	3.31E-18	3.10E-18	3.30E-18	3.80E-18
Ru-97	1.46E-18	1.53E-18	1.38E-18	1.36E-18	2.69E-18	1.36E-18	1.32E-18	1.44E-18	1.68E-18
Ru-103	3.04E-18	3.12E-18	2.91E-18	2.88E-18	4.38E-18	3.01E-18	2.81E-18	2.99E-18	3.43E-18
Ru-105	5.01E-18	5.16E-18	4.85E-18	4.83E-18	7.09E-18	5.02E-18	4.66E-18	4.95E-18	6.91E-18
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	4.28E-18	4.41E-18	4.12E-18	4.11E-18	6.17E-18	4.21E-18	3.97E-18	4.22E-18	4.87E-18
Rh-99	3.78E-18	3.89E-18	3.62E-18	3.56E-18	5.98E-18	3.69E-18	3.47E-18	3.72E-18	4.30E-18
Rh-100	1.68E-17	1.70E-17	1.63E-17	1.64E-17	2.18E-17	1.63E-17	1.57E-17	1.65E-17	1.93E-17
Rh-101m	1.91E-18	1.98E-18	1.81E-18	1.79E-18	3.13E-18	1.82E-18	1.74E-18	1.88E-18	2.19E-18
Rh-101	1.62E-18	1.68E-18	1.52E-18	1.47E-18	3.38E-18	1.48E-18	1.44E-18	1.59E-18	1.84E-18
Rh-102m	3.09E-18	3.17E-18	2.96E-18	2.94E-18	4.41E-18	3.06E-18	2.86E-18	3.04E-18	4.22E-18
Rh-102	1.35E-17	1.39E-17	1.31E-17	1.31E-17	1.86E-17	1.36E-17	1.26E-17	1.34E-17	1.53E-17
Rh-103m	2.21E-21	2.70E-21	2.43E-22	3.42E-22	2.19E-21	5.95E-22	4.99E-22	1.26E-21	6.13E-21
Rh-105	5.03E-19	5.21E-19	4.80E-19	4.74E-19	8.28E-19	4.81E-19	4.60E-19	4.96E-19	5.75E-19
Rh-106m	1.83E-17	1.88E-17	1.78E-17	1.78E-17	2.49E-17	1.83E-17	1.71E-17	1.81E-17	2.10E-17
Rh-106	1.38E-18	1.42E-18	1.33E-18	1.32E-18	1.97E-18	1.38E-18	1.28E-18	1.36E-18	2.06E-17
Rh-107	2.02E-18	2.10E-18	1.93E-18	1.91E-18	3.29E-18	1.94E-18	1.85E-18	1.99E-18	3.99E-18
Palladium									
Pd-100	6.41E-19	6.73E-19	5.70E-19	4.96E-19	1.99E-18	5.52E-19	5.34E-19	6.26E-19	7.58E-19
Pd-101	2.02E-18	2.09E-18	1.92E-18	1.91E-18	2.92E-18	1.97E-18	1.85E-18	1.98E-18	2.35E-18
Pd-103	1.91E-20	2.32E-20	2.17E-21	3.22E-21	1.73E-20	5.21E-21	4.40E-21	1.09E-20	5.33E-20
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	4.12E-20	4.50E-20	2.74E-20	2.54E-20	9.12E-20	2.91E-20	2.72E-20	3.52E-20	8.91E-19
Silver									
Ag-102	2.09E-17	2.13E-17	2.02E-17	2.03E-17	2.81E-17	2.06E-17	1.95E-17	2.06E-17	3.27E-17
Ag-103	4.81E-18	4.94E-18	4.62E-18	4.59E-18	7.15E-18	4.72E-18	4.44E-18	4.74E-18	7.10E-18
Ag-104m	7.37E-18	7.51E-18	7.09E-18	7.09E-18	1.01E-17	7.25E-18	6.84E-18	7.24E-18	1.41E-17
Ag-104	1.68E-17	1.73E-17	1.63E-17	1.63E-17	2.27E-17	1.68E-17	1.57E-17	1.66E-17	1.93E-17
Ag-105	3.28E-18	3.40E-18	3.13E-18	3.09E-18	5.08E-18	3.19E-18	3.01E-18	3.23E-18	3.75E-18
Ag-106m	1.77E-17	1.82E-17	1.71E-17	1.72E-17	2.41E-17	1.76E-17	1.65E-17	1.75E-17	1.99E-17
Ag-106	4.59E-18	4.71E-18	4.40E-18	4.35E-18	6.59E-18	4.54E-18	4.23E-18	4.51E-18	9.63E-18
Ag-108m	1.04E-17	1.07E-17	9.99E-18	9.93E-18	1.46E-17	1.04E-17	9.62E-18	1.02E-17	1.17E-17
Ag-108	1.27E-19	1.31E-19	1.21E-19	1.20E-19	1.90E-19	1.25E-19	1.17E-19	1.25E-19	4.23E-18
Ag-109m	3.23E-20	3.56E-20	1.92E-20	1.76E-20	7.34E-20	2.08E-20	1.95E-20	2.65E-20	5.24E-20
Ag-110m	1.72E-17	1.77E-17	1.68E-17	1.68E-17	2.31E-17	1.74E-17	1.62E-17	1.71E-17	1.95E-17
Ag-110	2.45E-19	2.53E-19	2.35E-19	2.33E-19	3.66E-19	2.43E-19	2.26E-19	2.42E-19	1.47E-17
Ag-111	1.75E-19	1.81E-19	1.67E-19	1.64E-19	2.89E-19	1.68E-19	1.60E-19	1.72E-19	9.94E-19
Ag-112	4.15E-18	4.23E-18	4.02E-18	4.04E-18	5.54E-18	4.10E-18	3.88E-18	4.10E-18	2.34E-17
Ag-115	4.37E-18	4.44E-18	4.22E-18	4.25E-18	6.09E-18	4.21E-18	4.07E-18	4.31E-18	1.69E-17
Cadmium									
Cd-104	1.52E-18	1.58E-18	1.44E-18	1.40E-18	2.54E-18	1.48E-18	1.38E-18	1.49E-18	1.76E-18
Cd-107	1.00E-19	1.10E-19	6.08E-20	5.95E-20	1.69E-19	6.82E-20	6.23E-20	8.19E-20	1.64E-19
Cd-109	5.83E-20	6.70E-20	2.25E-20	2.18E-20	1.01E-19	2.86E-20	2.58E-20	4.16E-20	1.14E-19
Cd-113m	1.29E-21	1.38E-21	1.05E-21	9.23E-22	3.47E-21	1.05E-21	1.00E-21	1.20E-21	1.54E-20
Cd-113	2.95E-22	3.22E-22	2.15E-22	1.79E-22	8.22E-22	2.20E-22	2.06E-22	2.62E-22	4.07E-22
Cd-115m	1.50E-19	1.55E-19	1.46E-19	1.46E-19	2.11E-19	1.50E-19	1.40E-19	1.48E-19	4.13E-18
Cd-115	1.51E-18	1.55E-18	1.44E-18	1.43E-18	2.18E-18	1.49E-18	1.39E-18	1.48E-18	2.34E-18
Cd-117m	1.24E-17	1.26E-17	1.21E-17	1.22E-17	1.60E-17	1.22E-17	1.17E-17	1.23E-17	1.42E-17
Cd-117	6.72E-18	6.88E-18	6.53E-18	6.57E-18	9.14E-18	6.61E-18	6.30E-18	6.65E-18	1.04E-17

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	4.16E-18	4.29E-18	3.99E-18	3.97E-18	6.29E-18	4.05E-18	3.84E-18	4.10E-18	4.75E-18
In-110b[1]	1.91E-17	1.97E-17	1.86E-17	1.86E-17	2.59E-17	1.93E-17	1.79E-17	1.90E-17	2.17E-17
In-110a[2]	9.86E-18	1.01E-17	9.50E-18	9.47E-18	1.36E-17	9.78E-18	9.16E-18	9.70E-18	1.76E-17
In-111	2.49E-18	2.61E-18	2.35E-18	2.29E-18	4.81E-18	2.29E-18	2.24E-18	2.45E-18	2.85E-18
In-112	1.71E-18	1.76E-18	1.63E-18	1.62E-18	2.44E-18	1.69E-18	1.57E-18	1.68E-18	2.96E-18
In-113m	1.65E-18	1.70E-18	1.56E-18	1.54E-18	2.53E-18	1.60E-18	1.51E-18	1.62E-18	1.87E-18
In-114m	5.63E-19	5.86E-19	5.27E-19	5.20E-19	8.97E-19	5.38E-19	5.07E-19	5.49E-19	6.54E-19
In-114	1.71E-20	1.76E-20	1.65E-20	1.67E-20	2.27E-20	1.68E-20	1.60E-20	1.69E-20	1.97E-20
In-115m	1.01E-18	1.05E-18	9.49E-19	9.37E-19	1.62E-18	9.59E-19	9.13E-19	9.86E-19	1.17E-18
In-115	8.55E-22	9.19E-22	6.79E-22	5.87E-22	2.34E-21	6.81E-22	6.46E-22	7.88E-22	2.00E-21
In-116m	1.51E-17	1.55E-17	1.48E-17	1.49E-17	1.98E-17	1.50E-17	1.43E-17	1.50E-17	1.75E-17
In-117m	5.70E-19	5.93E-19	5.34E-19	5.22E-19	1.03E-18	5.31E-19	5.11E-19	5.58E-19	3.13E-18
In-117	4.44E-18	4.57E-18	4.25E-18	4.19E-18	6.99E-18	4.35E-18	4.08E-18	4.37E-18	5.13E-18
In-119m	9.20E-20	9.67E-20	8.07E-20	7.91E-20	1.53E-19	8.29E-20	7.79E-20	8.71E-20	1.20E-17
In-119	4.86E-18	5.02E-18	4.73E-18	4.72E-18	6.61E-18	4.93E-18	4.55E-18	4.81E-18	9.58E-18
Tin									
Sn-110	1.86E-18	1.94E-18	1.75E-18	1.72E-18	3.17E-18	1.74E-18	1.68E-18	1.83E-18	2.14E-18
Sn-111	3.19E-18	3.26E-18	3.05E-18	3.04E-18	4.42E-18	3.13E-18	2.94E-18	3.13E-18	4.97E-18
Sn-113	6.96E-20	7.85E-20	3.62E-20	3.59E-20	1.04E-19	4.25E-20	3.85E-20	5.38E-20	1.14E-19
Sn-117m	9.25E-19	9.66E-19	8.46E-19	8.10E-19	2.03E-18	8.21E-19	8.03E-19	9.01E-19	1.06E-18
Sn-119m	2.52E-20	3.00E-20	5.06E-21	4.96E-21	3.36E-20	9.29E-21	7.58E-21	1.56E-20	5.00E-20
Sn-121m	1.39E-20	1.63E-20	4.39E-21	3.56E-21	2.41E-20	6.35E-21	5.31E-21	9.39E-21	2.38E-20
Sn-121	4.67E-22	5.06E-22	3.54E-22	3.00E-22	1.30E-21	3.59E-22	3.38E-22	4.22E-22	6.22E-22
Sn-123m	8.75E-19	9.10E-19	8.25E-19	7.90E-19	1.94E-18	7.95E-19	7.80E-19	8.65E-19	2.80E-18
Sn-123	5.28E-20	5.47E-20	5.09E-20	5.06E-20	7.93E-20	5.22E-20	4.89E-20	5.22E-20	2.88E-18
Sn-125	1.96E-18	2.01E-18	1.91E-18	1.92E-18	2.60E-18	1.96E-18	1.84E-18	1.94E-18	1.05E-17
Sn-126	2.96E-19	3.10E-19	2.57E-19	2.24E-19	9.06E-19	2.51E-19	2.42E-19	2.85E-19	3.43E-19
Sn-127	1.18E-17	1.21E-17	1.15E-17	1.15E-17	1.57E-17	1.17E-17	1.11E-17	1.17E-17	1.76E-17
Sn-128	4.10E-18	4.23E-18	3.84E-18	3.77E-18	6.30E-18	3.97E-18	3.69E-18	3.99E-18	4.73E-18
Antimony									
Sb-115	5.83E-18	5.99E-18	5.57E-18	5.52E-18	8.36E-18	5.76E-18	5.37E-18	5.72E-18	8.09E-18
Sb-116m	1.95E-17	2.00E-17	1.89E-17	1.90E-17	2.67E-17	1.94E-17	1.82E-17	1.93E-17	2.23E-17
Sb-116	1.33E-17	1.36E-17	1.29E-17	1.30E-17	1.75E-17	1.31E-17	1.25E-17	1.31E-17	1.89E-17
Sb-117	1.08E-18	1.13E-18	9.91E-19	9.55E-19	2.23E-18	9.74E-19	9.43E-19	1.05E-18	1.25E-18
Sb-118m	1.58E-17	1.63E-17	1.54E-17	1.55E-17	2.15E-17	1.58E-17	1.49E-17	1.57E-17	1.79E-17
Sb-119	5.35E-20	6.37E-20	1.12E-20	1.07E-20	7.30E-20	2.01E-20	1.64E-20	3.33E-20	1.04E-19
Sb-120b[3]	1.51E-17	1.56E-17	1.48E-17	1.48E-17	2.14E-17	1.51E-17	1.42E-17	1.50E-17	1.71E-17
Sb-120a[4]	2.89E-18	2.96E-18	2.75E-18	2.72E-18	4.13E-18	2.84E-18	2.65E-18	2.83E-18	5.52E-18
Sb-122	2.85E-18	2.93E-18	2.75E-18	2.73E-18	4.00E-18	2.84E-18	2.64E-18	2.81E-18	6.83E-18
Sb-124n[5]	1.69E-22	2.02E-22	3.17E-23	3.22E-23	2.18E-22	6.09E-23	4.95E-23	1.04E-22	3.40E-22
Sb-124m[6]	2.27E-18	2.33E-18	2.18E-18	2.17E-18	3.18E-18	2.26E-18	2.10E-18	2.23E-18	2.82E-18
Sb-124	1.12E-17	1.14E-17	1.09E-17	1.10E-17	1.48E-17	1.10E-17	1.05E-17	1.11E-17	1.50E-17
Sb-125	2.73E-18	2.81E-18	2.59E-18	2.57E-18	3.99E-18	2.68E-18	2.50E-18	2.67E-18	3.11E-18
Sb-126m	9.93E-18	1.02E-17	9.60E-18	9.55E-18	1.40E-17	9.95E-18	9.24E-18	9.80E-18	1.56E-17
Sb-126	1.81E-17	1.86E-17	1.75E-17	1.75E-17	2.51E-17	1.82E-17	1.69E-17	1.79E-17	2.15E-17
Sb-127	4.40E-18	4.54E-18	4.25E-18	4.23E-18	6.23E-18	4.40E-18	4.09E-18	4.35E-18	5.57E-18
Sb-128b[7]	1.97E-17	2.03E-17	1.91E-17	1.90E-17	2.73E-17	1.98E-17	1.84E-17	1.94E-17	2.43E-17
Sb-128a[8]	1.26E-17	1.30E-17	1.23E-17	1.22E-17	1.77E-17	1.27E-17	1.18E-17	1.25E-17	2.38E-17
Sb-129	8.96E-18	9.20E-18	8.73E-18	8.76E-18	1.20E-17	8.97E-18	8.42E-18	8.87E-18	1.23E-17
Sb-130	2.05E-17	2.12E-17	2.00E-17	1.99E-17	2.87E-17	2.05E-17	1.92E-17	2.03E-17	2.92E-17
Sb-131	1.15E-17	1.18E-17	1.12E-17	1.13E-17	1.52E-17	1.14E-17	1.08E-17	1.14E-17	1.69E-17
Tellurium									
Te-116	3.42E-19	3.64E-19	2.68E-19	2.47E-19	7.81E-19	2.76E-19	2.59E-19	3.11E-19	4.31E-19
Te-121m	1.32E-18	1.38E-18	1.24E-18	1.21E-18	2.42E-18	1.22E-18	1.18E-18	1.30E-18	1.52E-18

[1] $T_{½}$ = 4.9 h
[2] $T_{½}$ = 69.1 m
[3] $T_{½}$ = 5.76 d
[4] $T_{½}$ = 15.89 m
[5] $T_{½}$ = 20.2 m
[6] $T_{½}$ = 93 s
[7] $T_{½}$ = 9.01 h
[8] $T_{½}$ = 10.4 m

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	3.65E-18	3.76E-18	3.47E-18	3.44E-18	5.15E-18	3.61E-18	3.35E-18	3.57E-18	4.15E-18
Te-123m	8.82E-19	9.21E-19	8.10E-19	7.75E-19	1.95E-18	7.86E-19	7.68E-19	8.61E-19	1.00E-18
Te-123	5.20E-20	6.17E-20	1.32E-20	1.15E-20	7.89E-20	2.14E-20	1.76E-20	3.35E-20	9.38E-20
Te-125m	1.05E-19	1.23E-19	3.34E-20	2.70E-20	1.80E-19	4.81E-20	4.03E-20	7.08E-20	1.75E-19
Te-127m	3.31E-20	3.88E-20	1.13E-20	9.28E-21	5.79E-20	1.58E-20	1.33E-20	2.28E-20	5.87E-20
Te-127	3.34E-20	3.45E-20	3.17E-20	3.11E-20	5.35E-20	3.23E-20	3.04E-20	3.28E-20	1.12E-19
Te-129m	2.15E-19	2.25E-19	1.93E-19	1.91E-19	3.06E-19	2.04E-19	1.87E-19	2.05E-19	1.55E-18
Te-129	3.76E-19	3.89E-19	3.52E-19	3.48E-19	5.58E-19	3.63E-19	3.39E-19	3.66E-19	3.18E-18
Te-131m	8.89E-18	9.16E-18	8.65E-18	8.65E-18	1.23E-17	8.90E-18	8.32E-18	8.80E-18	1.05E-17
Te-131	2.66E-18	2.74E-18	2.56E-18	2.52E-18	4.31E-18	2.60E-18	2.45E-18	2.63E-18	8.61E-18
Te-132	1.41E-18	1.48E-18	1.30E-18	1.26E-18	2.70E-18	1.28E-18	1.24E-18	1.37E-18	1.63E-18
Te-133m	1.44E-17	1.48E-17	1.40E-17	1.41E-17	1.97E-17	1.44E-17	1.35E-17	1.43E-17	2.18E-17
Te-133	5.85E-18	6.02E-18	5.67E-18	5.67E-18	8.34E-18	5.76E-18	5.45E-18	5.79E-18	1.42E-17
Te-134	5.62E-18	5.80E-18	5.40E-18	5.34E-18	8.54E-18	5.54E-18	5.19E-18	5.54E-18	6.58E-18
Iodine									
I-120m	3.30E-17	3.36E-17	3.19E-17	3.20E-17	4.42E-17	3.26E-17	3.08E-17	3.25E-17	5.38E-17
I-120	1.69E-17	1.72E-17	1.63E-17	1.64E-17	2.27E-17	1.66E-17	1.58E-17	1.66E-17	3.94E-17
I-121	2.61E-18	2.71E-18	2.47E-18	2.43E-18	4.31E-18	2.49E-18	2.37E-18	2.56E-18	3.20E-18
I-122	6.14E-18	6.30E-18	5.89E-18	5.83E-18	8.77E-18	6.08E-18	5.67E-18	6.03E-18	2.06E-17
I-123	9.99E-19	1.04E-18	9.02E-19	8.65E-19	2.11E-18	8.86E-19	8.59E-19	9.66E-19	1.15E-18
I-124	6.85E-18	7.00E-18	6.59E-18	6.59E-18	9.28E-18	6.74E-18	6.36E-18	6.73E-18	9.31E-18
I-125	1.22E-19	1.44E-19	3.73E-20	3.00E-20	2.07E-19	5.50E-20	4.58E-20	8.19E-20	2.07E-19
I-126	2.88E-18	2.97E-18	2.76E-18	2.74E-18	4.13E-18	2.85E-18	2.66E-18	2.83E-18	3.61E-18
I-128	5.69E-19	5.85E-19	5.41E-19	5.34E-19	8.51E-19	5.56E-19	5.21E-19	5.57E-19	7.32E-18
I-129	8.31E-20	9.68E-20	3.30E-20	2.45E-20	1.68E-19	4.30E-20	3.65E-20	5.95E-20	1.28E-19
I-130	1.37E-17	1.41E-17	1.32E-17	1.32E-17	1.90E-17	1.37E-17	1.27E-17	1.35E-17	1.60E-17
I-131	2.47E-18	2.54E-18	2.36E-18	2.33E-18	3.84E-18	2.40E-18	2.26E-18	2.43E-18	2.80E-18
I-132m	2.02E-18	2.08E-18	1.94E-18	1.92E-18	2.89E-18	2.01E-18	1.87E-18	1.99E-18	2.63E-18
I-132	1.44E-17	1.48E-17	1.40E-17	1.40E-17	1.95E-17	1.45E-17	1.35E-17	1.42E-17	1.90E-17
I-133	3.90E-18	4.01E-18	3.76E-18	3.74E-18	5.49E-18	3.89E-18	3.62E-18	3.85E-18	5.85E-18
I-134	1.64E-17	1.69E-17	1.60E-17	1.61E-17	2.20E-17	1.65E-17	1.54E-17	1.63E-17	2.28E-17
I-135	9.64E-18	9.85E-18	9.42E-18	9.51E-18	1.25E-17	9.54E-18	9.10E-18	9.55E-18	1.21E-17
Xenon									
Xe-120	2.61E-18	2.71E-18	2.44E-18	2.40E-18	4.02E-18	2.52E-18	2.35E-18	2.54E-18	3.02E-18
Xe-121	1.11E-17	1.13E-17	1.07E-17	1.07E-17	1.52E-17	1.08E-17	1.03E-17	1.09E-17	1.88E-17
Xe-122	3.62E-19	3.85E-19	3.01E-19	2.90E-19	6.26E-19	3.12E-19	2.92E-19	3.35E-19	4.44E-19
Xe-123	3.92E-18	4.02E-18	3.73E-18	3.70E-18	5.96E-18	3.78E-18	3.59E-18	3.84E-18	5.34E-18
Xe-125	1.62E-18	1.70E-18	1.49E-18	1.45E-18	2.95E-18	1.49E-18	1.43E-18	1.58E-18	1.88E-18
Xe-127	1.70E-18	1.78E-18	1.57E-18	1.53E-18	3.22E-18	1.55E-18	1.50E-18	1.66E-18	1.95E-18
Xe-129m	1.97E-19	2.23E-19	1.08E-19	9.31E-20	3.90E-19	1.24E-19	1.11E-19	1.56E-19	2.82E-19
Xe-131m	7.42E-20	8.43E-20	3.83E-20	3.28E-20	1.46E-19	4.47E-20	4.00E-20	5.74E-20	1.08E-19
Xe-133m	2.05E-19	2.22E-19	1.62E-19	1.55E-19	3.82E-19	1.67E-19	1.58E-19	1.87E-19	2.58E-19
Xe-133	2.30E-19	2.46E-19	1.86E-19	1.57E-19	6.89E-19	1.85E-19	1.76E-19	2.15E-19	2.75E-19
Xe-135m	2.77E-18	2.84E-18	2.65E-18	2.62E-18	3.95E-18	2.74E-18	2.55E-18	2.71E-18	3.22E-18
Xe-135	1.59E-18	1.66E-18	1.52E-18	1.49E-18	2.81E-18	1.50E-18	1.45E-18	1.57E-18	2.23E-18
Xe-138	6.85E-18	6.93E-18	6.62E-18	6.69E-18	9.17E-18	6.58E-18	6.41E-18	6.74E-18	1.36E-17
Cesium									
Cs-125	4.33E-18	4.45E-18	4.13E-18	4.09E-18	6.27E-18	4.26E-18	3.98E-18	4.25E-18	7.87E-18
Cs-126	7.12E-18	7.31E-18	6.81E-18	6.74E-18	1.04E-17	7.02E-18	6.56E-18	6.99E-18	2.92E-17
Cs-127	2.63E-18	2.72E-18	2.48E-18	2.44E-18	4.06E-18	2.54E-18	2.38E-18	2.57E-18	3.02E-18
Cs-128	5.84E-18	5.99E-18	5.58E-18	5.53E-18	8.42E-18	5.76E-18	5.38E-18	5.73E-18	1.69E-17
Cs-129	1.72E-18	1.79E-18	1.58E-18	1.55E-18	2.69E-18	1.62E-18	1.52E-18	1.66E-18	1.99E-18
Cs-130	3.31E-18	3.40E-18	3.15E-18	3.12E-18	4.75E-18	3.26E-18	3.04E-18	3.24E-18	7.42E-18
Cs-131	7.41E-20	8.68E-20	2.67E-20	2.02E-20	1.39E-19	3.63E-20	3.06E-20	5.16E-20	1.17E-19
Cs-132	4.43E-18	4.57E-18	4.25E-18	4.23E-18	6.13E-18	4.43E-18	4.09E-18	4.36E-18	5.05E-18
Cs-134m	1.34E-19	1.42E-19	1.07E-19	9.79E-20	3.22E-19	1.08E-19	1.03E-19	1.23E-19	1.61E-19
Cs-134	9.89E-18	1.02E-17	9.60E-18	9.58E-18	1.36E-17	9.97E-18	9.24E-18	9.78E-18	1.12E-17
Cs-135m	9.98E-18	1.03E-17	9.75E-18	9.75E-18	1.35E-17	1.02E-17	9.39E-18	9.91E-18	1.16E-17
Cs-135	1.24E-22	1.38E-22	8.05E-23	6.48E-23	3.38E-22	8.55E-23	7.86E-23	1.05E-22	1.87E-22
Cs-136	1.35E-17	1.40E-17	1.32E-17	1.32E-17	1.88E-17	1.36E-17	1.27E-17	1.34E-17	1.53E-17

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	1.43E-21	1.52E-21	1.18E-21	1.04E-21	3.74E-21	1.18E-21	1.12E-21	1.34E-21	9.03E-20
Cs-138	1.44E-17	1.46E-17	1.40E-17	1.42E-17	1.87E-17	1.41E-17	1.36E-17	1.42E-17	3.08E-17
Barium									
Ba-126	9.79E-19	1.02E-18	8.90E-19	8.71E-19	1.59E-18	9.12E-19	8.58E-19	9.42E-19	1.15E-18
Ba-128	4.16E-19	4.43E-19	3.50E-19	3.37E-19	7.44E-19	3.57E-19	3.38E-19	3.87E-19	5.04E-19
Ba-131m	4.28E-19	4.44E-19	3.72E-19	3.36E-19	1.16E-18	3.63E-19	3.51E-19	4.09E-19	4.85E-19
Ba-131	2.86E-18	2.95E-18	2.67E-18	2.62E-18	4.65E-18	2.73E-18	2.57E-18	2.78E-18	3.25E-18
Ba-133m	3.75E-19	3.98E-19	3.24E-19	3.13E-19	6.74E-19	3.29E-19	3.12E-19	3.54E-19	4.47E-19
Ba-133	2.46E-18	2.57E-18	2.27E-18	2.21E-18	4.30E-18	2.30E-18	2.18E-18	2.39E-18	2.83E-18
Ba-135m	3.35E-19	3.56E-19	2.85E-19	2.74E-19	6.09E-19	2.90E-19	2.75E-19	3.14E-19	4.01E-19
Ba-137m	3.81E-18	3.92E-18	3.68E-18	3.67E-18	5.25E-18	3.83E-18	3.55E-18	3.76E-18	4.55E-18
Ba-139	2.93E-19	3.05E-19	2.75E-19	2.65E-19	6.10E-19	2.68E-19	2.61E-19	2.88E-19	9.14E-18
Ba-140	1.16E-18	1.20E-18	1.11E-18	1.09E-18	1.75E-18	1.14E-18	1.06E-18	1.14E-18	1.80E-18
Ba-141	5.34E-18	5.49E-18	5.15E-18	5.13E-18	7.98E-18	5.20E-18	4.95E-18	5.27E-18	1.49E-17
Ba-142	6.50E-18	6.71E-18	6.32E-18	6.33E-18	9.13E-18	6.49E-18	6.09E-18	6.44E-18	9.05E-18
Lanthanum									
La-131	4.25E-18	4.38E-18	4.03E-18	3.97E-18	6.58E-18	4.13E-18	3.87E-18	4.16E-18	6.11E-18
La-132	1.25E-17	1.27E-17	1.20E-17	1.21E-17	1.70E-17	1.22E-17	1.16E-17	1.23E-17	2.04E-17
La-134	4.51E-18	4.63E-18	4.31E-18	4.27E-18	6.47E-18	4.45E-18	4.15E-18	4.42E-18	1.39E-17
La-135	1.58E-19	1.74E-19	1.03E-19	9.17E-20	2.90E-19	1.15E-19	1.03E-19	1.32E-19	2.10E-19
La-137	8.69E-20	1.01E-19	3.71E-20	2.70E-20	1.85E-19	4.69E-20	4.01E-20	6.35E-20	1.29E-19
La-138	7.54E-18	7.71E-18	7.34E-18	7.41E-18	9.79E-18	7.45E-18	7.10E-18	7.46E-18	8.45E-18
La-140	1.42E-17	1.44E-17	1.38E-17	1.39E-17	1.86E-17	1.39E-17	1.33E-17	1.40E-17	1.87E-17
La-141	2.95E-19	3.01E-19	2.86E-19	2.88E-19	4.02E-19	2.88E-19	2.76E-19	2.91E-19	1.03E-17
La-142	1.64E-17	1.65E-17	1.59E-17	1.61E-17	2.08E-17	1.58E-17	1.54E-17	1.61E-17	2.65E-17
La-143	6.36E-19	6.47E-19	6.15E-19	6.19E-19	8.60E-19	6.21E-19	5.94E-19	6.27E-19	1.81E-17
Cerium									
Ce-134	9.81E-20	1.13E-19	4.53E-20	3.26E-20	2.22E-19	5.55E-20	4.77E-20	7.34E-20	1.41E-19
Ce-135	1.14E-17	1.18E-17	1.10E-17	1.09E-17	1.66E-17	1.13E-17	1.06E-17	1.13E-17	1.31E-17
Ce-137m	2.88E-19	3.08E-19	2.40E-19	2.26E-19	5.48E-19	2.46E-19	2.31E-19	2.67E-19	3.47E-19
Ce-137	1.54E-19	1.70E-19	9.81E-20	8.47E-20	3.05E-19	1.10E-19	9.78E-20	1.28E-19	2.05E-19
Ce-139	9.32E-19	9.81E-19	8.34E-19	7.90E-19	2.04E-18	8.15E-19	7.92E-19	8.98E-19	1.07E-18
Ce-141	4.64E-19	4.82E-19	4.28E-19	4.04E-19	1.09E-18	4.14E-19	4.04E-19	4.55E-19	5.22E-19
Ce-143	1.75E-18	1.83E-18	1.64E-18	1.61E-18	2.89E-18	1.67E-18	1.58E-18	1.71E-18	3.43E-18
Ce-144	1.19E-19	1.24E-19	1.05E-19	9.61E-20	3.05E-19	1.03E-19	9.94E-20	1.15E-19	1.35E-19
Praseodymium									
Pr-136	1.33E-17	1.35E-17	1.28E-17	1.27E-17	1.82E-17	1.31E-17	1.23E-17	1.30E-17	2.41E-17
Pr-137	3.17E-18	3.26E-18	3.01E-18	2.98E-18	4.58E-18	3.11E-18	2.90E-18	3.10E-18	5.03E-18
Pr-138m	1.55E-17	1.60E-17	1.51E-17	1.51E-17	2.15E-17	1.56E-17	1.45E-17	1.54E-17	1.89E-17
Pr-138	5.31E-18	5.44E-18	5.08E-18	5.03E-18	7.63E-18	5.24E-18	4.89E-18	5.21E-18	2.20E-17
Pr-139	7.20E-19	7.49E-19	6.46E-19	6.28E-19	1.12E-18	6.72E-19	6.23E-19	6.86E-19	9.66E-19
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	3.78E-19	3.84E-19	3.67E-19	3.71E-19	4.99E-19	3.66E-19	3.55E-19	3.73E-19	8.14E-18
Pr-143	3.75E-21	3.97E-21	3.22E-21	2.91E-21	9.37E-21	3.20E-21	3.05E-21	3.56E-21	5.00E-19
Pr-144m	5.18E-20	5.83E-20	3.01E-20	2.30E-20	1.25E-19	3.42E-20	3.01E-20	4.19E-20	7.16E-20
Pr-144	2.46E-19	2.50E-19	2.37E-19	2.37E-19	3.51E-19	2.38E-19	2.28E-19	2.42E-19	1.53E-17
Pr-145	9.86E-20	1.02E-19	9.46E-20	9.35E-20	1.50E-19	9.76E-20	9.08E-20	9.72E-20	5.21E-18
Pr-147	5.40E-18	5.56E-18	5.17E-18	5.12E-18	8.00E-18	5.29E-18	4.97E-18	5.31E-18	1.26E-17
Neodymium									
Nd-136	1.76E-18	1.82E-18	1.60E-18	1.54E-18	3.15E-18	1.64E-18	1.53E-18	1.69E-18	2.08E-18
Nd-138	2.07E-19	2.27E-19	1.48E-19	1.29E-19	4.50E-19	1.58E-19	1.44E-19	1.81E-19	2.62E-19
Nd-139m	9.75E-18	1.01E-17	9.43E-18	9.40E-18	1.37E-17	9.74E-18	9.08E-18	9.63E-18	1.14E-17
Nd-139	2.56E-18	2.63E-18	2.42E-18	2.39E-18	3.73E-18	2.50E-18	2.33E-18	2.50E-18	4.45E-18
Nd-141m	4.80E-18	4.96E-18	4.68E-18	4.67E-18	6.54E-18	4.87E-18	4.50E-18	4.76E-18	5.82E-18
Nd-141	4.11E-19	4.35E-19	3.49E-19	3.30E-19	6.99E-19	3.66E-19	3.36E-19	3.82E-19	5.00E-19
Nd-147	8.56E-19	8.86E-19	7.88E-19	7.52E-19	1.60E-18	8.05E-19	7.52E-19	8.30E-19	1.15E-18
Nd-149	2.43E-18	2.52E-18	2.31E-18	2.25E-18	4.24E-18	2.32E-18	2.21E-18	2.39E-18	4.74E-18
Nd-151	5.71E-18	5.89E-18	5.53E-18	5.49E-18	8.60E-18	5.64E-18	5.31E-18	5.65E-18	1.09E-17
Promethium									
Pm-141	4.74E-18	4.86E-18	4.54E-18	4.51E-18	6.72E-18	4.66E-18	4.37E-18	4.65E-18	1.29E-17
Pm-142	5.66E-18	5.81E-18	5.42E-18	5.37E-18	8.12E-18	5.59E-18	5.22E-18	5.56E-18	2.63E-17
Pm-143	1.93E-18	2.01E-18	1.83E-18	1.81E-18	2.79E-18	1.92E-18	1.76E-18	1.89E-18	2.22E-18

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Promethium, cont'd									
Pm-144	9.95E-18	1.02E-17	9.57E-18	9.50E-18	1.40E-17	9.95E-18	9.21E-18	9.79E-18	1.13E-17
Pm-145	1.31E-19	1.47E-19	7.79E-20	5.64E-20	3.58E-19	8.65E-20	7.65E-20	1.07E-19	1.73E-19
Pm-146	4.78E-18	4.93E-18	4.59E-18	4.55E-18	6.83E-18	4.76E-18	4.42E-18	4.71E-18	5.48E-18
Pm-147	1.37E-22	1.50E-22	9.54E-23	7.93E-23	3.71E-22	9.91E-23	9.22E-23	1.19E-22	1.96E-22
Pm-148m	1.28E-17	1.31E-17	1.23E-17	1.23E-17	1.79E-17	1.28E-17	1.19E-17	1.26E-17	1.45E-17
Pm-148	3.58E-18	3.66E-18	3.49E-18	3.51E-18	4.75E-18	3.55E-18	3.37E-18	3.54E-18	1.05E-17
Pm-149	7.34E-20	7.64E-20	6.99E-20	6.87E-20	1.24E-19	7.01E-20	6.69E-20	7.23E-20	9.98E-19
Pm-150	8.87E-18	9.09E-18	8.62E-18	8.67E-18	1.21E-17	8.75E-18	8.32E-18	8.78E-18	1.69E-17
Pm-151	2.03E-18	2.10E-18	1.93E-18	1.89E-18	3.40E-18	1.95E-18	1.85E-18	1.99E-18	2.76E-18
Samarium									
Sm-141m	1.24E-17	1.28E-17	1.20E-17	1.20E-17	1.77E-17	1.23E-17	1.15E-17	1.23E-17	1.83E-17
Sm-141	8.91E-18	9.12E-18	8.56E-18	8.53E-18	1.26E-17	8.75E-18	8.25E-18	8.76E-18	1.88E-17
Sm-142	5.44E-19	5.70E-19	4.76E-19	4.51E-19	9.46E-19	4.97E-19	4.57E-19	5.13E-19	7.19E-19
Sm-145	2.86E-19	3.19E-19	1.83E-19	1.32E-19	8.32E-19	1.98E-19	1.76E-19	2.41E-19	3.68E-19
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	9.28E-24	1.13E-23	8.75E-25	1.36E-24	8.72E-24	2.47E-24	2.02E-24	5.22E-24	2.44E-23
Sm-153	3.34E-19	3.53E-19	2.79E-19	2.37E-19	9.80E-19	2.77E-19	2.62E-19	3.15E-19	4.86E-19
Sm-155	6.32E-19	6.50E-19	5.83E-19	5.33E-19	1.69E-18	5.64E-19	5.46E-19	6.21E-19	3.82E-18
Sm-156	7.34E-19	7.66E-19	6.84E-19	6.49E-19	1.63E-18	6.66E-19	6.48E-19	7.21E-19	8.71E-19
Europium									
Eu-145	8.94E-18	9.17E-18	8.67E-18	8.70E-18	1.20E-17	8.86E-18	8.37E-18	8.83E-18	1.02E-17
Eu-146	1.57E-17	1.61E-17	1.52E-17	1.52E-17	2.14E-17	1.57E-17	1.46E-17	1.55E-17	1.79E-17
Eu-147	3.04E-18	3.15E-18	2.89E-18	2.84E-18	4.81E-18	2.96E-18	2.77E-18	2.98E-18	3.46E-18
Eu-148	1.38E-17	1.41E-17	1.33E-17	1.32E-17	1.92E-17	1.37E-17	1.28E-17	1.36E-17	1.55E-17
Eu-149	3.39E-19	3.63E-19	2.78E-19	2.50E-19	7.34E-19	2.87E-19	2.66E-19	3.13E-19	4.06E-19
Eu-150b[1]	9.50E-18	9.79E-18	9.11E-18	9.03E-18	1.40E-17	9.35E-18	8.76E-18	9.35E-18	1.08E-17
Eu-150a[2]	2.96E-19	3.06E-19	2.79E-19	2.75E-19	4.62E-19	2.85E-19	2.68E-19	2.89E-19	1.00E-18
Eu-152m	1.82E-18	1.89E-18	1.77E-18	1.76E-18	2.61E-18	1.83E-18	1.70E-18	1.81E-18	5.94E-18
Eu-152	7.11E-18	7.33E-18	6.89E-18	6.88E-18	1.01E-17	7.04E-18	6.63E-18	7.03E-18	8.13E-18
Eu-154	7.68E-18	7.90E-18	7.48E-18	7.49E-18	1.07E-17	7.67E-18	7.21E-18	7.62E-18	9.41E-18
Eu-155	3.45E-19	3.58E-19	3.09E-19	2.70E-19	1.05E-18	2.99E-19	2.89E-19	3.37E-19	3.83E-19
Eu-156	8.09E-18	8.24E-18	7.88E-18	7.95E-18	1.06E-17	7.97E-18	7.62E-18	8.00E-18	1.21E-17
Eu-157	1.62E-18	1.68E-18	1.51E-18	1.45E-18	2.85E-18	1.54E-18	1.44E-18	1.58E-18	2.94E-18
Eu-158	6.54E-18	6.73E-18	6.39E-18	6.41E-18	8.85E-18	6.56E-18	6.15E-18	6.49E-18	1.71E-17
Gadolinium									
Gd-145	1.38E-17	1.39E-17	1.33E-17	1.34E-17	1.80E-17	1.33E-17	1.29E-17	1.35E-17	2.17E-17
Gd-146	1.41E-18	1.48E-18	1.23E-18	1.10E-18	3.74E-18	1.21E-18	1.16E-18	1.35E-18	1.61E-18
Gd-147	8.37E-18	8.65E-18	8.06E-18	8.00E-18	1.23E-17	8.26E-18	7.74E-18	8.26E-18	9.49E-18
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	2.60E-18	2.70E-18	2.44E-18	2.37E-18	4.53E-18	2.47E-18	2.33E-18	2.54E-18	2.96E-18
Gd-151	3.32E-19	3.57E-19	2.69E-19	2.34E-19	8.23E-19	2.72E-19	2.56E-19	3.06E-19	3.97E-19
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	5.53E-19	5.87E-19	4.52E-19	3.78E-19	1.65E-18	4.50E-19	4.25E-19	5.16E-19	6.42E-19
Gd-159	3.09E-19	3.22E-19	2.84E-19	2.71E-19	5.72E-19	2.88E-19	2.71E-19	3.00E-19	7.95E-19
Terbium									
Tb-147	9.97E-18	1.03E-17	9.67E-18	9.64E-18	1.40E-17	9.96E-18	9.30E-18	9.86E-18	1.82E-17
Tb-149	9.97E-18	1.02E-17	9.63E-18	9.64E-18	1.39E-17	9.75E-18	9.28E-18	9.83E-18	1.28E-17
Tb-150	1.06E-17	1.08E-17	1.02E-17	1.02E-17	1.45E-17	1.04E-17	9.81E-18	1.04E-17	1.87E-17
Tb-151	5.60E-18	5.79E-18	5.32E-18	5.22E-18	8.94E-18	5.43E-18	5.11E-18	5.50E-18	6.36E-18
Tb-153	1.35E-18	1.42E-18	1.24E-18	1.17E-18	2.81E-18	1.24E-18	1.17E-18	1.31E-18	1.55E-18
Tb-154	1.40E-17	1.42E-17	1.36E-17	1.37E-17	1.85E-17	1.36E-17	1.31E-17	1.38E-17	1.57E-17
Tb-155	7.91E-19	8.33E-19	6.94E-19	6.21E-19	2.03E-18	6.86E-19	6.54E-19	7.58E-19	9.06E-19
Tb-156m[3]	1.24E-19	1.35E-19	9.61E-20	7.04E-20	4.24E-19	9.73E-20	8.90E-20	1.14E-19	1.48E-19
Tb-156n[4]	1.81E-20	1.95E-20	1.42E-20	1.11E-20	5.79E-20	1.43E-20	1.33E-20	1.66E-20	2.14E-20
Tb-156	1.13E-17	1.16E-17	1.09E-17	1.09E-17	1.61E-17	1.11E-17	1.05E-17	1.11E-17	1.27E-17
Tb-157	1.17E-20	1.29E-20	8.02E-21	5.74E-21	3.66E-20	8.46E-21	7.59E-21	1.01E-20	1.46E-20
Tb-158	4.90E-18	5.08E-18	4.75E-18	4.72E-18	7.09E-18	4.92E-18	4.56E-18	4.85E-18	5.62E-18

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	6.98E-18	7.20E-18	6.81E-18	6.81E-18	9.73E-18	7.00E-18	6.55E-18	6.93E-18	8.02E-18
Tb-161	1.60E-19	1.74E-19	1.22E-19	9.57E-20	5.06E-19	1.24E-19	1.15E-19	1.46E-19	2.00E-19
Dysprosium									
Dy-155	3.57E-18	3.70E-18	3.41E-18	3.36E-18	5.75E-18	3.44E-18	3.27E-18	3.52E-18	4.06E-18
Dy-157	2.24E-18	2.33E-18	2.09E-18	2.03E-18	3.94E-18	2.11E-18	2.00E-18	2.18E-18	2.54E-18
Dy-159	2.09E-19	2.31E-19	1.50E-19	1.09E-19	6.78E-19	1.56E-19	1.41E-19	1.85E-19	2.57E-19
Dy-165	1.65E-19	1.72E-19	1.53E-19	1.46E-19	3.21E-19	1.56E-19	1.46E-19	1.61E-19	1.95E-18
Dy-166	2.09E-19	2.23E-19	1.75E-19	1.42E-19	6.47E-19	1.75E-19	1.63E-19	1.97E-19	2.43E-19
Holmium									
Ho-155	2.43E-18	2.51E-18	2.29E-18	2.23E-18	4.00E-18	2.35E-18	2.20E-18	2.38E-18	4.62E-18
Ho-157	3.02E-18	3.14E-18	2.83E-18	2.73E-18	5.35E-18	2.88E-18	2.70E-18	2.95E-18	3.56E-18
Ho-159	2.19E-18	2.29E-18	2.02E-18	1.90E-18	4.70E-18	2.01E-18	1.91E-18	2.13E-18	2.48E-18
Ho-161	2.80E-19	3.06E-19	2.08E-19	1.59E-19	8.75E-19	2.13E-19	1.96E-19	2.51E-19	3.47E-19
Ho-162m	3.49E-18	3.61E-18	3.34E-18	3.30E-18	5.47E-18	3.41E-18	3.21E-18	3.44E-18	3.95E-18
Ho-162	9.78E-19	1.02E-18	9.01E-19	8.57E-19	1.79E-18	9.20E-19	8.60E-19	9.47E-19	1.19E-18
Ho-164m	2.15E-19	2.35E-19	1.62E-19	1.19E-19	7.15E-19	1.65E-19	1.51E-19	1.94E-19	2.60E-19
Ho-164	1.44E-19	1.57E-19	1.11E-19	8.36E-20	4.76E-19	1.13E-19	1.04E-19	1.32E-19	3.77E-19
Ho-166m	1.10E-17	1.14E-17	1.07E-17	1.06E-17	1.63E-17	1.10E-17	1.03E-17	1.09E-17	1.25E-17
Ho-166	1.84E-19	1.90E-19	1.72E-19	1.63E-19	3.62E-19	1.72E-19	1.64E-19	1.80E-19	5.32E-18
Ho-167	2.34E-18	2.43E-18	2.23E-18	2.18E-18	3.93E-18	2.24E-18	2.14E-18	2.31E-18	2.80E-18
Erbium									
Er-161	5.65E-18	5.84E-18	5.47E-18	5.43E-18	8.19E-18	5.64E-18	5.25E-18	5.59E-18	6.43E-18
Er-165	1.80E-19	1.97E-19	1.37E-19	1.00E-19	6.08E-19	1.40E-19	1.27E-19	1.64E-19	2.16E-19
Er-169	3.49E-22	3.80E-22	2.59E-22	2.17E-22	9.72E-22	2.64E-22	2.48E-22	3.13E-22	4.75E-22
Er-171	2.41E-18	2.51E-18	2.28E-18	2.22E-18	4.45E-18	2.28E-18	2.18E-18	2.37E-18	3.63E-18
Er-172	3.34E-18	3.44E-18	3.19E-18	3.14E-18	5.09E-18	3.29E-18	3.07E-18	3.28E-18	3.77E-18
Thulium									
Tm-162	1.08E-17	1.10E-17	1.04E-17	1.05E-17	1.47E-17	1.05E-17	1.01E-17	1.06E-17	1.60E-17
Tm-166	1.14E-17	1.16E-17	1.10E-17	1.11E-17	1.57E-17	1.11E-17	1.06E-17	1.12E-17	1.30E-17
Tm-167	8.46E-19	8.95E-19	7.65E-19	7.02E-19	1.99E-18	7.54E-19	7.21E-19	8.20E-19	9.70E-19
Tm-170	3.25E-20	3.43E-20	2.85E-20	2.37E-20	1.05E-19	2.78E-20	2.65E-20	3.15E-20	5.80E-19
Tm-171	3.24E-21	3.49E-21	2.70E-21	2.06E-21	1.14E-20	2.67E-21	2.49E-21	3.07E-21	3.76E-21
Tm-172	2.91E-18	2.97E-18	2.83E-18	2.85E-18	3.90E-18	2.86E-18	2.74E-18	2.88E-18	6.69E-18
Tm-173	2.52E-18	2.59E-18	2.40E-18	2.37E-18	3.90E-18	2.45E-18	2.31E-18	2.47E-18	3.29E-18
Tm-175	6.65E-18	6.85E-18	6.44E-18	6.42E-18	9.35E-18	6.65E-18	6.20E-18	6.57E-18	9.77E-18
Ytterbium									
Yb-162	7.88E-19	8.26E-19	7.09E-19	6.35E-19	2.11E-18	6.90E-19	6.65E-19	7.66E-19	8.88E-19
Yb-166	4.33E-19	4.67E-19	3.57E-19	2.74E-19	1.49E-18	3.55E-19	3.30E-19	4.09E-19	5.04E-19
Yb-167	1.52E-18	1.59E-18	1.36E-18	1.21E-18	4.16E-18	1.34E-18	1.28E-18	1.47E-18	1.71E-18
Yb-169	1.79E-18	1.89E-18	1.62E-18	1.46E-18	4.63E-18	1.59E-18	1.52E-18	1.75E-18	2.04E-18
Yb-175	2.54E-19	2.62E-19	2.41E-19	2.34E-19	4.42E-19	2.43E-19	2.30E-19	2.50E-19	2.86E-19
Yb-177	1.16E-18	1.20E-18	1.13E-18	1.12E-18	1.82E-18	1.14E-18	1.08E-18	1.15E-18	3.18E-18
Yb-178	2.27E-19	2.34E-19	2.16E-19	2.13E-19	3.61E-19	2.20E-19	2.08E-19	2.23E-19	2.86E-19
Lutetium									
Lu-169	6.33E-18	6.51E-18	6.12E-18	6.08E-18	9.38E-18	6.21E-18	5.88E-18	6.26E-18	7.18E-18
Lu-170	1.48E-17	1.49E-17	1.43E-17	1.45E-17	1.94E-17	1.44E-17	1.39E-17	1.46E-17	1.68E-17
Lu-171	4.29E-18	4.45E-18	4.12E-18	4.03E-18	6.73E-18	4.27E-18	3.94E-18	4.23E-18	4.88E-18
Lu-172	1.16E-17	1.20E-17	1.13E-17	1.13E-17	1.66E-17	1.16E-17	1.09E-17	1.15E-17	1.32E-17
Lu-173	7.26E-19	7.69E-19	6.45E-19	5.64E-19	1.95E-18	6.40E-19	6.04E-19	7.01E-19	8.31E-19
Lu-174m	3.18E-19	3.40E-19	2.72E-19	2.22E-19	9.89E-19	2.72E-19	2.53E-19	3.04E-19	3.68E-19
Lu-174	7.12E-19	7.44E-19	6.61E-19	6.16E-19	1.47E-18	6.68E-19	6.26E-19	6.95E-19	8.10E-19
Lu-176m	8.34E-20	8.74E-20	7.48E-20	6.33E-20	2.68E-19	7.25E-20	6.95E-20	8.16E-20	1.78E-18
Lu-176	3.12E-18	3.25E-18	2.96E-18	2.88E-18	5.80E-18	2.93E-18	2.83E-18	3.08E-18	3.53E-18
Lu-177m	6.31E-18	6.56E-18	5.98E-18	5.77E-18	1.21E-17	5.93E-18	5.69E-18	6.22E-18	7.11E-18
Lu-177	2.17E-19	2.26E-19	2.04E-19	1.94E-19	4.84E-19	1.98E-19	1.93E-19	2.15E-19	2.44E-19
Lu-178m	7.07E-18	7.32E-18	6.72E-18	6.55E-18	1.26E-17	6.74E-18	6.43E-18	6.97E-18	9.65E-18
Lu-178	8.67E-19	8.87E-19	8.42E-19	8.41E-19	1.25E-18	8.49E-19	8.11E-19	8.58E-19	7.57E-18
Lu-179	2.03E-19	2.13E-19	1.93E-19	1.88E-19	3.93E-19	1.89E-19	1.84E-19	2.01E-19	2.22E-18

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	3.41E-18	3.52E-18	3.22E-18	3.10E-18	6.23E-18	3.27E-18	3.07E-18	3.34E-18	3.84E-18
Hf-172	5.93E-19	6.33E-19	5.06E-19	4.10E-19	1.94E-18	4.98E-19	4.70E-19	5.68E-19	6.86E-19
Hf-173	2.50E-18	2.60E-18	2.35E-18	2.22E-18	5.40E-18	2.32E-18	2.22E-18	2.46E-18	2.81E-18
Hf-175	2.32E-18	2.41E-18	2.18E-18	2.10E-18	4.22E-18	2.20E-18	2.08E-18	2.27E-18	2.62E-18
Hf-177m	1.43E-17	1.48E-17	1.36E-17	1.32E-17	2.58E-17	1.35E-17	1.30E-17	1.41E-17	1.61E-17
Hf-178m	1.51E-17	1.56E-17	1.44E-17	1.41E-17	2.47E-17	1.46E-17	1.38E-17	1.49E-17	1.70E-17
Hf-179m	5.71E-18	5.91E-18	5.41E-18	5.25E-18	1.02E-17	5.44E-18	5.17E-18	5.62E-18	6.43E-18
Hf-180m	6.43E-18	6.65E-18	6.11E-18	5.96E-18	1.11E-17	6.16E-18	5.85E-18	6.32E-18	7.25E-18
Hf-181	3.56E-18	3.66E-18	3.39E-18	3.32E-18	5.87E-18	3.46E-18	3.25E-18	3.50E-18	4.00E-18
Hf-182m	5.88E-18	6.08E-18	5.64E-18	5.53E-18	9.64E-18	5.74E-18	5.40E-18	5.80E-18	6.71E-18
Hf-182	1.53E-18	1.59E-18	1.45E-18	1.42E-18	2.79E-18	1.43E-18	1.39E-18	1.51E-18	1.72E-18
Hf-183	4.73E-18	4.88E-18	4.58E-18	4.53E-18	7.04E-18	4.73E-18	4.40E-18	4.68E-18	7.09E-18
Hf-184	1.54E-18	1.60E-18	1.45E-18	1.39E-18	3.07E-18	1.44E-18	1.38E-18	1.52E-18	2.27E-18
Tantalum									
Ta-172	9.61E-18	9.89E-18	9.30E-18	9.26E-18	1.41E-17	9.48E-18	8.94E-18	9.50E-18	1.54E-17
Ta-173	3.62E-18	3.73E-18	3.45E-18	3.36E-18	6.05E-18	3.52E-18	3.30E-18	3.56E-18	7.16E-18
Ta-174	3.91E-18	4.05E-18	3.74E-18	3.65E-18	6.62E-18	3.79E-18	3.58E-18	3.86E-18	7.45E-18
Ta-175	5.67E-18	5.81E-18	5.45E-18	5.39E-18	8.80E-18	5.48E-18	5.24E-18	5.59E-18	6.36E-18
Ta-176	1.29E-17	1.31E-17	1.26E-17	1.26E-17	1.73E-17	1.26E-17	1.21E-17	1.28E-17	1.47E-17
Ta-177	3.60E-19	3.82E-19	3.17E-19	2.64E-19	1.11E-18	3.13E-19	2.95E-19	3.49E-19	4.11E-19
Ta-178b[1]	6.45E-18	6.69E-18	6.11E-18	5.90E-18	1.20E-17	6.12E-18	5.83E-18	6.35E-18	7.27E-18
Ta-178a[2]	6.08E-19	6.36E-19	5.60E-19	5.10E-19	1.43E-18	5.59E-19	5.27E-19	5.93E-19	6.90E-19
Ta-179	1.62E-19	1.74E-19	1.37E-19	1.06E-19	5.74E-19	1.35E-19	1.27E-19	1.55E-19	1.87E-19
Ta-180m	2.50E-19	2.67E-19	2.14E-19	1.69E-19	8.70E-19	2.10E-19	1.98E-19	2.40E-19	2.94E-19
Ta-180	3.51E-18	3.66E-18	3.32E-18	3.21E-18	6.68E-18	3.30E-18	3.17E-18	3.46E-18	3.97E-18
Ta-182m	1.51E-18	1.58E-18	1.41E-18	1.31E-18	3.60E-18	1.36E-18	1.32E-18	1.49E-18	1.69E-18
Ta-182	7.91E-18	8.15E-18	7.72E-18	7.71E-18	1.14E-17	7.88E-18	7.43E-18	7.86E-18	9.03E-18
Ta-183	1.78E-18	1.86E-18	1.67E-18	1.58E-18	3.89E-18	1.64E-18	1.58E-18	1.76E-18	2.03E-18
Ta-184	1.02E-17	1.05E-17	9.85E-18	9.77E-18	1.55E-17	1.01E-17	9.46E-18	1.01E-17	1.28E-17
Ta-185	1.18E-18	1.23E-18	1.11E-18	1.04E-18	2.63E-18	1.09E-18	1.05E-18	1.16E-18	5.81E-18
Ta-186	9.95E-18	1.03E-17	9.58E-18	9.47E-18	1.54E-17	9.79E-18	9.19E-18	9.83E-18	2.03E-17
Tungsten									
W-176	9.80E-19	1.03E-18	8.80E-19	7.42E-19	3.17E-18	8.51E-19	8.17E-19	9.59E-19	1.09E-18
W-177	5.56E-18	5.75E-18	5.33E-18	5.19E-18	9.58E-18	5.42E-18	5.09E-18	5.49E-18	6.37E-18
W-178	6.76E-20	7.25E-20	5.82E-20	4.52E-20	2.41E-19	5.70E-20	5.37E-20	6.52E-20	7.76E-20
W-179	2.81E-19	3.05E-19	2.24E-19	1.74E-19	9.38E-19	2.24E-19	2.09E-19	2.61E-19	3.38E-19
W-181	2.05E-19	2.20E-19	1.77E-19	1.38E-19	7.28E-19	1.73E-19	1.63E-19	1.98E-19	2.35E-19
W-185	9.11E-22	9.72E-22	7.49E-22	6.44E-22	2.61E-21	7.44E-22	7.08E-22	8.54E-22	1.14E-21
W-187	3.04E-18	3.13E-18	2.92E-18	2.88E-18	4.63E-18	3.02E-18	2.81E-18	3.00E-18	3.96E-18
W-188	1.23E-20	1.28E-20	1.16E-20	1.12E-20	2.38E-20	1.14E-20	1.10E-20	1.21E-20	1.40E-20
Rhenium									
Re-177	3.79E-18	3.88E-18	3.62E-18	3.54E-18	6.23E-18	3.65E-18	3.47E-18	3.73E-18	7.07E-18
Re-178	7.43E-18	7.57E-18	7.15E-18	7.12E-18	1.10E-17	7.22E-18	6.88E-18	7.32E-18	1.47E-17
Re-180	7.35E-18	7.60E-18	7.15E-18	7.09E-18	1.08E-17	7.40E-18	6.86E-18	7.29E-18	8.93E-18
Re-181	4.81E-18	4.97E-18	4.61E-18	4.51E-18	7.84E-18	4.70E-18	4.41E-18	4.74E-18	5.44E-18
Re-182b[3]	1.15E-17	1.19E-17	1.12E-17	1.10E-17	1.84E-17	1.13E-17	1.07E-17	1.14E-17	1.31E-17
Re-182a[4]	7.15E-18	7.36E-18	6.95E-18	6.90E-18	1.07E-17	7.08E-18	6.68E-18	7.09E-18	8.17E-18
Re-184m	2.38E-18	2.47E-18	2.28E-18	2.21E-18	4.29E-18	2.31E-18	2.17E-18	2.36E-18	2.70E-18
Re-184	5.52E-18	5.72E-18	5.37E-18	5.31E-18	8.25E-18	5.56E-18	5.15E-18	5.48E-18	6.29E-18
Re-186m	7.41E-20	7.96E-20	6.22E-20	4.87E-20	2.54E-19	6.14E-20	5.77E-20	7.05E-20	8.85E-20
Re-186	1.25E-19	1.30E-19	1.16E-19	1.05E-19	3.40E-19	1.12E-19	1.09E-19	1.24E-19	8.99E-19
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	4.22E-19	4.46E-19	3.79E-19	3.14E-19	1.43E-18	3.67E-19	3.52E-19	4.15E-19	4.75E-19
Re-188	3.81E-19	3.93E-19	3.64E-19	3.53E-19	7.02E-19	3.64E-19	3.46E-19	3.76E-19	7.11E-18
Re-189	4.33E-19	4.52E-19	4.10E-19	3.94E-19	8.90E-19	4.02E-19	3.89E-19	4.28E-19	1.03E-18
Osmium									
Os-180	3.26E-19	3.45E-19	2.89E-19	2.41E-19	1.02E-18	2.85E-19	2.69E-19	3.17E-19	3.83E-19

[1] $T_{½}$ = 2.2 h
[2] $T_{½}$ = 9.31 m
[3] $T_{½}$ = 64.0 h
[4] $T_{½}$ = 12.7 h

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	7.53E-18	7.76E-18	7.28E-18	7.22E-18	1.16E-17	7.41E-18	6.99E-18	7.45E-18	8.62E-18
Os-182	2.72E-18	2.81E-18	2.58E-18	2.49E-18	4.91E-18	2.61E-18	2.47E-18	2.68E-18	3.07E-18
Os-185	4.53E-18	4.67E-18	4.37E-18	4.31E-18	6.77E-18	4.53E-18	4.19E-18	4.47E-18	5.15E-18
Os-189m	1.05E-23	2.37E-23	1.47E-25	8.10E-25	4.90E-24	1.00E-24	2.63E-24	7.26E-24	5.34E-22
Os-190m	1.02E-17	1.05E-17	9.80E-18	9.69E-18	1.55E-17	1.00E-17	9.42E-18	1.01E-17	1.15E-17
Os-191m	3.88E-20	4.12E-20	3.46E-20	2.78E-20	1.38E-19	3.35E-20	3.20E-20	3.81E-20	4.46E-20
Os-191	4.38E-19	4.57E-19	4.03E-19	3.52E-19	1.34E-18	3.88E-19	3.75E-19	4.33E-19	4.88E-19
Os-193	4.62E-19	4.77E-19	4.37E-19	4.19E-19	8.87E-19	4.40E-19	4.17E-19	4.54E-19	1.38E-18
Os-194	4.76E-21	5.30E-21	3.22E-21	2.30E-21	1.47E-20	3.41E-21	3.06E-21	4.11E-21	6.53E-21
Iridium									
Ir-182	8.50E-18	8.76E-18	8.19E-18	8.10E-18	1.30E-17	8.37E-18	7.87E-18	8.40E-18	2.18E-17
Ir-184	1.18E-17	1.21E-17	1.14E-17	1.14E-17	1.75E-17	1.16E-17	1.10E-17	1.17E-17	1.54E-17
Ir-185	3.56E-18	3.63E-18	3.42E-18	3.38E-18	5.73E-18	3.38E-18	3.29E-18	3.51E-18	4.03E-18
Ir-186a[1]	1.02E-17	1.04E-17	9.80E-18	9.74E-18	1.52E-17	9.93E-18	9.42E-18	1.00E-17	1.15E-17
Ir-186b[2]	6.01E-18	6.19E-18	5.81E-18	5.74E-18	9.20E-18	5.94E-18	5.57E-18	5.94E-18	8.26E-18
Ir-187	2.22E-18	2.30E-18	2.13E-18	2.06E-18	3.90E-18	2.17E-18	2.03E-18	2.19E-18	2.53E-18
Ir-188	9.58E-18	9.71E-18	9.26E-18	9.29E-18	1.34E-17	9.27E-18	8.94E-18	9.44E-18	1.07E-17
Ir-189	4.44E-19	4.69E-19	4.05E-19	3.51E-19	1.32E-18	3.94E-19	3.78E-19	4.37E-19	5.03E-19
Ir-190n[3]	9.94E-18	1.02E-17	9.52E-18	9.36E-18	1.56E-17	9.74E-18	9.14E-18	9.79E-18	1.12E-17
Ir-190m[4]	1.34E-23	2.96E-23	5.63E-26	9.86E-25	5.83E-24	1.09E-24	3.13E-24	9.07E-24	5.86E-22
Ir-190	9.18E-18	9.46E-18	8.79E-18	8.64E-18	1.46E-17	8.99E-18	8.44E-18	9.04E-18	1.04E-17
Ir-191m	4.12E-19	4.30E-19	3.80E-19	3.33E-19	1.25E-18	3.65E-19	3.54E-19	4.07E-19	4.59E-19
Ir-192m	1.01E-18	1.05E-18	9.61E-19	9.22E-19	2.25E-18	9.25E-19	9.10E-19	1.01E-18	1.13E-18
Ir-192	5.28E-18	5.45E-18	5.05E-18	4.98E-18	8.35E-18	5.12E-18	4.85E-18	5.20E-18	5.99E-18
Ir-194m	1.50E-17	1.55E-17	1.45E-17	1.43E-17	2.22E-17	1.49E-17	1.39E-17	1.48E-17	1.70E-17
Ir-194	5.99E-19	6.18E-19	5.76E-19	5.71E-19	9.22E-19	5.83E-19	5.53E-19	5.91E-19	8.20E-18
Ir-195m	2.61E-18	2.70E-18	2.48E-18	2.40E-18	4.75E-18	2.51E-18	2.37E-18	2.57E-18	3.17E-18
Ir-195	3.18E-19	3.34E-19	2.91E-19	2.49E-19	1.02E-18	2.81E-19	2.71E-19	3.15E-19	1.02E-18
Platinum									
Pt-186	4.66E-18	4.81E-18	4.50E-18	4.44E-18	7.00E-18	4.67E-18	4.32E-18	4.60E-18	5.28E-18
Pt-188	1.20E-18	1.26E-18	1.13E-18	1.05E-18	2.82E-18	1.11E-18	1.06E-18	1.19E-18	1.36E-18
Pt-189	1.97E-18	2.04E-18	1.87E-18	1.78E-18	3.89E-18	1.89E-18	1.77E-18	1.94E-18	2.23E-18
Pt-191	1.83E-18	1.90E-18	1.72E-18	1.61E-18	3.99E-18	1.73E-18	1.63E-18	1.80E-18	2.07E-18
Pt-193m	5.74E-20	6.07E-20	5.20E-20	4.27E-20	2.01E-19	5.02E-20	4.82E-20	5.68E-20	6.55E-20
Pt-193	4.65E-23	9.70E-23	1.62E-25	3.52E-24	2.06E-23	3.60E-24	1.00E-23	3.03E-23	1.66E-21
Pt-195m	3.90E-19	4.10E-19	3.55E-19	2.99E-19	1.30E-18	3.42E-19	3.30E-19	3.86E-19	4.39E-19
Pt-197m	4.77E-19	4.98E-19	4.46E-19	4.12E-19	1.12E-18	4.42E-19	4.21E-19	4.70E-19	5.43E-19
Pt-197	1.36E-19	1.43E-19	1.27E-19	1.13E-19	3.96E-19	1.23E-19	1.19E-19	1.36E-19	1.90E-19
Pt-199	1.30E-18	1.34E-18	1.25E-18	1.24E-18	1.98E-18	1.28E-18	1.20E-18	1.28E-18	4.34E-18
Pt-200	3.45E-19	3.61E-19	3.22E-19	2.93E-19	9.05E-19	3.14E-19	3.02E-19	3.42E-19	4.14E-19
Gold									
Au-193	9.29E-19	9.71E-19	8.66E-19	7.87E-19	2.40E-18	8.48E-19	8.13E-19	9.18E-19	1.04E-18
Au-194	6.54E-18	6.69E-18	6.32E-18	6.30E-18	9.65E-18	6.34E-18	6.09E-18	6.46E-18	7.40E-18
Au-195m	1.26E-18	1.31E-18	1.20E-18	1.16E-18	2.38E-18	1.18E-18	1.14E-18	1.24E-18	1.42E-18
Au-195	4.43E-19	4.66E-19	4.03E-19	3.36E-19	1.51E-18	3.88E-19	3.74E-19	4.38E-19	4.97E-19
Au-198m	3.56E-18	3.71E-18	3.37E-18	3.20E-18	7.88E-18	3.27E-18	3.19E-18	3.52E-18	3.99E-18
Au-198	2.63E-18	2.71E-18	2.52E-18	2.48E-18	4.00E-18	2.57E-18	2.42E-18	2.59E-18	3.50E-18
Au-199	5.44E-19	5.66E-19	5.14E-19	4.87E-19	1.26E-18	4.95E-19	4.85E-19	5.39E-19	6.07E-19
Au-200m	1.33E-17	1.38E-17	1.28E-17	1.27E-17	2.00E-17	1.32E-17	1.23E-17	1.32E-17	1.51E-17
Au-200	1.71E-18	1.76E-18	1.67E-18	1.67E-18	2.37E-18	1.70E-18	1.60E-18	1.70E-18	8.61E-18
Au-201	3.46E-19	3.56E-19	3.32E-19	3.26E-19	5.33E-19	3.41E-19	3.18E-19	3.41E-19	1.90E-18
Mercury									
Hg-193m	6.48E-18	6.68E-18	6.25E-18	6.18E-18	1.01E-17	6.33E-18	6.00E-18	6.41E-18	7.33E-18
Hg-193	1.18E-18	1.23E-18	1.10E-18	1.01E-18	2.98E-18	1.07E-18	1.03E-18	1.16E-18	1.37E-18
Hg-194	9.47E-23	1.82E-22	4.09E-25	7.60E-24	4.40E-23	7.13E-24	1.83E-23	5.89E-23	2.32E-21
Hg-195m	1.29E-18	1.34E-18	1.23E-18	1.18E-18	2.44E-18	1.23E-18	1.17E-18	1.27E-18	1.46E-18
Hg-195	1.20E-18	1.25E-18	1.15E-18	1.10E-18	2.39E-18	1.17E-18	1.09E-18	1.19E-18	1.37E-18

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	5.44E-19	5.64E-19	5.10E-19	4.68E-19	1.43E-18	4.92E-19	4.78E-19	5.39E-19	6.05E-19
Hg-197	3.64E-19	3.83E-19	3.34E-19	2.78E-19	1.25E-18	3.21E-19	3.09E-19	3.62E-19	4.09E-19
Hg-199m	1.12E-18	1.17E-18	1.06E-18	9.97E-19	2.60E-18	1.04E-18	1.00E-18	1.11E-18	1.26E-18
Hg-203	1.52E-18	1.58E-18	1.45E-18	1.42E-18	2.71E-18	1.44E-18	1.39E-18	1.50E-18	1.72E-18
Thallium									
Tl-194m	1.48E-17	1.52E-17	1.43E-17	1.41E-17	2.19E-17	1.47E-17	1.37E-17	1.46E-17	1.93E-17
Tl-194	4.94E-18	5.09E-18	4.74E-18	4.66E-18	7.80E-18	4.87E-18	4.55E-18	4.87E-18	5.59E-18
Tl-195	7.73E-18	7.88E-18	7.49E-18	7.49E-18	1.09E-17	7.56E-18	7.22E-18	7.63E-18	8.93E-18
Tl-197	2.50E-18	2.58E-18	2.40E-18	2.34E-18	4.40E-18	2.43E-18	2.30E-18	2.48E-18	2.89E-18
Tl-198m	7.62E-18	7.85E-18	7.31E-18	7.20E-18	1.17E-17	7.51E-18	7.02E-18	7.51E-18	8.63E-18
Tl-198	1.23E-17	1.25E-17	1.19E-17	1.19E-17	1.69E-17	1.20E-17	1.15E-17	1.21E-17	1.37E-17
Tl-199	1.52E-18	1.57E-18	1.44E-18	1.37E-18	3.14E-18	1.44E-18	1.36E-18	1.50E-18	1.71E-18
Tl-200	8.15E-18	8.38E-18	7.90E-18	7.86E-18	1.19E-17	8.04E-18	7.59E-18	8.06E-18	9.24E-18
Tl-201	5.12E-19	5.37E-19	4.74E-19	4.11E-19	1.61E-18	4.56E-19	4.41E-19	5.09E-19	5.73E-19
Tl-202	2.97E-18	3.06E-18	2.83E-18	2.75E-18	5.04E-18	2.88E-18	2.71E-18	2.92E-18	3.34E-18
Tl-204	8.20E-21	8.65E-21	7.35E-21	6.25E-21	2.63E-20	7.13E-21	6.86E-21	8.04E-21	1.80E-19
Tl-206	1.15E-20	1.20E-20	1.03E-20	9.53E-21	2.61E-20	1.02E-20	9.71E-21	1.10E-20	3.01E-18
Tl-207	2.31E-20	2.40E-20	2.17E-20	2.12E-20	3.99E-20	2.22E-20	2.08E-20	2.26E-20	2.43E-18
Tl-208	2.00E-17	2.00E-17	1.93E-17	1.96E-17	2.55E-17	1.92E-17	1.87E-17	1.96E-17	2.53E-17
Tl-209	1.25E-17	1.27E-17	1.21E-17	1.21E-17	1.73E-17	1.21E-17	1.17E-17	1.23E-17	1.88E-17
Lead									
Pb-195m	1.01E-17	1.04E-17	9.75E-18	9.64E-18	1.53E-17	1.00E-17	9.36E-18	9.98E-18	1.24E-17
Pb-198	2.73E-18	2.83E-18	2.60E-18	2.51E-18	5.16E-18	2.61E-18	2.48E-18	2.70E-18	3.09E-18
Pb-199	9.10E-18	9.32E-18	8.82E-18	8.80E-18	1.31E-17	8.92E-18	8.49E-18	8.99E-18	1.02E-17
Pb-200	1.24E-18	1.29E-18	1.16E-18	1.08E-18	3.09E-18	1.13E-18	1.09E-18	1.23E-18	1.38E-18
Pb-201	4.75E-18	4.91E-18	4.57E-18	4.50E-18	7.67E-18	4.65E-18	4.38E-18	4.70E-18	5.39E-18
Pb-202m	1.29E-17	1.33E-17	1.25E-17	1.25E-17	1.80E-17	1.30E-17	1.21E-17	1.28E-17	1.46E-17
Pb-202	4.97E-23	1.06E-22	1.71E-25	3.72E-24	2.18E-23	3.97E-24	1.11E-23	3.30E-23	2.07E-21
Pb-203	1.93E-18	2.01E-18	1.83E-18	1.76E-18	3.93E-18	1.81E-18	1.74E-18	1.91E-18	2.18E-18
Pb-205	5.76E-23	1.21E-22	2.14E-25	4.38E-24	2.57E-23	4.58E-24	1.26E-23	3.78E-23	2.24E-21
Pb-209	1.50E-21	1.60E-21	1.23E-21	1.09E-21	3.98E-21	1.23E-21	1.17E-21	1.40E-21	3.59E-20
Pb-210	9.36E-21	1.05E-20	6.63E-21	4.81E-21	3.01E-20	6.88E-21	6.25E-21	8.27E-21	1.55E-20
Pb-211	3.29E-19	3.40E-19	3.18E-19	3.16E-19	4.79E-19	3.28E-19	3.06E-19	3.25E-19	2.38E-18
Pb-212	9.20E-19	9.60E-19	8.73E-19	8.38E-19	1.93E-18	8.53E-19	8.29E-19	9.11E-19	1.04E-18
Pb-214	1.59E-18	1.65E-18	1.52E-18	1.49E-18	2.75E-18	1.53E-18	1.45E-18	1.57E-18	1.91E-18
Bismuth									
Bi-200	1.51E-17	1.56E-17	1.46E-17	1.45E-17	2.23E-17	1.50E-17	1.40E-17	1.49E-17	1.83E-17
Bi-201	8.32E-18	8.58E-18	8.09E-18	8.04E-18	1.21E-17	8.35E-18	7.78E-18	8.25E-18	1.00E-17
Bi-202	1.70E-17	1.74E-17	1.65E-17	1.64E-17	2.41E-17	1.69E-17	1.58E-17	1.68E-17	1.95E-17
Bi-203	1.45E-17	1.48E-17	1.42E-17	1.42E-17	1.97E-17	1.43E-17	1.37E-17	1.44E-17	1.65E-17
Bi-205	1.03E-17	1.05E-17	1.00E-17	1.01E-17	1.41E-17	1.01E-17	9.67E-18	1.02E-17	1.16E-17
Bi-206	2.04E-17	2.10E-17	1.98E-17	1.98E-17	2.86E-17	2.03E-17	1.91E-17	2.02E-17	2.31E-17
Bi-207	9.59E-18	9.87E-18	9.33E-18	9.30E-18	1.36E-17	9.59E-18	8.97E-18	9.50E-18	1.17E-17
Bi-210m	1.64E-18	1.71E-18	1.57E-18	1.54E-18	2.87E-18	1.56E-18	1.50E-18	1.62E-18	1.86E-18
Bi-210	5.79E-21	6.11E-21	5.06E-21	4.64E-21	1.39E-20	5.03E-21	4.80E-21	5.54E-21	1.19E-18
Bi-211	3.01E-19	3.11E-19	2.87E-19	2.82E-19	4.97E-19	2.89E-19	2.75E-19	2.96E-19	3.39E-19
Bi-212	1.16E-18	1.19E-18	1.13E-18	1.13E-18	1.57E-18	1.16E-18	1.09E-18	1.15E-18	5.37E-18
Bi-213	8.67E-19	8.91E-19	8.29E-19	8.17E-19	1.33E-18	8.50E-19	7.97E-19	8.52E-19	2.71E-18
Bi-214	9.26E-18	9.42E-18	9.01E-18	9.09E-18	1.21E-17	9.11E-18	8.71E-18	9.15E-18	1.56E-17
Polonium									
Po-203	1.01E-17	1.04E-17	9.87E-18	9.86E-18	1.44E-17	1.01E-17	9.50E-18	1.00E-17	1.22E-17
Po-205	9.75E-18	1.00E-17	9.51E-18	9.49E-18	1.38E-17	9.75E-18	9.15E-18	9.67E-18	1.12E-17
Po-207	8.25E-18	8.51E-18	8.04E-18	8.02E-18	1.19E-17	8.29E-18	7.73E-18	8.19E-18	9.48E-18
Po-210	5.36E-23	5.54E-23	5.24E-23	5.24E-23	7.26E-23	5.45E-23	5.04E-23	5.32E-23	6.12E-23
Po-211	4.94E-20	5.09E-20	4.81E-20	4.80E-20	6.77E-20	4.99E-20	4.62E-20	4.89E-20	5.67E-20
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	5.26E-22	5.43E-22	5.13E-22	5.13E-22	7.12E-22	5.35E-22	4.94E-22	5.22E-22	6.00E-22
Po-215	1.15E-21	1.18E-21	1.10E-21	1.08E-21	1.71E-21	1.12E-21	1.05E-21	1.13E-21	1.29E-21
Po-216	1.07E-22	1.10E-22	1.04E-22	1.04E-22	1.44E-22	1.09E-22	1.00E-22	1.06E-22	1.22E-22
Po-218	5.73E-23	5.93E-23	5.61E-23	5.61E-23	7.74E-23	5.84E-23	5.40E-23	5.70E-23	6.55E-23

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	8.19E-18	8.39E-18	7.94E-18	7.92E-18	1.18E-17	8.10E-18	7.64E-18	8.10E-18	9.24E-18
At-211	2.15E-19	2.23E-19	2.00E-19	1.73E-19	6.83E-19	1.92E-19	1.86E-19	2.14E-19	2.39E-19
At-215	1.25E-21	1.29E-21	1.20E-21	1.18E-21	1.92E-21	1.22E-21	1.15E-21	1.23E-21	1.41E-21
At-216	8.41E-21	8.73E-21	7.81E-21	6.80E-21	2.68E-20	7.48E-21	7.27E-21	8.37E-21	9.30E-21
At-217	1.98E-21	2.04E-21	1.90E-21	1.87E-21	3.02E-21	1.95E-21	1.82E-21	1.95E-21	2.23E-21
At-218	1.84E-20	2.01E-20	1.47E-20	1.11E-20	6.34E-20	1.47E-20	1.36E-20	1.71E-20	2.59E-20
Radon									
Rn-218	4.87E-21	5.00E-21	4.70E-21	4.67E-21	6.79E-21	4.88E-21	4.52E-21	4.80E-21	5.52E-21
Rn-219	3.61E-19	3.74E-19	3.45E-19	3.39E-19	6.04E-19	3.46E-19	3.31E-19	3.56E-19	4.08E-19
Rn-220	2.49E-21	2.56E-21	2.40E-21	2.38E-21	3.54E-21	2.48E-21	2.31E-21	2.45E-21	2.82E-21
Rn-222	2.59E-21	2.65E-21	2.48E-21	2.46E-21	3.73E-21	2.56E-21	2.39E-21	2.54E-21	2.92E-21
Francium									
Fr-219	2.25E-20	2.32E-20	2.15E-20	2.11E-20	3.61E-20	2.18E-20	2.06E-20	2.21E-20	2.53E-20
Fr-220	6.56E-20	6.81E-20	6.17E-20	5.81E-20	1.59E-19	5.94E-20	5.82E-20	6.50E-20	7.51E-20
Fr-221	1.95E-19	2.03E-19	1.85E-19	1.80E-19	3.87E-19	1.80E-19	1.76E-19	1.93E-19	2.20E-19
Fr-222	1.99E-20	2.08E-20	1.81E-20	1.70E-20	4.25E-20	1.80E-20	1.72E-20	1.93E-20	6.13E-18
Fr-223	3.20E-19	3.38E-19	2.88E-19	2.58E-19	8.20E-19	2.85E-19	2.70E-19	3.10E-19	1.17E-18
Radium									
Ra-222	5.93E-20	6.15E-20	5.67E-20	5.58E-20	9.79E-20	5.68E-20	5.43E-20	5.85E-20	6.70E-20
Ra-223	8.18E-19	8.47E-19	7.74E-19	7.33E-19	1.82E-18	7.59E-19	7.32E-19	8.10E-19	9.16E-19
Ra-224	6.29E-20	6.56E-20	6.00E-20	5.87E-20	1.17E-19	5.87E-20	5.72E-20	6.22E-20	7.11E-20
Ra-225	5.17E-20	5.83E-20	3.08E-20	2.19E-20	1.44E-19	3.42E-20	3.01E-20	4.24E-20	7.14E-20
Ra-226	4.18E-20	4.37E-20	3.97E-20	3.83E-20	8.93E-20	3.84E-20	3.77E-20	4.15E-20	4.71E-20
Ra-227	1.01E-18	1.04E-18	9.49E-19	9.31E-19	1.69E-18	9.59E-19	9.10E-19	9.85E-19	2.27E-18
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	2.80E-20	2.90E-20	2.63E-20	2.52E-20	5.68E-20	2.61E-20	2.50E-20	2.75E-20	3.41E-20
Ac-224	1.20E-18	1.25E-18	1.13E-18	1.07E-18	2.87E-18	1.09E-18	1.07E-18	1.19E-18	1.34E-18
Ac-225	9.67E-20	1.00E-19	9.04E-20	8.35E-20	2.51E-19	8.73E-20	8.48E-20	9.56E-20	1.10E-19
Ac-226	8.04E-19	8.38E-19	7.63E-19	7.36E-19	1.68E-18	7.42E-19	7.25E-19	7.97E-19	1.37E-18
Ac-227	7.94E-22	8.35E-22	7.11E-22	6.57E-22	2.03E-21	6.87E-22	6.71E-22	7.70E-22	1.08E-21
Ac-228	6.02E-18	6.20E-18	5.87E-18	5.87E-18	8.32E-18	6.02E-18	5.65E-18	5.97E-18	8.58E-18
Thorium									
Th-226	4.81E-20	4.97E-20	4.51E-20	4.23E-20	1.17E-19	4.35E-20	4.25E-20	4.75E-20	5.49E-20
Th-227	6.59E-19	6.87E-19	6.22E-19	6.02E-19	1.27E-18	6.14E-19	5.93E-19	6.49E-19	7.55E-19
Th-228	1.24E-20	1.31E-20	1.14E-20	1.05E-20	3.21E-20	1.10E-20	1.07E-20	1.22E-20	1.62E-20
Th-229	5.15E-19	5.34E-19	4.78E-19	4.36E-19	1.41E-18	4.60E-19	4.48E-19	5.09E-19	5.87E-19
Th-230	2.50E-21	2.77E-21	2.00E-21	1.76E-21	6.89E-21	1.96E-21	1.91E-21	2.33E-21	4.98E-21
Th-231	7.64E-20	8.22E-20	6.02E-20	5.35E-20	2.09E-19	5.98E-20	5.76E-20	7.04E-20	1.14E-19
Th-232	1.33E-21	1.54E-21	9.06E-22	7.90E-22	3.41E-21	9.09E-22	8.85E-22	1.16E-21	3.64E-21
Th-234	4.64E-20	4.83E-20	4.20E-20	3.64E-20	1.46E-19	4.04E-20	3.92E-20	4.56E-20	5.40E-20
Protactinium									
Pa-227	1.16E-19	1.20E-19	1.06E-19	9.36E-20	3.56E-19	1.02E-19	9.91E-20	1.14E-19	1.32E-19
Pa-228	7.02E-18	7.22E-18	6.81E-18	6.78E-18	1.04E-17	6.96E-18	6.54E-18	6.95E-18	7.99E-18
Pa-230	4.02E-18	4.15E-18	3.91E-18	3.88E-18	6.06E-18	4.03E-18	3.75E-18	3.99E-18	4.57E-18
Pa-231	2.37E-19	2.49E-19	2.18E-19	2.14E-19	4.07E-19	2.19E-19	2.09E-19	2.30E-19	2.92E-19
Pa-232	5.85E-18	6.04E-18	5.70E-18	5.69E-18	8.15E-18	5.90E-18	5.48E-18	5.80E-18	6.69E-18
Pa-233	1.26E-18	1.31E-18	1.20E-18	1.16E-18	2.36E-18	1.19E-18	1.14E-18	1.24E-18	1.43E-18
Pa-234m	9.66E-20	9.98E-20	9.27E-20	9.15E-20	1.52E-19	9.46E-20	8.89E-20	9.53E-20	7.82E-18
Pa-234	1.19E-17	1.23E-17	1.16E-17	1.15E-17	1.71E-17	1.19E-17	1.11E-17	1.18E-17	1.40E-17
Uranium									
U-230	7.34E-21	7.93E-21	6.19E-21	5.74E-21	1.77E-20	6.07E-21	5.91E-21	6.94E-21	1.19E-20
U-231	4.01E-19	4.14E-19	3.63E-19	3.27E-19	1.15E-18	3.50E-19	3.40E-19	3.92E-19	4.71E-19
U-232	2.26E-21	2.64E-21	1.37E-21	1.26E-21	4.87E-21	1.42E-21	1.38E-21	1.88E-21	6.36E-21
U-233	2.40E-21	2.64E-21	1.84E-21	1.74E-21	4.93E-21	1.85E-21	1.79E-21	2.16E-21	4.67E-21
U-234	1.32E-21	1.61E-21	6.18E-22	5.78E-22	2.50E-21	6.71E-22	6.57E-22	1.01E-21	4.66E-21
U-235	9.57E-19	9.97E-19	9.07E-19	8.73E-19	2.06E-18	8.76E-19	8.60E-19	9.49E-19	1.08E-18
U-236	9.38E-22	1.20E-21	3.09E-22	3.06E-22	1.46E-21	3.69E-22	3.66E-22	6.53E-22	4.03E-21
U-237	8.09E-19	8.42E-19	7.49E-19	6.91E-19	2.05E-18	7.25E-19	7.04E-19	7.96E-19	9.21E-19
U-238	6.92E-22	9.19E-22	1.47E-22	1.54E-22	9.25E-22	2.05E-22	2.05E-22	4.42E-22	3.40E-21
U-239	2.96E-19	3.10E-19	2.73E-19	2.39E-19	8.65E-19	2.68E-19	2.55E-19	2.93E-19	1.63E-18
U-240	8.00E-21	9.74E-21	2.85E-21	2.43E-21	1.50E-20	3.54E-21	3.23E-21	5.62E-21	2.38E-20

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	7.49E-18	7.74E-18	7.27E-18	7.21E-18	1.13E-17	7.46E-18	6.97E-18	7.43E-18	8.57E-18
Np-233	5.18E-19	5.31E-19	4.82E-19	4.41E-19	1.42E-18	4.65E-19	4.51E-19	5.12E-19	5.76E-19
Np-234	8.72E-18	8.88E-18	8.49E-18	8.56E-18	1.18E-17	8.52E-18	8.20E-18	8.63E-18	9.97E-18
Np-235	8.31E-21	9.59E-21	4.73E-21	4.50E-21	1.70E-20	4.97E-21	4.84E-21	6.74E-21	2.20E-20
Np-236a[1]	7.20E-19	7.43E-19	6.66E-19	6.16E-19	1.90E-18	6.40E-19	6.25E-19	7.09E-19	8.29E-19
Np-236b[2]	2.87E-19	2.94E-19	2.67E-19	2.47E-19	7.48E-19	2.60E-19	2.51E-19	2.83E-19	3.26E-19
Np-237	1.45E-19	1.53E-19	1.24E-19	1.11E-19	4.04E-19	1.21E-19	1.17E-19	1.38E-19	1.84E-19
Np-238	3.40E-18	3.51E-18	3.33E-18	3.35E-18	4.52E-18	3.46E-18	3.22E-18	3.38E-18	4.57E-18
Np-239	1.03E-18	1.07E-18	9.70E-19	9.23E-19	2.32E-18	9.45E-19	9.18E-19	1.02E-18	1.17E-18
Np-240m	2.12E-18	2.17E-18	2.04E-18	2.03E-18	2.95E-18	2.10E-18	1.96E-18	2.08E-18	7.13E-18
Np-240	8.17E-18	8.43E-18	7.92E-18	7.88E-18	1.19E-17	8.16E-18	7.61E-18	8.08E-18	9.59E-18
Plutonium									
Pu-234	3.82E-19	3.91E-19	3.54E-19	3.22E-19	1.09E-18	3.39E-19	3.31E-19	3.77E-19	4.26E-19
Pu-235	5.25E-19	5.39E-19	4.88E-19	4.48E-19	1.41E-18	4.72E-19	4.57E-19	5.18E-19	5.91E-19
Pu-236	1.34E-21	1.73E-21	2.61E-22	3.05E-22	1.55E-21	3.92E-22	3.83E-22	8.34E-22	5.73E-21
Pu-237	2.73E-19	2.81E-19	2.50E-19	2.27E-19	7.79E-19	2.40E-19	2.34E-19	2.68E-19	3.13E-19
Pu-238	1.07E-21	1.40E-21	1.43E-22	1.96E-22	1.05E-21	2.58E-22	2.56E-22	6.34E-22	4.89E-21
Pu-239	7.31E-22	8.68E-22	3.62E-22	3.63E-22	1.12E-21	4.02E-22	3.85E-22	5.61E-22	2.20E-21
Pu-240	1.04E-21	1.36E-21	1.48E-22	1.94E-22	1.07E-21	2.58E-22	2.55E-22	6.20E-22	4.68E-21
Pu-241	9.91E-24	1.03E-23	8.81E-24	8.09E-24	2.66E-23	8.50E-24	8.31E-24	9.60E-24	1.28E-23
Pu-242	8.67E-22	1.13E-21	1.32E-22	1.70E-22	9.11E-22	2.22E-22	2.20E-22	5.23E-22	3.89E-21
Pu-243	1.40E-19	1.45E-19	1.29E-19	1.14E-19	4.15E-19	1.24E-19	1.20E-19	1.38E-19	1.66E-19
Pu-244	6.77E-22	9.02E-22	5.60E-23	9.54E-23	5.88E-22	1.35E-22	1.35E-22	3.85E-22	3.25E-21
Pu-245	2.62E-18	2.70E-18	2.52E-18	2.50E-18	4.04E-18	2.58E-18	2.42E-18	2.59E-18	3.39E-18
Pu-246	8.16E-19	8.50E-19	7.53E-19	7.09E-19	1.89E-18	7.32E-19	7.11E-19	7.99E-19	9.31E-19
Americium									
Am-237	2.28E-18	2.35E-18	2.17E-18	2.10E-18	4.32E-18	2.16E-18	2.06E-18	2.25E-18	2.58E-18
Am-238	5.48E-18	5.64E-18	5.33E-18	5.31E-18	8.04E-18	5.46E-18	5.12E-18	5.43E-18	6.33E-18
Am-239	1.39E-18	1.43E-18	1.30E-18	1.23E-18	3.33E-18	1.26E-18	1.23E-18	1.37E-18	1.57E-18
Am-240	6.31E-18	6.52E-18	6.16E-18	6.16E-18	8.96E-18	6.37E-18	5.93E-18	6.27E-18	7.24E-18
Am-241	1.22E-19	1.33E-19	9.96E-20	7.83E-20	4.15E-19	9.85E-20	9.28E-20	1.15E-19	1.62E-19
Am-242m	5.96E-21	7.09E-21	2.36E-21	2.34E-21	9.75E-21	2.80E-21	2.65E-21	4.29E-21	1.67E-20
Am-242	8.45E-20	8.74E-20	7.52E-20	6.88E-20	2.30E-19	7.26E-20	7.08E-20	8.18E-20	1.28E-19
Am-243	2.99E-19	3.15E-19	2.72E-19	2.28E-19	1.01E-18	2.62E-19	2.53E-19	2.96E-19	3.39E-19
Am-244m	1.10E-20	1.19E-20	8.72E-21	8.17E-21	2.33E-20	8.87E-21	8.42E-21	1.01E-20	2.60E-18
Am-244	4.98E-18	5.15E-18	4.84E-18	4.83E-18	7.02E-18	5.02E-18	4.65E-18	4.94E-18	5.85E-18
Am-245	1.97E-19	2.04E-19	1.85E-19	1.76E-19	4.33E-19	1.80E-19	1.75E-19	1.94E-19	4.91E-19
Am-246m	6.29E-18	6.49E-18	6.16E-18	6.19E-18	8.43E-18	6.36E-18	5.94E-18	6.25E-18	9.26E-18
Am-246	4.32E-18	4.46E-18	4.15E-18	4.11E-18	6.58E-18	4.27E-18	3.99E-18	4.26E-18	5.89E-18
Curium									
Cm-238	4.36E-19	4.47E-19	4.05E-19	3.71E-19	1.20E-18	3.88E-19	3.79E-19	4.31E-19	4.86E-19
Cm-240	1.41E-21	1.83E-21	1.26E-22	2.05E-22	1.27E-21	3.09E-22	2.91E-22	8.02E-22	5.82E-21
Cm-241	3.12E-18	3.21E-18	2.97E-18	2.90E-18	5.31E-18	3.02E-18	2.84E-18	3.07E-18	3.53E-18
Cm-242	1.31E-21	1.69E-21	1.47E-22	2.18E-22	1.21E-21	3.12E-22	2.94E-22	7.59E-22	5.31E-21
Cm-243	7.89E-19	8.18E-19	7.42E-19	7.09E-19	1.74E-18	7.23E-19	7.03E-19	7.79E-19	8.97E-19
Cm-244	1.16E-21	1.51E-21	9.00E-23	1.60E-22	9.96E-22	2.44E-22	2.30E-22	6.54E-22	4.86E-21
Cm-245	5.31E-19	5.46E-19	4.93E-19	4.55E-19	1.42E-18	4.73E-19	4.62E-19	5.24E-19	6.00E-19
Cm-246	1.05E-21	1.36E-21	9.09E-23	1.51E-22	9.36E-22	2.28E-22	2.15E-22	5.96E-22	4.35E-21
Cm-247	2.04E-18	2.10E-18	1.95E-18	1.92E-18	3.16E-18	1.98E-18	1.87E-18	2.00E-18	2.30E-18
Cm-248	8.01E-22	1.04E-21	6.67E-23	1.13E-22	7.03E-22	1.71E-22	1.62E-22	4.52E-22	3.32E-21
Cm-249	1.26E-19	1.29E-19	1.21E-19	1.19E-19	1.85E-19	1.25E-19	1.16E-19	1.24E-19	4.67E-19
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	1.39E-18	1.43E-18	1.30E-18	1.23E-18	3.24E-18	1.27E-18	1.23E-18	1.37E-18	1.56E-18
Bk-246	5.87E-18	6.06E-18	5.71E-18	5.69E-18	8.50E-18	5.90E-18	5.49E-18	5.83E-18	6.71E-18
Bk-247	6.33E-19	6.55E-19	5.95E-19	5.54E-19	1.56E-18	5.77E-19	5.60E-19	6.26E-19	7.06E-19
Bk-249	2.04E-23	2.34E-23	1.02E-23	8.12E-24	4.72E-23	1.18E-23	1.06E-23	1.57E-23	3.75E-23
Bk-250	5.47E-18	5.66E-18	5.37E-18	5.40E-18	7.27E-18	5.57E-18	5.19E-18	5.45E-18	6.81E-18

[1] $T_{½}$ = 1.15E5 y

[2] $T_{½}$ = 22.5 h

Table III.4. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 1 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	1.69E-21	2.14E-21	1.45E-22	2.39E-22	1.51E-21	3.96E-22	3.50E-22	9.53E-22	5.99E-21
Cf-246	1.26E-21	1.57E-21	1.97E-22	2.52E-22	1.32E-21	3.63E-22	3.29E-22	7.52E-22	4.19E-21
Cf-248	1.16E-21	1.46E-21	1.02E-22	1.65E-22	1.04E-21	2.73E-22	2.41E-22	6.53E-22	4.08E-21
Cf-249	2.14E-18	2.21E-18	2.04E-18	2.01E-18	3.41E-18	2.07E-18	1.96E-18	2.11E-18	2.42E-18
Cf-250	1.10E-21	1.39E-21	9.67E-23	1.57E-22	9.90E-22	2.59E-22	2.29E-22	6.21E-22	3.89E-21
Cf-251	7.50E-19	7.77E-19	6.98E-19	6.62E-19	1.75E-18	6.75E-19	6.60E-19	7.38E-19	8.57E-19
Cf-252	1.16E-21	1.44E-21	1.87E-22	2.36E-22	1.23E-21	3.39E-22	3.07E-22	6.95E-22	3.83E-21
Cf-253	2.27E-22	2.53E-22	1.48E-22	1.23E-22	5.94E-22	1.56E-22	1.45E-22	1.93E-22	3.64E-22
Cf-254	3.59E-24	4.54E-24	3.17E-25	5.12E-25	3.23E-24	8.47E-25	7.48E-25	2.02E-24	1.27E-23
Einsteinium									
Es-250	2.41E-18	2.49E-18	2.34E-18	2.31E-18	3.90E-18	2.38E-18	2.24E-18	2.39E-18	2.76E-18
Es-251	5.56E-19	5.71E-19	5.14E-19	4.78E-19	1.44E-18	4.93E-19	4.83E-19	5.46E-19	6.27E-19
Es-253	2.86E-21	3.12E-21	2.03E-21	2.00E-21	4.47E-21	2.17E-21	2.02E-21	2.47E-21	4.91E-21
Es-254m	2.97E-18	3.06E-18	2.88E-18	2.86E-18	4.13E-18	2.99E-18	2.77E-18	2.94E-18	3.73E-18
Es-254	3.34E-20	3.82E-20	1.83E-20	1.72E-20	6.28E-20	2.04E-20	1.89E-20	2.65E-20	7.11E-20
Fermium									
Fm-252	1.25E-21	1.55E-21	1.29E-22	1.87E-22	1.20E-21	3.23E-22	2.77E-22	7.11E-22	3.90E-21
Fm-253	4.74E-19	4.88E-19	4.39E-19	4.12E-19	1.18E-18	4.24E-19	4.14E-19	4.66E-19	5.35E-19
Fm-254	1.49E-21	1.82E-21	2.93E-22	3.39E-22	1.77E-21	4.92E-22	4.38E-22	9.20E-22	4.31E-21
Fm-255	1.91E-20	2.22E-20	9.78E-21	9.01E-21	3.93E-20	1.08E-20	1.02E-20	1.49E-20	4.65E-20
Fm-257	6.28E-19	6.49E-19	5.82E-19	5.48E-19	1.51E-18	5.62E-19	5.49E-19	6.17E-19	7.16E-19
Mendelevium									
Md-257	6.80E-19	6.99E-19	6.36E-19	6.07E-19	1.47E-18	6.26E-19	6.03E-19	6.68E-19	7.65E-19
Md-258	1.01E-20	1.19E-20	3.69E-21	3.52E-21	1.77E-20	4.70E-21	4.27E-21	7.13E-21	2.35E-20

TABLE III.5

Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units. The coefficients are for soil at a density of 1.6×10^3 kg m^{-3}.

h_T: The tissue dose equivalent coefficient for organ or tissue T (Sv per Bq s m^{-3}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-3}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

To convert to a source per unit mass basis (Sv per Bq s kg^{-1}), multiply table entries by 1.6×10^3 (kg m^{-3}).

To convert to conventional units (mrem per µCi y cm^{-3}), multiply table entries by 1.168×10^{23}.

To convert to conventional units for a source per unit mass basis (mrem per µCi y g^{-1}), multiply table entries by 1.868×10^{23}.

Radionuclide dose coefficients for soil contaminated to a finite depth cannot be scaled to account for a different soil density.

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium									
Be-7	9.44E-19	9.69E-19	8.74E-19	8.60E-19	1.40E-18	8.32E-19	8.40E-19	9.08E-19	1.04E-18
Be-10	4.72E-21	5.00E-21	3.99E-21	3.55E-21	1.25E-20	3.82E-21	3.76E-21	4.45E-21	3.02E-20
Carbon									
C-11	1.95E-17	2.00E-17	1.81E-17	1.78E-17	2.85E-17	1.72E-17	1.74E-17	1.88E-17	2.23E-17
C-14	8.10E-23	9.09E-23	5.04E-23	3.97E-23	2.19E-22	5.29E-23	4.92E-23	6.76E-23	1.21E-22
Nitrogen									
N-13	1.95E-17	2.00E-17	1.81E-17	1.78E-17	2.85E-17	1.72E-17	1.74E-17	1.88E-17	2.34E-17
Oxygen									
O-15	1.95E-17	2.01E-17	1.81E-17	1.79E-17	2.86E-17	1.73E-17	1.74E-17	1.88E-17	2.72E-17
Fluorine									
F-18	1.95E-17	2.00E-17	1.81E-17	1.78E-17	2.85E-17	1.72E-17	1.74E-17	1.88E-17	2.16E-17
Neon									
Ne-19	1.96E-17	2.01E-17	1.82E-17	1.79E-17	2.87E-17	1.73E-17	1.75E-17	1.89E-17	3.14E-17
Sodium									
Na-22	4.07E-17	4.17E-17	3.84E-17	3.83E-17	5.54E-17	3.65E-17	3.71E-17	3.95E-17	4.48E-17
Na-24	7.18E-17	7.26E-17	6.91E-17	7.00E-17	8.90E-17	6.67E-17	6.72E-17	7.03E-17	8.02E-17
Magnesium									
Mg-28	2.48E-17	2.55E-17	2.36E-17	2.36E-17	3.29E-17	2.24E-17	2.28E-17	2.42E-17	2.74E-17
Aluminum									
Al-26	4.86E-17	4.97E-17	4.62E-17	4.64E-17	6.42E-17	4.41E-17	4.48E-17	4.74E-17	5.52E-17
Al-28	3.17E-17	3.24E-17	3.05E-17	3.09E-17	3.98E-17	2.91E-17	2.97E-17	3.11E-17	5.00E-17
Silicon									
Si-31	4.85E-20	5.03E-20	4.42E-20	4.24E-20	9.25E-20	4.20E-20	4.22E-20	4.68E-20	3.59E-18
Si-32	1.96E-22	2.16E-22	1.37E-22	1.11E-22	5.56E-22	1.39E-22	1.31E-22	1.71E-22	2.67E-22
Phosphorus									
P-30	1.97E-17	2.02E-17	1.83E-17	1.80E-17	2.89E-17	1.74E-17	1.76E-17	1.90E-17	4.10E-17
P-32	4.45E-20	4.65E-20	3.98E-20	3.74E-20	9.57E-20	3.78E-20	3.78E-20	4.27E-20	5.18E-18
P-33	3.13E-22	3.42E-22	2.29E-22	1.89E-22	8.96E-22	2.29E-22	2.18E-22	2.79E-22	4.11E-22
Sulphur									
S-35	8.81E-23	9.85E-23	5.62E-23	4.46E-23	2.41E-22	5.85E-23	5.46E-23	7.43E-23	1.30E-22
Chlorine									
Cl-36	9.30E-21	9.73E-21	8.18E-21	7.60E-21	2.06E-20	7.81E-21	7.76E-21	8.86E-21	1.76E-19
Cl-38	2.65E-17	2.70E-17	2.55E-17	2.58E-17	3.31E-17	2.44E-17	2.48E-17	2.60E-17	5.04E-17
Cl-39	2.62E-17	2.68E-17	2.50E-17	2.51E-17	3.48E-17	2.37E-17	2.42E-17	2.56E-17	3.63E-17
Argon									
Ar-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar-39	3.81E-21	4.04E-21	3.21E-21	2.85E-21	1.01E-20	3.08E-21	3.02E-21	3.59E-21	2.29E-20
Ar-41	2.33E-17	2.39E-17	2.23E-17	2.25E-17	3.00E-17	2.12E-17	2.16E-17	2.28E-17	2.75E-17
Potassium									
K-38	5.74E-17	5.85E-17	5.47E-17	5.49E-17	7.55E-17	5.24E-17	5.30E-17	5.60E-17	7.71E-17
K-40	2.84E-18	2.91E-18	2.73E-18	2.75E-18	3.64E-18	2.59E-18	2.64E-18	2.78E-18	6.11E-18
K-42	5.16E-18	5.29E-18	4.95E-18	4.99E-18	6.67E-18	4.70E-18	4.80E-18	5.06E-18	2.52E-17
K-43	1.85E-17	1.90E-17	1.72E-17	1.69E-17	2.74E-17	1.63E-17	1.65E-17	1.78E-17	2.08E-17
K-44	4.02E-17	4.08E-17	3.86E-17	3.89E-17	5.08E-17	3.71E-17	3.74E-17	3.93E-17	6.38E-17
K-45	3.32E-17	3.39E-17	3.18E-17	3.21E-17	4.40E-17	3.04E-17	3.09E-17	3.25E-17	4.66E-17
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	3.29E-22	3.59E-22	2.43E-22	2.01E-22	9.43E-22	2.42E-22	2.31E-22	2.94E-22	4.30E-22
Ca-47	1.94E-17	1.98E-17	1.85E-17	1.86E-17	2.51E-17	1.76E-17	1.79E-17	1.89E-17	2.27E-17
Ca-49	5.34E-17	5.32E-17	5.14E-17	5.22E-17	6.48E-17	5.06E-17	5.01E-17	5.23E-17	6.47E-17
Scandium									
Sc-43	2.10E-17	2.15E-17	1.94E-17	1.91E-17	3.14E-17	1.85E-17	1.86E-17	2.02E-17	2.38E-17
Sc-44m	5.28E-18	5.46E-18	4.88E-18	4.79E-18	9.12E-18	4.62E-18	4.68E-18	5.12E-18	5.84E-18
Sc-44	3.99E-17	4.09E-17	3.76E-17	3.74E-17	5.48E-17	3.57E-17	3.62E-17	3.87E-17	4.76E-17
Sc-46	3.71E-17	3.80E-17	3.52E-17	3.52E-17	4.88E-17	3.34E-17	3.40E-17	3.61E-17	4.09E-17
Sc-47	1.94E-18	2.01E-18	1.78E-18	1.68E-18	4.44E-18	1.66E-18	1.68E-18	1.89E-18	2.13E-18
Sc-48	6.13E-17	6.29E-17	5.85E-17	5.86E-17	8.02E-17	5.54E-17	5.65E-17	5.99E-17	6.79E-17
Sc-49	8.14E-20	8.44E-20	7.45E-20	7.16E-20	1.54E-19	7.07E-20	7.11E-20	7.86E-20	7.49E-18

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	1.72E-18	1.82E-18	1.51E-18	1.26E-18	5.76E-18	1.43E-18	1.40E-18	1.67E-18	1.90E-18
Ti-45	1.66E-17	1.71E-17	1.54E-17	1.52E-17	2.43E-17	1.47E-17	1.48E-17	1.60E-17	1.94E-17
Vanadium									
V-47	1.91E-17	1.95E-17	1.77E-17	1.74E-17	2.79E-17	1.68E-17	1.70E-17	1.83E-17	2.80E-17
V-48	5.36E-17	5.50E-17	5.10E-17	5.10E-17	7.13E-17	4.83E-17	4.92E-17	5.22E-17	5.92E-17
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	7.99E-18	8.26E-18	7.34E-18	7.07E-18	1.56E-17	6.94E-18	6.99E-18	7.74E-18	8.80E-18
Cr-49	1.98E-17	2.04E-17	1.83E-17	1.79E-17	3.12E-17	1.74E-17	1.76E-17	1.91E-17	2.55E-17
Cr-51	6.01E-19	6.21E-19	5.53E-19	5.41E-19	1.02E-18	5.24E-19	5.30E-19	5.80E-19	6.64E-19
Manganese									
Mn-51	1.91E-17	1.96E-17	1.77E-17	1.75E-17	2.80E-17	1.69E-17	1.71E-17	1.84E-17	3.05E-17
Mn-52m	4.46E-17	4.57E-17	4.22E-17	4.21E-17	6.05E-17	4.01E-17	4.08E-17	4.34E-17	6.24E-17
Mn-52	6.36E-17	6.52E-17	6.05E-17	6.05E-17	8.43E-17	5.74E-17	5.84E-17	6.20E-17	7.01E-17
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	1.56E-17	1.60E-17	1.47E-17	1.47E-17	2.10E-17	1.40E-17	1.42E-17	1.51E-17	1.72E-17
Mn-56	3.07E-17	3.14E-17	2.93E-17	2.95E-17	3.99E-17	2.79E-17	2.84E-17	3.00E-17	4.24E-17
Iron									
Fe-52	1.39E-17	1.44E-17	1.29E-17	1.26E-17	2.27E-17	1.22E-17	1.24E-17	1.35E-17	1.56E-17
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0
Fe-59	2.17E-17	2.22E-17	2.07E-17	2.08E-17	2.82E-17	1.96E-17	2.00E-17	2.12E-17	2.39E-17
Fe-60	6.96E-23	7.85E-23	4.13E-23	3.23E-23	1.84E-22	4.40E-23	4.06E-23	5.70E-23	1.08E-22
Cobalt									
Co-55	3.73E-17	3.82E-17	3.51E-17	3.49E-17	5.16E-17	3.33E-17	3.38E-17	3.61E-17	4.33E-17
Co-56	6.43E-17	6.55E-17	6.14E-17	6.17E-17	8.31E-17	5.88E-17	5.95E-17	6.28E-17	7.09E-17
Co-57	2.03E-18	2.10E-18	1.86E-18	1.71E-18	5.32E-18	1.74E-18	1.74E-18	1.99E-18	2.21E-18
Co-58m	2.27E-23	2.70E-23	4.08E-24	4.24E-24	2.85E-23	7.91E-24	6.47E-24	1.38E-23	4.58E-23
Co-58	1.83E-17	1.87E-17	1.72E-17	1.71E-17	2.50E-17	1.63E-17	1.66E-17	1.77E-17	2.02E-17
Co-60m	7.44E-20	7.70E-20	6.96E-20	6.76E-20	1.23E-19	6.62E-20	6.68E-20	7.23E-20	9.16E-20
Co-60	4.55E-17	4.67E-17	4.36E-17	4.38E-17	5.87E-17	4.13E-17	4.22E-17	4.45E-17	5.02E-17
Co-61	1.31E-18	1.38E-18	1.18E-18	1.07E-18	3.22E-18	1.12E-18	1.11E-18	1.27E-18	3.26E-18
Co-62m	4.89E-17	5.00E-17	4.68E-17	4.71E-17	6.28E-17	4.45E-17	4.53E-17	4.78E-17	6.56E-17
Nickel									
Ni-56	3.20E-17	3.28E-17	3.00E-17	2.97E-17	4.69E-17	2.85E-17	2.89E-17	3.10E-17	3.53E-17
Ni-57	3.49E-17	3.58E-17	3.33E-17	3.34E-17	4.63E-17	3.16E-17	3.22E-17	3.41E-17	3.85E-17
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	9.99E-18	1.02E-17	9.56E-18	9.61E-18	1.29E-17	9.07E-18	9.26E-18	9.77E-18	1.62E-17
Ni-66	2.32E-22	2.55E-22	1.66E-22	1.36E-22	6.62E-22	1.67E-22	1.59E-22	2.05E-22	3.11E-22
Copper									
Cu-60	7.08E-17	7.24E-17	6.74E-17	6.76E-17	9.35E-17	6.43E-17	6.52E-17	6.91E-17	8.68E-17
Cu-61	1.57E-17	1.61E-17	1.46E-17	1.44E-17	2.30E-17	1.39E-17	1.41E-17	1.52E-17	1.86E-17
Cu-62	1.94E-17	1.99E-17	1.80E-17	1.77E-17	2.84E-17	1.71E-17	1.73E-17	1.87E-17	3.77E-17
Cu-64	3.61E-18	3.70E-18	3.35E-18	3.31E-18	5.26E-18	3.19E-18	3.22E-18	3.48E-18	4.00E-18
Cu-66	1.67E-18	1.71E-18	1.58E-18	1.58E-18	2.26E-18	1.50E-18	1.53E-18	1.63E-18	1.40E-17
Cu-67	2.03E-18	2.11E-18	1.86E-18	1.76E-18	4.60E-18	1.75E-18	1.76E-18	1.98E-18	2.24E-18
Zinc									
Zn-62	8.17E-18	8.39E-18	7.57E-18	7.45E-18	1.20E-17	7.20E-18	7.27E-18	7.86E-18	9.03E-18
Zn-63	2.10E-17	2.15E-17	1.95E-17	1.93E-17	3.04E-17	1.86E-17	1.88E-17	2.02E-17	3.27E-17
Zn-65	1.07E-17	1.09E-17	1.02E-17	1.02E-17	1.39E-17	9.63E-18	9.81E-18	1.04E-17	1.18E-17
Zn-69m	7.96E-18	8.18E-18	7.36E-18	7.23E-18	1.21E-17	7.00E-18	7.07E-18	7.66E-18	8.79E-18
Zn-69	9.31E-21	9.81E-21	8.09E-21	7.37E-21	2.29E-20	7.71E-21	7.63E-21	8.86E-21	4.90E-19
Zn-71m	2.95E-17	3.02E-17	2.74E-17	2.71E-17	4.32E-17	2.61E-17	2.64E-17	2.84E-17	3.56E-17
Zn-72	2.56E-18	2.66E-18	2.35E-18	2.20E-18	6.15E-18	2.20E-18	2.21E-18	2.50E-18	2.81E-18
Gallium									
Ga-65	2.21E-17	2.27E-17	2.05E-17	2.02E-17	3.38E-17	1.95E-17	1.97E-17	2.13E-17	3.21E-17
Ga-66	4.40E-17	4.45E-17	4.18E-17	4.21E-17	5.72E-17	4.05E-17	4.06E-17	4.28E-17	6.18E-17
Ga-67	2.73E-18	2.83E-18	2.50E-18	2.39E-18	5.74E-18	2.36E-18	2.38E-18	2.65E-18	3.01E-18
Ga-68	1.82E-17	1.86E-17	1.69E-17	1.66E-17	2.65E-17	1.61E-17	1.62E-17	1.75E-17	2.65E-17
Ga-70	1.78E-19	1.84E-19	1.67E-19	1.65E-19	2.76E-19	1.58E-19	1.61E-19	1.73E-19	4.65E-18
Ga-72	4.89E-17	4.98E-17	4.66E-17	4.69E-17	6.32E-17	4.46E-17	4.52E-17	4.77E-17	5.69E-17
Ga-73	5.86E-18	6.06E-18	5.40E-18	5.28E-18	1.00E-17	5.11E-18	5.17E-18	5.66E-18	8.13E-18

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	1.27E-17	1.31E-17	1.18E-17	1.15E-17	1.99E-17	1.12E-17	1.13E-17	1.23E-17	1.42E-17
Ge-67	2.66E-17	2.73E-17	2.48E-17	2.44E-17	3.98E-17	2.36E-17	2.38E-17	2.57E-17	4.62E-17
Ge-68	5.68E-24	1.48E-23	1.35E-26	3.75E-25	2.28E-24	5.32E-25	1.65E-24	4.26E-24	4.59E-22
Ge-69	1.63E-17	1.67E-17	1.53E-17	1.52E-17	2.26E-17	1.46E-17	1.48E-17	1.58E-17	1.87E-17
Ge-71	5.75E-24	1.49E-23	1.36E-26	3.80E-25	2.31E-24	5.39E-25	1.67E-24	4.31E-24	4.65E-22
Ge-75	6.62E-19	6.86E-19	6.08E-19	5.93E-19	1.21E-18	5.75E-19	5.82E-19	6.41E-19	2.11E-18
Ge-77	2.03E-17	2.09E-17	1.90E-17	1.88E-17	3.10E-17	1.80E-17	1.83E-17	1.97E-17	2.75E-17
Ge-78	5.29E-18	5.48E-18	4.86E-18	4.75E-18	9.45E-18	4.60E-18	4.66E-18	5.11E-18	5.94E-18
Arsenic									
As-69	1.95E-17	2.00E-17	1.80E-17	1.78E-17	2.88E-17	1.72E-17	1.73E-17	1.87E-17	3.76E-17
As-70	7.55E-17	7.73E-17	7.15E-17	7.14E-17	1.01E-16	6.80E-17	6.91E-17	7.34E-17	9.17E-17
As-71	1.07E-17	1.10E-17	9.90E-18	9.69E-18	1.75E-17	9.38E-18	9.49E-18	1.03E-17	1.19E-17
As-72	3.38E-17	3.46E-17	3.17E-17	3.14E-17	4.73E-17	3.01E-17	3.05E-17	3.27E-17	4.93E-17
As-73	5.25E-20	5.75E-20	4.09E-20	3.07E-20	1.77E-19	4.03E-20	3.79E-20	4.82E-20	6.27E-20
As-74	1.44E-17	1.48E-17	1.34E-17	1.32E-17	2.06E-17	1.28E-17	1.29E-17	1.39E-17	1.68E-17
As-76	8.18E-18	8.38E-18	7.67E-18	7.62E-18	1.14E-17	7.30E-18	7.40E-18	7.92E-18	2.15E-17
As-77	1.70E-19	1.76E-19	1.56E-19	1.52E-19	3.02E-19	1.48E-19	1.49E-19	1.64E-19	2.64E-19
As-78	2.32E-17	2.37E-17	2.20E-17	2.20E-17	3.09E-17	2.09E-17	2.13E-17	2.26E-17	4.38E-17
Selenium									
Se-70	1.87E-17	1.92E-17	1.73E-17	1.70E-17	2.85E-17	1.65E-17	1.66E-17	1.80E-17	2.34E-17
Se-73m	4.64E-18	4.76E-18	4.30E-18	4.24E-18	6.83E-18	4.09E-18	4.13E-18	4.46E-18	6.34E-18
Se-73	2.04E-17	2.09E-17	1.88E-17	1.84E-17	3.20E-17	1.79E-17	1.80E-17	1.96E-17	2.42E-17
Se-75	7.17E-18	7.42E-18	6.59E-18	6.35E-18	1.41E-17	6.21E-18	6.27E-18	6.95E-18	7.90E-18
Se-77m	1.52E-18	1.58E-18	1.39E-18	1.32E-18	3.45E-18	1.31E-18	1.32E-18	1.48E-18	1.67E-18
Se-79	1.10E-22	1.23E-22	7.05E-23	5.58E-23	3.02E-22	7.33E-23	6.84E-23	9.29E-23	1.61E-22
Se-81m	2.15E-19	2.24E-19	1.97E-19	1.77E-19	6.19E-19	1.84E-19	1.83E-19	2.11E-19	2.40E-19
Se-81	2.10E-19	2.17E-19	1.94E-19	1.89E-19	3.51E-19	1.84E-19	1.86E-19	2.03E-19	4.15E-18
Se-83	4.47E-17	4.58E-17	4.23E-17	4.22E-17	6.16E-17	4.02E-17	4.08E-17	4.35E-17	5.23E-17
Bromine									
Br-74m	7.43E-17	7.56E-17	7.03E-17	7.03E-17	9.95E-17	6.75E-17	6.80E-17	7.22E-17	1.00E-16
Br-74	8.04E-17	8.11E-17	7.64E-17	7.68E-17	1.05E-16	7.42E-17	7.41E-17	7.83E-17	1.00E-16
Br-75	2.31E-17	2.38E-17	2.14E-17	2.11E-17	3.55E-17	2.04E-17	2.06E-17	2.23E-17	2.93E-17
Br-76	4.79E-17	4.88E-17	4.53E-17	4.54E-17	6.40E-17	4.34E-17	4.39E-17	4.65E-17	6.09E-17
Br-77	5.96E-18	6.14E-18	5.53E-18	5.44E-18	9.34E-18	5.25E-18	5.31E-18	5.76E-18	6.59E-18
Br-80m	8.01E-20	9.18E-20	4.11E-20	2.90E-20	1.95E-19	4.69E-20	4.15E-20	6.19E-20	1.20E-19
Br-80	1.52E-18	1.56E-18	1.41E-18	1.40E-18	2.17E-18	1.35E-18	1.36E-18	1.46E-18	2.55E-18
Br-82	4.92E-17	5.05E-17	4.64E-17	4.63E-17	6.66E-17	4.41E-17	4.48E-17	4.78E-17	5.43E-17
Br-83	1.53E-19	1.57E-19	1.41E-19	1.38E-19	2.30E-19	1.34E-19	1.35E-19	1.47E-19	6.77E-19
Br-84	3.16E-17	3.20E-17	3.03E-17	3.06E-17	4.01E-17	2.92E-17	2.94E-17	3.09E-17	5.04E-17
Krypton									
Kr-74	2.20E-17	2.26E-17	2.04E-17	2.00E-17	3.48E-17	1.94E-17	1.96E-17	2.12E-17	3.16E-17
Kr-76	8.01E-18	8.26E-18	7.37E-18	7.21E-18	1.34E-17	6.99E-18	7.07E-18	7.72E-18	8.86E-18
Kr-77	1.91E-17	1.96E-17	1.77E-17	1.73E-17	3.10E-17	1.68E-17	1.69E-17	1.84E-17	2.62E-17
Kr-79	4.77E-18	4.90E-18	4.42E-18	4.35E-18	7.34E-18	4.20E-18	4.25E-18	4.60E-18	5.27E-18
Kr-81m	2.36E-18	2.45E-18	2.16E-18	2.08E-18	4.94E-18	2.03E-18	2.06E-18	2.29E-18	2.61E-18
Kr-81	1.05E-19	1.09E-19	9.64E-20	9.42E-20	1.88E-19	9.12E-20	9.24E-20	1.02E-19	1.24E-19
Kr-83m	2.57E-22	4.21E-22	2.73E-23	3.51E-23	2.24E-22	4.78E-23	6.28E-23	1.62E-22	3.47E-21
Kr-85m	2.85E-18	2.95E-18	2.61E-18	2.49E-18	6.20E-18	2.46E-18	2.48E-18	2.77E-18	3.37E-18
Kr-85	4.76E-20	4.90E-20	4.38E-20	4.27E-20	7.56E-20	4.17E-20	4.20E-20	4.58E-20	1.67E-19
Kr-87	1.44E-17	1.47E-17	1.37E-17	1.37E-17	1.93E-17	1.31E-17	1.33E-17	1.40E-17	3.33E-17
Kr-88	3.44E-17	3.50E-17	3.31E-17	3.34E-17	4.40E-17	3.17E-17	3.21E-17	3.37E-17	3.99E-17
Rubidium									
Rb-79	2.57E-17	2.64E-17	2.39E-17	2.35E-17	3.88E-17	2.27E-17	2.29E-17	2.48E-17	3.60E-17
Rb-80	2.42E-17	2.48E-17	2.24E-17	2.21E-17	3.52E-17	2.14E-17	2.16E-17	2.33E-17	5.75E-17
Rb-81m	6.09E-20	6.43E-20	5.41E-20	4.67E-20	1.92E-19	5.07E-20	5.03E-20	5.93E-20	7.66E-20
Rb-81	1.17E-17	1.20E-17	1.08E-17	1.06E-17	1.86E-17	1.03E-17	1.04E-17	1.13E-17	1.33E-17
Rb-82m	5.41E-17	5.55E-17	5.11E-17	5.08E-17	7.35E-17	4.85E-17	4.92E-17	5.25E-17	5.99E-17
Rb-82	2.10E-17	2.16E-17	1.95E-17	1.93E-17	3.06E-17	1.86E-17	1.88E-17	2.02E-17	4.23E-17
Rb-83	9.47E-18	9.72E-18	8.80E-18	8.68E-18	1.37E-17	8.37E-18	8.46E-18	9.12E-18	1.05E-17
Rb-84	1.71E-17	1.76E-17	1.61E-17	1.60E-17	2.35E-17	1.53E-17	1.55E-17	1.66E-17	1.91E-17
Rb-86	1.78E-18	1.83E-18	1.69E-18	1.69E-18	2.37E-18	1.61E-18	1.64E-18	1.74E-18	7.19E-18
Rb-87	7.10E-22	7.68E-22	5.47E-22	4.59E-22	2.04E-21	5.37E-22	5.17E-22	6.46E-22	8.93E-22

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	1.16E-17	1.19E-17	1.12E-17	1.13E-17	1.49E-17	1.07E-17	1.08E-17	1.14E-17	4.41E-17
Rb-89	3.73E-17	3.81E-17	3.57E-17	3.60E-17	4.80E-17	3.41E-17	3.46E-17	3.65E-17	5.26E-17
Strontium									
Sr-80	1.13E-21	1.90E-21	6.86E-24	9.87E-23	5.68E-22	8.60E-23	1.86E-22	6.55E-22	1.48E-20
Sr-81	2.63E-17	2.70E-17	2.44E-17	2.40E-17	4.03E-17	2.32E-17	2.34E-17	2.53E-17	4.04E-17
Sr-82	1.11E-21	1.87E-21	6.74E-24	9.71E-23	5.58E-22	8.46E-23	1.83E-22	6.44E-22	1.45E-20
Sr-83	1.48E-17	1.52E-17	1.39E-17	1.38E-17	2.10E-17	1.32E-17	1.34E-17	1.44E-17	1.69E-17
Sr-85m	4.08E-18	4.24E-18	3.74E-18	3.63E-18	7.98E-18	3.53E-18	3.57E-18	3.96E-18	4.51E-18
Sr-85	9.62E-18	9.87E-18	8.92E-18	8.79E-18	1.40E-17	8.50E-18	8.58E-18	9.26E-18	1.06E-17
Sr-87m	6.10E-18	6.28E-18	5.63E-18	5.52E-18	9.66E-18	5.35E-18	5.40E-18	5.88E-18	6.73E-18
Sr-89	3.43E-20	3.58E-20	3.07E-20	2.88E-20	7.42E-20	2.91E-20	2.91E-20	3.29E-20	3.69E-18
Sr-90	3.13E-21	3.33E-21	2.63E-21	2.33E-21	8.38E-21	2.52E-21	2.48E-21	2.95E-21	1.41E-20
Sr-91	1.30E-17	1.33E-17	1.23E-17	1.23E-17	1.75E-17	1.17E-17	1.19E-17	1.26E-17	1.98E-17
Sr-92	2.42E-17	2.48E-17	2.32E-17	2.34E-17	3.12E-17	2.20E-17	2.25E-17	2.37E-17	2.69E-17
Yttrium									
Y-86m	4.08E-18	4.24E-18	3.75E-18	3.64E-18	7.92E-18	3.54E-18	3.58E-18	3.96E-18	4.53E-18
Y-86	6.58E-17	6.73E-17	6.24E-17	6.24E-17	8.76E-17	5.94E-17	6.03E-17	6.40E-17	7.38E-17
Y-87	8.57E-18	8.80E-18	7.94E-18	7.81E-18	1.27E-17	7.56E-18	7.63E-18	8.25E-18	9.47E-18
Y-88	4.82E-17	4.93E-17	4.62E-17	4.66E-17	6.16E-17	4.40E-17	4.48E-17	4.72E-17	5.27E-17
Y-90m	1.19E-17	1.22E-17	1.10E-17	1.07E-17	1.96E-17	1.04E-17	1.05E-17	1.15E-17	1.31E-17
Y-90	8.64E-20	8.98E-20	7.81E-20	7.44E-20	1.73E-19	7.42E-20	7.44E-20	8.31E-20	9.85E-18
Y-91m	1.01E-17	1.04E-17	9.39E-18	9.27E-18	1.45E-17	8.94E-18	9.03E-18	9.73E-18	1.12E-17
Y-91	1.01E-19	1.04E-19	9.43E-20	9.26E-20	1.62E-19	8.95E-20	9.06E-20	9.80E-20	4.07E-18
Y-92	4.86E-18	4.98E-18	4.60E-18	4.60E-18	6.56E-18	4.37E-18	4.44E-18	4.73E-18	2.53E-17
Y-93	1.76E-18	1.80E-18	1.66E-18	1.66E-18	2.52E-18	1.58E-18	1.61E-18	1.71E-18	1.64E-17
Y-94	2.06E-17	2.12E-17	1.96E-17	1.96E-17	2.73E-17	1.87E-17	1.90E-17	2.01E-17	4.70E-17
Y-95	1.59E-17	1.60E-17	1.52E-17	1.54E-17	2.00E-17	1.47E-17	1.48E-17	1.55E-17	3.90E-17
Zirconium									
Zr-86	5.02E-18	5.20E-18	4.60E-18	4.49E-18	9.16E-18	4.35E-18	4.40E-18	4.85E-18	5.59E-18
Zr-88	7.52E-18	7.74E-18	6.93E-18	6.81E-18	1.19E-17	6.59E-18	6.66E-18	7.24E-18	8.32E-18
Zr-89	2.16E-17	2.22E-17	2.04E-17	2.03E-17	2.94E-17	1.93E-17	1.96E-17	2.10E-17	2.41E-17
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	1.39E-17	1.43E-17	1.31E-17	1.30E-17	1.90E-17	1.24E-17	1.26E-17	1.35E-17	1.54E-17
Zr-97	3.36E-18	3.44E-18	3.18E-18	3.17E-18	4.62E-18	3.02E-18	3.07E-18	3.27E-18	9.34E-18
Niobium									
Nb-88	7.71E-17	7.91E-17	7.25E-17	7.20E-17	1.07E-16	6.88E-17	6.98E-17	7.47E-17	1.00E-16
Nb-89b[1]	2.57E-17	2.62E-17	2.42E-17	2.41E-17	3.54E-17	2.32E-17	2.34E-17	2.49E-17	4.33E-17
Nb-89a[2]	3.67E-17	3.77E-17	3.41E-17	3.37E-17	5.31E-17	3.25E-17	3.28E-17	3.54E-17	4.89E-17
Nb-90	7.53E-17	7.67E-17	7.19E-17	7.23E-17	9.90E-17	6.88E-17	6.97E-17	7.36E-17	8.42E-17
Nb-93m	1.03E-21	1.41E-21	2.51E-23	1.12E-22	6.70E-22	1.37E-22	1.58E-22	5.57E-22	5.26E-21
Nb-94	2.95E-17	3.02E-17	2.78E-17	2.76E-17	4.00E-17	2.64E-17	2.68E-17	2.86E-17	3.26E-17
Nb-95m	1.14E-18	1.19E-18	1.05E-18	1.02E-18	2.19E-18	9.88E-19	1.00E-18	1.11E-18	1.28E-18
Nb-95	1.44E-17	1.47E-17	1.35E-17	1.35E-17	1.96E-17	1.28E-17	1.30E-17	1.39E-17	1.59E-17
Nb-96	4.61E-17	4.73E-17	4.35E-17	4.33E-17	6.28E-17	4.13E-17	4.19E-17	4.47E-17	5.11E-17
Nb-97m	1.37E-17	1.40E-17	1.29E-17	1.28E-17	1.87E-17	1.22E-17	1.24E-17	1.33E-17	1.52E-17
Nb-97	1.24E-17	1.27E-17	1.16E-17	1.15E-17	1.73E-17	1.10E-17	1.12E-17	1.20E-17	1.57E-17
Nb-98	4.50E-17	4.61E-17	4.26E-17	4.25E-17	6.02E-17	4.04E-17	4.11E-17	4.37E-17	5.85E-17
Molybdenum									
Mo-90	1.51E-17	1.56E-17	1.41E-17	1.38E-17	2.50E-17	1.33E-17	1.35E-17	1.47E-17	1.71E-17
Mo-93m	4.11E-17	4.22E-17	3.91E-17	3.92E-17	5.51E-17	3.71E-17	3.78E-17	4.01E-17	4.52E-17
Mo-93	5.84E-21	8.00E-21	1.42E-22	6.37E-22	3.80E-21	7.78E-22	8.98E-22	3.16E-21	2.99E-20
Mo-99	2.80E-18	2.88E-18	2.62E-18	2.59E-18	4.15E-18	2.49E-18	2.52E-18	2.71E-18	4.45E-18
Mo-101	2.50E-17	2.56E-17	2.38E-17	2.38E-17	3.37E-17	2.26E-17	2.30E-17	2.44E-17	3.16E-17
Technetium									
Tc-93m	1.28E-17	1.30E-17	1.22E-17	1.22E-17	1.73E-17	1.17E-17	1.18E-17	1.25E-17	1.39E-17
Tc-93	2.61E-17	2.67E-17	2.50E-17	2.52E-17	3.32E-17	2.38E-17	2.43E-17	2.55E-17	2.87E-17
Tc-94m	3.45E-17	3.54E-17	3.25E-17	3.24E-17	4.74E-17	3.10E-17	3.14E-17	3.35E-17	4.63E-17
Tc-94	4.97E-17	5.11E-17	4.69E-17	4.67E-17	6.75E-17	4.45E-17	4.52E-17	4.82E-17	5.51E-17
Tc-95m	1.24E-17	1.28E-17	1.16E-17	1.15E-17	1.86E-17	1.10E-17	1.12E-17	1.20E-17	1.38E-17

[1] $T_{½}$ = 122 m
[2] $T_{½}$ = 66 m

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Technetium, cont'd									
Tc-95	1.47E-17	1.51E-17	1.39E-17	1.38E-17	2.00E-17	1.31E-17	1.33E-17	1.43E-17	1.63E-17
Tc-96m	8.35E-19	8.58E-19	7.86E-19	7.85E-19	1.12E-18	7.46E-19	7.59E-19	8.10E-19	9.38E-19
Tc-96	4.66E-17	4.78E-17	4.40E-17	4.38E-17	6.29E-17	4.17E-17	4.24E-17	4.52E-17	5.16E-17
Tc-97m	1.28E-20	1.53E-20	4.63E-21	4.75E-21	2.02E-20	5.50E-21	5.31E-21	8.99E-21	3.51E-20
Tc-97	8.02E-21	1.06E-20	2.78E-22	9.22E-22	5.59E-21	1.28E-21	1.30E-21	4.33E-21	3.44E-20
Tc-98	2.66E-17	2.73E-17	2.50E-17	2.48E-17	3.67E-17	2.37E-17	2.41E-17	2.58E-17	2.95E-17
Tc-99m	2.18E-18	2.26E-18	2.00E-18	1.87E-18	5.35E-18	1.87E-18	1.88E-18	2.13E-18	2.38E-18
Tc-99	6.31E-22	6.83E-22	4.87E-22	4.09E-22	1.81E-21	4.78E-22	4.60E-22	5.74E-22	7.94E-22
Tc-101	6.37E-18	6.58E-18	5.87E-18	5.75E-18	1.08E-17	5.57E-18	5.63E-18	6.16E-18	9.09E-18
Tc-104	3.62E-17	3.70E-17	3.44E-17	3.44E-17	4.92E-17	3.28E-17	3.33E-17	3.53E-17	6.22E-17
Ruthenium									
Ru-94	9.86E-18	1.01E-17	9.20E-18	9.10E-18	1.46E-17	8.73E-18	8.85E-18	9.53E-18	1.09E-17
Ru-97	4.25E-18	4.42E-18	3.90E-18	3.79E-18	8.15E-18	3.68E-18	3.72E-18	4.12E-18	4.73E-18
Ru-103	8.95E-18	9.18E-18	8.29E-18	8.17E-18	1.31E-17	7.90E-18	7.97E-18	8.61E-18	9.87E-18
Ru-105	1.48E-17	1.52E-17	1.39E-17	1.37E-17	2.12E-17	1.32E-17	1.33E-17	1.43E-17	1.76E-17
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	1.26E-17	1.30E-17	1.18E-17	1.17E-17	1.85E-17	1.12E-17	1.14E-17	1.22E-17	1.40E-17
Rh-99	1.10E-17	1.13E-17	1.02E-17	9.99E-18	1.74E-17	9.68E-18	9.78E-18	1.06E-17	1.22E-17
Rh-100	4.96E-17	5.06E-17	4.73E-17	4.76E-17	6.47E-17	4.52E-17	4.59E-17	4.84E-17	5.49E-17
Rh-101m	5.60E-18	5.79E-18	5.15E-18	5.04E-18	9.53E-18	4.88E-18	4.94E-18	5.41E-18	6.22E-18
Rh-101	4.59E-18	4.77E-18	4.20E-18	4.01E-18	9.87E-18	3.95E-18	3.98E-18	4.46E-18	5.09E-18
Rh-102m	9.09E-18	9.33E-18	8.45E-18	8.34E-18	1.32E-17	8.04E-18	8.13E-18	8.77E-18	1.08E-17
Rh-102	4.00E-17	4.10E-17	3.75E-17	3.72E-17	5.55E-17	3.56E-17	3.61E-17	3.87E-17	4.42E-17
Rh-103m	2.27E-21	2.77E-21	2.69E-22	3.61E-22	2.31E-21	6.23E-22	5.25E-22	1.30E-21	6.22E-21
Rh-105	1.48E-18	1.53E-18	1.36E-18	1.34E-18	2.52E-18	1.29E-18	1.31E-18	1.43E-18	1.65E-18
Rh-106m	5.42E-17	5.55E-17	5.11E-17	5.09E-17	7.40E-17	4.86E-17	4.93E-17	5.26E-17	6.01E-17
Rh-106	4.08E-18	4.18E-18	3.80E-18	3.76E-18	5.86E-18	3.62E-18	3.66E-18	3.93E-18	2.36E-17
Rh-107	5.96E-18	6.16E-18	5.49E-18	5.38E-18	1.00E-17	5.21E-18	5.27E-18	5.76E-18	8.30E-18
Palladium									
Pd-100	1.51E-18	1.59E-18	1.32E-18	1.14E-18	4.69E-18	1.25E-18	1.23E-18	1.46E-18	1.71E-18
Pd-101	5.91E-18	6.08E-18	5.49E-18	5.43E-18	8.72E-18	5.22E-18	5.29E-18	5.70E-18	6.60E-18
Pd-103	2.05E-20	2.47E-20	3.41E-21	4.44E-21	1.96E-20	6.35E-21	5.56E-21	1.22E-20	5.50E-20
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	8.43E-20	9.01E-20	6.54E-20	5.94E-20	2.07E-19	6.40E-20	6.26E-20	7.65E-20	9.38E-19
Silver									
Ag-102	6.18E-17	6.32E-17	5.84E-17	5.83E-17	8.38E-17	5.57E-17	5.64E-17	6.01E-17	7.72E-17
Ag-103	1.41E-17	1.45E-17	1.32E-17	1.30E-17	2.12E-17	1.25E-17	1.27E-17	1.36E-17	1.72E-17
Ag-104m	2.18E-17	2.22E-17	2.04E-17	2.03E-17	3.02E-17	1.95E-17	1.97E-17	2.11E-17	2.98E-17
Ag-104	4.97E-17	5.10E-17	4.69E-17	4.67E-17	6.75E-17	4.45E-17	4.52E-17	4.82E-17	5.52E-17
Ag-105	9.61E-18	9.90E-18	8.88E-18	8.74E-18	1.52E-17	8.44E-18	8.53E-18	9.27E-18	1.07E-17
Ag-106m	5.23E-17	5.36E-17	4.93E-17	4.91E-17	7.17E-17	4.68E-17	4.75E-17	5.07E-17	5.77E-17
Ag-106	1.35E-17	1.39E-17	1.25E-17	1.23E-17	1.97E-17	1.19E-17	1.20E-17	1.30E-17	1.93E-17
Ag-108m	3.06E-17	3.14E-17	2.85E-17	2.82E-17	4.36E-17	2.71E-17	2.74E-17	2.95E-17	3.38E-17
Ag-108	3.70E-19	3.80E-19	3.43E-19	3.37E-19	5.53E-19	3.26E-19	3.29E-19	3.56E-19	4.49E-18
Ag-109m	6.02E-20	6.50E-20	4.37E-20	3.87E-20	1.60E-19	4.33E-20	4.20E-20	5.34E-20	8.32E-20
Ag-110m	5.11E-17	5.24E-17	4.83E-17	4.82E-17	6.86E-17	4.59E-17	4.66E-17	4.96E-17	5.64E-17
Ag-110	7.15E-19	7.35E-19	6.66E-19	6.56E-19	1.06E-18	6.33E-19	6.40E-19	6.90E-19	1.52E-17
Ag-111	5.14E-19	5.30E-19	4.72E-19	4.62E-19	8.71E-19	4.48E-19	4.53E-19	4.95E-19	1.36E-18
Ag-112	1.23E-17	1.26E-17	1.16E-17	1.16E-17	1.65E-17	1.11E-17	1.12E-17	1.19E-17	3.22E-17
Ag-115	1.29E-17	1.32E-17	1.22E-17	1.22E-17	1.81E-17	1.17E-17	1.18E-17	1.26E-17	2.62E-17
Cadmium									
Cd-104	4.31E-18	4.44E-18	3.98E-18	3.87E-18	7.04E-18	3.78E-18	3.81E-18	4.15E-18	4.80E-18
Cd-107	2.04E-19	2.18E-19	1.54E-19	1.48E-19	3.81E-19	1.53E-19	1.50E-19	1.81E-19	2.78E-19
Cd-109	8.67E-20	9.69E-20	4.70E-20	4.29E-20	1.88E-19	5.12E-20	4.84E-20	6.87E-20	1.46E-19
Cd-113m	2.88E-21	3.06E-21	2.42E-21	2.14E-21	7.71E-21	2.32E-21	2.28E-21	2.71E-21	1.72E-20
Cd-113	5.68E-22	6.14E-22	4.39E-22	3.69E-22	1.62E-21	4.30E-22	4.15E-22	5.17E-22	7.14E-22
Cd-115m	4.40E-19	4.52E-19	4.16E-19	4.15E-19	6.12E-19	3.95E-19	4.02E-19	4.28E-19	4.44E-18
Cd-115	4.43E-18	4.55E-18	4.11E-18	4.05E-18	6.53E-18	3.91E-18	3.95E-18	4.27E-18	5.53E-18
Cd-117m	3.68E-17	3.76E-17	3.52E-17	3.54E-17	4.74E-17	3.35E-17	3.41E-17	3.60E-17	4.07E-17
Cd-117	1.99E-17	2.04E-17	1.89E-17	1.89E-17	2.72E-17	1.79E-17	1.83E-17	1.94E-17	2.48E-17

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	1.22E-17	1.25E-17	1.14E-17	1.13E-17	1.87E-17	1.08E-17	1.10E-17	1.18E-17	1.35E-17
In-110b[1]	5.67E-17	5.82E-17	5.34E-17	5.32E-17	7.68E-17	5.07E-17	5.15E-17	5.50E-17	6.27E-17
In-110a[2]	2.91E-17	2.98E-17	2.72E-17	2.70E-17	4.06E-17	2.60E-17	2.63E-17	2.81E-17	3.85E-17
In-111	7.19E-18	7.47E-18	6.56E-18	6.34E-18	1.44E-17	6.19E-18	6.26E-18	6.96E-18	7.98E-18
In-112	5.01E-18	5.14E-18	4.64E-18	4.58E-18	7.28E-18	4.42E-18	4.47E-18	4.82E-18	6.56E-18
In-113m	4.83E-18	4.97E-18	4.44E-18	4.36E-18	7.62E-18	4.23E-18	4.27E-18	4.64E-18	5.34E-18
In-114m	1.62E-18	1.67E-18	1.49E-18	1.46E-18	2.63E-18	1.41E-18	1.43E-18	1.56E-18	1.81E-18
In-114	5.01E-20	5.15E-20	4.77E-20	4.79E-20	6.59E-20	4.53E-20	4.62E-20	4.89E-20	5.58E-20
In-115m	2.94E-18	3.04E-18	2.69E-18	2.64E-18	4.88E-18	2.56E-18	2.58E-18	2.83E-18	3.28E-18
In-115	1.84E-21	1.96E-21	1.51E-21	1.32E-21	5.04E-21	1.46E-21	1.43E-21	1.72E-21	3.09E-21
In-116m	4.49E-17	4.60E-17	4.29E-17	4.31E-17	5.85E-17	4.08E-17	4.15E-17	4.39E-17	4.99E-17
In-117m	1.64E-18	1.70E-18	1.50E-18	1.45E-18	3.06E-18	1.42E-18	1.43E-18	1.58E-18	4.30E-18
In-117	1.30E-17	1.34E-17	1.20E-17	1.18E-17	2.08E-17	1.14E-17	1.15E-17	1.25E-17	1.45E-17
In-119m	2.47E-19	2.57E-19	2.22E-19	2.17E-19	4.16E-19	2.12E-19	2.14E-19	2.36E-19	1.21E-17
In-119	1.44E-17	1.48E-17	1.35E-17	1.35E-17	1.96E-17	1.29E-17	1.30E-17	1.39E-17	2.00E-17
Tin									
Sn-110	5.42E-18	5.62E-18	4.96E-18	4.84E-18	9.60E-18	4.70E-18	4.75E-18	5.23E-18	6.03E-18
Sn-111	9.35E-18	9.59E-18	8.74E-18	8.67E-18	1.31E-17	8.33E-18	8.43E-18	9.04E-18	1.17E-17
Sn-113	1.30E-19	1.41E-19	8.94E-20	8.76E-20	2.16E-19	9.16E-20	8.90E-20	1.11E-19	1.81E-19
Sn-117m	2.55E-18	2.65E-18	2.30E-18	2.18E-18	5.81E-18	2.17E-18	2.18E-18	2.47E-18	2.83E-18
Sn-119m	2.62E-20	3.11E-20	5.21E-21	5.14E-21	3.46E-20	9.48E-21	7.81E-21	1.61E-20	5.18E-20
Sn-121m	1.56E-20	1.82E-20	4.98E-21	4.03E-21	2.71E-20	7.01E-21	5.96E-21	1.05E-20	2.61E-20
Sn-121	9.45E-22	1.02E-21	7.53E-22	6.44E-22	2.66E-21	7.32E-22	7.10E-22	8.71E-22	1.16E-21
Sn-123m	2.47E-18	2.57E-18	2.26E-18	2.14E-18	5.63E-18	2.12E-18	2.14E-18	2.40E-18	4.54E-18
Sn-123	1.53E-19	1.57E-19	1.44E-19	1.43E-19	2.25E-19	1.37E-19	1.39E-19	1.49E-19	2.99E-18
Sn-125	5.80E-18	5.95E-18	5.52E-18	5.52E-18	7.69E-18	5.24E-18	5.33E-18	5.65E-18	1.47E-17
Sn-126	6.82E-19	7.19E-19	5.94E-19	5.12E-19	2.13E-18	5.62E-19	5.53E-19	6.58E-19	7.67E-19
Sn-127	3.49E-17	3.57E-17	3.32E-17	3.32E-17	4.66E-17	3.15E-17	3.21E-17	3.40E-17	4.28E-17
Sn-128	1.17E-17	1.21E-17	1.08E-17	1.05E-17	1.80E-17	1.03E-17	1.03E-17	1.12E-17	1.30E-17
Antimony									
Sb-115	1.71E-17	1.76E-17	1.59E-17	1.56E-17	2.50E-17	1.51E-17	1.53E-17	1.65E-17	2.04E-17
Sb-116m	5.75E-17	5.90E-17	5.44E-17	5.43E-17	7.87E-17	5.16E-17	5.25E-17	5.59E-17	6.38E-17
Sb-116	3.93E-17	4.02E-17	3.74E-17	3.74E-17	5.20E-17	3.55E-17	3.61E-17	3.83E-17	4.72E-17
Sb-117	2.99E-18	3.11E-18	2.72E-18	2.59E-18	6.38E-18	2.56E-18	2.58E-18	2.89E-18	3.33E-18
Sb-118m	4.68E-17	4.81E-17	4.44E-17	4.44E-17	6.35E-17	4.21E-17	4.29E-17	4.56E-17	5.17E-17
Sb-119	5.56E-20	6.60E-20	1.14E-20	1.10E-20	7.49E-20	2.04E-20	1.69E-20	3.44E-20	1.08E-19
Sb-120b[3]	4.47E-17	4.59E-17	4.24E-17	4.22E-17	6.26E-17	4.01E-17	4.08E-17	4.35E-17	4.94E-17
Sb-120a[4]	8.45E-18	8.67E-18	7.82E-18	7.71E-18	1.23E-17	7.45E-18	7.52E-18	8.12E-18	1.16E-17
Sb-122	8.41E-18	8.63E-18	7.83E-18	7.74E-18	1.20E-17	7.45E-18	7.54E-18	8.11E-18	1.29E-17
Sb-124n[5]	1.75E-22	2.08E-22	3.20E-23	3.29E-23	2.22E-22	6.14E-23	5.02E-23	1.06E-22	3.50E-22
Sb-124m[6]	6.69E-18	6.86E-18	6.23E-18	6.16E-18	9.50E-18	5.93E-18	5.99E-18	6.45E-18	7.65E-18
Sb-124	3.33E-17	3.40E-17	3.16E-17	3.17E-17	4.40E-17	3.01E-17	3.06E-17	3.24E-17	3.89E-17
Sb-125	7.96E-18	8.18E-18	7.36E-18	7.25E-18	1.18E-17	7.01E-18	7.08E-18	7.66E-18	8.82E-18
Sb-126m	2.94E-17	3.01E-17	2.74E-17	2.71E-17	4.17E-17	2.61E-17	2.64E-17	2.83E-17	3.68E-17
Sb-126	5.35E-17	5.49E-17	5.01E-17	4.97E-17	7.51E-17	4.76E-17	4.82E-17	5.17E-17	6.02E-17
Sb-127	1.30E-17	1.34E-17	1.21E-17	1.20E-17	1.86E-17	1.15E-17	1.17E-17	1.26E-17	1.50E-17
Sb-128b[7]	5.82E-17	5.97E-17	5.46E-17	5.42E-17	8.15E-17	5.18E-17	5.26E-17	5.63E-17	6.64E-17
Sb-128a[8]	3.74E-17	3.84E-17	3.51E-17	3.48E-17	5.29E-17	3.33E-17	3.38E-17	3.62E-17	5.08E-17
Sb-129	2.66E-17	2.72E-17	2.52E-17	2.51E-17	3.56E-17	2.39E-17	2.43E-17	2.58E-17	3.15E-17
Sb-130	6.08E-17	6.24E-17	5.73E-17	5.69E-17	8.54E-17	5.43E-17	5.52E-17	5.90E-17	7.32E-17
Sb-131	3.41E-17	3.49E-17	3.24E-17	3.25E-17	4.50E-17	3.08E-17	3.14E-17	3.32E-17	4.15E-17
Tellurium									
Te-116	7.85E-19	8.25E-19	6.64E-19	6.10E-19	1.86E-18	6.38E-19	6.29E-19	7.37E-19	9.18E-19
Te-121m	3.79E-18	3.94E-18	3.47E-18	3.37E-18	7.19E-18	3.28E-18	3.32E-18	3.67E-18	4.22E-18

[1] $T_{½}$ = 4.9 h
[2] $T_{½}$ = 69.1 m
[3] $T_{½}$ = 5.76 d
[4] $T_{½}$ = 15.89 m
[5] $T_{½}$ = 20.2 m
[6] $T_{½}$ = 93 s
[7] $T_{½}$ = 9.01 h
[8] $T_{½}$ = 10.4 m

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	1.07E-17	1.09E-17	9.88E-18	9.75E-18	1.53E-17	9.41E-18	9.51E-18	1.03E-17	1.18E-17
Te-123m	2.43E-18	2.53E-18	2.20E-18	2.08E-18	5.55E-18	2.07E-18	2.08E-18	2.36E-18	2.70E-18
Te-123	5.50E-20	6.50E-20	1.37E-20	1.20E-20	8.21E-20	2.20E-20	1.83E-20	3.52E-20	9.89E-20
Te-125m	1.17E-19	1.37E-19	3.85E-20	3.15E-20	2.03E-19	5.35E-20	4.57E-20	7.97E-20	1.94E-19
Te-127m	3.89E-20	4.51E-20	1.47E-20	1.23E-20	6.97E-20	1.91E-20	1.66E-20	2.74E-20	6.64E-20
Te-127	9.69E-20	9.98E-20	8.90E-20	8.70E-20	1.57E-19	8.47E-20	8.54E-20	9.32E-20	1.81E-19
Te-129m	5.92E-19	6.11E-19	5.38E-19	5.32E-19	8.33E-19	5.15E-19	5.20E-19	5.64E-19	1.96E-18
Te-129	1.08E-18	1.11E-18	9.94E-19	9.79E-19	1.63E-18	9.48E-19	9.56E-19	1.04E-18	3.95E-18
Te-131m	2.63E-17	2.70E-17	2.48E-17	2.47E-17	3.64E-17	2.35E-17	2.39E-17	2.55E-17	2.95E-17
Te-131	7.75E-18	7.98E-18	7.23E-18	7.09E-18	1.27E-17	6.85E-18	6.93E-18	7.52E-18	1.42E-17
Te-132	3.97E-18	4.14E-18	3.59E-18	3.47E-18	7.82E-18	3.40E-18	3.43E-18	3.83E-18	4.43E-18
Te-133m	4.27E-17	4.38E-17	4.04E-17	4.03E-17	5.83E-17	3.83E-17	3.90E-17	4.15E-17	5.26E-17
Te-133	1.73E-17	1.78E-17	1.63E-17	1.62E-17	2.50E-17	1.55E-17	1.57E-17	1.68E-17	2.67E-17
Te-134	1.65E-17	1.69E-17	1.53E-17	1.51E-17	2.53E-17	1.45E-17	1.47E-17	1.59E-17	1.84E-17
Iodine									
I-120m	9.75E-17	9.97E-17	9.22E-17	9.20E-17	1.32E-16	8.79E-17	8.91E-17	9.48E-17	1.24E-16
I-120	5.00E-17	5.10E-17	4.72E-17	4.72E-17	6.76E-17	4.53E-17	4.57E-17	4.86E-17	7.52E-17
I-121	7.57E-18	7.82E-18	6.96E-18	6.81E-18	1.28E-17	6.60E-18	6.67E-18	7.30E-18	8.62E-18
I-122	1.81E-17	1.85E-17	1.68E-17	1.65E-17	2.62E-17	1.60E-17	1.61E-17	1.74E-17	3.36E-17
I-123	2.72E-18	2.83E-18	2.45E-18	2.33E-18	5.95E-18	2.31E-18	2.32E-18	2.62E-18	3.04E-18
I-124	2.01E-17	2.06E-17	1.89E-17	1.89E-17	2.75E-17	1.81E-17	1.83E-17	1.95E-17	2.38E-17
I-125	1.33E-19	1.57E-19	4.00E-20	3.23E-20	2.23E-19	5.83E-20	4.91E-20	8.87E-20	2.24E-19
I-126	8.46E-18	8.69E-18	7.85E-18	7.76E-18	1.23E-17	7.47E-18	7.56E-18	8.15E-18	9.69E-18
I-128	1.66E-18	1.71E-18	1.53E-18	1.51E-18	2.53E-18	1.46E-18	1.47E-18	1.60E-18	8.51E-18
I-129	9.73E-20	1.13E-19	3.81E-20	2.84E-20	1.94E-19	4.88E-20	4.21E-20	6.92E-20	1.48E-19
I-130	4.04E-17	4.14E-17	3.78E-17	3.75E-17	5.66E-17	3.59E-17	3.64E-17	3.90E-17	4.52E-17
I-131	7.25E-18	7.47E-18	6.70E-18	6.57E-18	1.16E-17	6.36E-18	6.43E-18	6.99E-18	8.03E-18
I-132m	5.91E-18	6.07E-18	5.51E-18	5.45E-18	8.52E-18	5.24E-18	5.30E-18	5.71E-18	6.88E-18
I-132	4.27E-17	4.38E-17	4.02E-17	4.00E-17	5.81E-17	3.82E-17	3.87E-17	4.14E-17	4.99E-17
I-133	1.15E-17	1.18E-17	1.07E-17	1.06E-17	1.64E-17	1.02E-17	1.03E-17	1.11E-17	1.42E-17
I-134	4.87E-17	4.99E-17	4.61E-17	4.60E-17	6.54E-17	4.37E-17	4.45E-17	4.73E-17	5.80E-17
I-135	2.86E-17	2.93E-17	2.73E-17	2.75E-17	3.71E-17	2.60E-17	2.65E-17	2.80E-17	3.27E-17
Xenon									
Xe-120	7.42E-18	7.65E-18	6.84E-18	6.73E-18	1.14E-17	6.51E-18	6.58E-18	7.14E-18	8.29E-18
Xe-121	3.26E-17	3.33E-17	3.09E-17	3.08E-17	4.50E-17	2.96E-17	2.98E-17	3.18E-17	4.22E-17
Xe-122	9.28E-19	9.70E-19	8.07E-19	7.81E-19	1.63E-18	7.77E-19	7.76E-19	8.73E-19	1.07E-18
Xe-123	1.14E-17	1.17E-17	1.06E-17	1.05E-17	1.75E-17	1.01E-17	1.02E-17	1.10E-17	1.35E-17
Xe-125	4.55E-18	4.73E-18	4.14E-18	4.01E-18	8.48E-18	3.92E-18	3.96E-18	4.39E-18	5.09E-18
Xe-127	4.80E-18	4.99E-18	4.35E-18	4.20E-18	9.39E-18	4.12E-18	4.15E-18	4.63E-18	5.34E-18
Xe-129m	3.28E-19	3.61E-19	2.13E-19	1.92E-19	6.56E-19	2.23E-19	2.11E-19	2.75E-19	4.32E-19
Xe-131m	1.18E-19	1.30E-19	7.29E-20	6.52E-20	2.40E-19	7.73E-20	7.29E-20	9.69E-20	1.58E-19
Xe-133m	5.01E-19	5.29E-19	4.24E-19	4.08E-19	9.57E-19	4.09E-19	4.08E-19	4.68E-19	5.84E-19
Xe-133	4.86E-19	5.18E-19	4.03E-19	3.41E-19	1.50E-18	3.87E-19	3.78E-19	4.58E-19	5.59E-19
Xe-135m	8.12E-18	8.33E-18	7.53E-18	7.42E-18	1.18E-17	7.17E-18	7.24E-18	7.82E-18	9.07E-18
Xe-135	4.68E-18	4.85E-18	4.30E-18	4.19E-18	8.56E-18	4.06E-18	4.11E-18	4.53E-18	5.60E-18
Xe-138	2.02E-17	2.07E-17	1.93E-17	1.94E-17	2.73E-17	1.84E-17	1.87E-17	1.98E-17	2.81E-17
Cesium									
Cs-125	1.27E-17	1.30E-17	1.17E-17	1.16E-17	1.86E-17	1.12E-17	1.13E-17	1.22E-17	1.70E-17
Cs-126	2.09E-17	2.15E-17	1.94E-17	1.91E-17	3.10E-17	1.84E-17	1.86E-17	2.01E-17	4.43E-17
Cs-127	7.59E-18	7.82E-18	6.98E-18	6.85E-18	1.19E-17	6.65E-18	6.70E-18	7.30E-18	8.44E-18
Cs-128	1.71E-17	1.76E-17	1.59E-17	1.57E-17	2.52E-17	1.51E-17	1.53E-17	1.65E-17	2.92E-17
Cs-129	4.86E-18	5.02E-18	4.42E-18	4.33E-18	7.72E-18	4.22E-18	4.25E-18	4.65E-18	5.42E-18
Cs-130	9.67E-18	9.93E-18	8.95E-18	8.83E-18	1.41E-17	8.53E-18	8.61E-18	9.30E-18	1.44E-17
Cs-131	8.36E-20	9.78E-20	2.94E-20	2.23E-20	1.54E-19	3.96E-20	3.37E-20	5.77E-20	1.31E-19
Cs-132	1.30E-17	1.33E-17	1.21E-17	1.20E-17	1.80E-17	1.15E-17	1.17E-17	1.25E-17	1.44E-17
Cs-134m	3.12E-19	3.29E-19	2.65E-19	2.42E-19	7.84E-19	2.53E-19	2.50E-19	2.94E-19	3.57E-19
Cs-134	2.93E-17	3.00E-17	2.75E-17	2.73E-17	4.04E-17	2.61E-17	2.65E-17	2.83E-17	3.24E-17
Cs-135m	2.96E-17	3.04E-17	2.80E-17	2.78E-17	4.01E-17	2.65E-17	2.69E-17	2.87E-17	3.30E-17
Cs-135	2.11E-22	2.32E-22	1.48E-22	1.20E-22	6.00E-22	1.50E-22	1.42E-22	1.85E-22	2.87E-22
Cs-136	4.00E-17	4.11E-17	3.78E-17	3.76E-17	5.55E-17	3.58E-17	3.64E-17	3.89E-17	4.42E-17

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	3.26E-21	3.45E-21	2.76E-21	2.46E-21	8.46E-21	2.64E-21	2.60E-21	3.07E-21	9.23E-20
Cs-138	4.27E-17	4.36E-17	4.08E-17	4.10E-17	5.54E-17	3.89E-17	3.95E-17	4.17E-17	6.15E-17
Barium									
Ba-126	2.73E-18	2.83E-18	2.47E-18	2.42E-18	4.48E-18	2.36E-18	2.37E-18	2.61E-18	3.06E-18
Ba-128	1.08E-18	1.13E-18	9.39E-19	9.08E-19	1.95E-18	9.00E-19	9.02E-19	1.02E-18	1.23E-18
Ba-131m	1.04E-18	1.09E-18	9.20E-19	8.25E-19	2.91E-18	8.68E-19	8.59E-19	1.01E-18	1.16E-18
Ba-131	8.16E-18	8.42E-18	7.48E-18	7.31E-18	1.34E-17	7.12E-18	7.18E-18	7.85E-18	9.05E-18
Ba-133m	9.95E-19	1.04E-18	8.76E-19	8.48E-19	1.80E-18	8.38E-19	8.41E-19	9.43E-19	1.13E-18
Ba-133	6.93E-18	7.17E-18	6.29E-18	6.10E-18	1.22E-17	5.98E-18	6.02E-18	6.64E-18	7.71E-18
Ba-135m	8.74E-19	9.15E-19	7.64E-19	7.38E-19	1.60E-18	7.32E-19	7.33E-19	8.26E-19	9.93E-19
Ba-137m	1.13E-17	1.15E-17	1.05E-17	1.04E-17	1.56E-17	1.00E-17	1.01E-17	1.09E-17	1.27E-17
Ba-139	8.24E-19	8.57E-19	7.55E-19	7.22E-19	1.75E-18	7.11E-19	7.17E-19	8.01E-19	9.72E-18
Ba-140	3.39E-18	3.49E-18	3.13E-18	3.08E-18	5.18E-18	2.98E-18	3.01E-18	3.26E-18	4.23E-18
Ba-141	1.57E-17	1.62E-17	1.47E-17	1.46E-17	2.38E-17	1.40E-17	1.42E-17	1.53E-17	2.62E-17
Ba-142	1.92E-17	1.97E-17	1.81E-17	1.81E-17	2.69E-17	1.72E-17	1.75E-17	1.87E-17	2.29E-17
Lanthanum									
La-131	1.23E-17	1.27E-17	1.14E-17	1.11E-17	1.93E-17	1.08E-17	1.09E-17	1.19E-17	1.49E-17
La-132	3.68E-17	3.77E-17	3.47E-17	3.46E-17	5.06E-17	3.32E-17	3.35E-17	3.57E-17	4.69E-17
La-134	1.32E-17	1.36E-17	1.23E-17	1.21E-17	1.92E-17	1.17E-17	1.18E-17	1.27E-17	2.34E-17
La-135	3.05E-19	3.28E-19	2.27E-19	2.12E-19	5.14E-19	2.30E-19	2.21E-19	2.67E-19	3.76E-19
La-137	1.04E-19	1.21E-19	4.34E-20	3.15E-20	2.16E-19	5.41E-20	4.69E-20	7.52E-20	1.52E-19
La-138	2.23E-17	2.28E-17	2.13E-17	2.14E-17	2.88E-17	2.02E-17	2.06E-17	2.18E-17	2.45E-17
La-140	4.20E-17	4.30E-17	4.01E-17	4.02E-17	5.52E-17	3.81E-17	3.88E-17	4.10E-17	4.89E-17
La-141	8.65E-19	8.87E-19	8.25E-19	8.27E-19	1.17E-18	7.84E-19	7.99E-19	8.46E-19	1.09E-17
La-142	4.86E-17	4.93E-17	4.66E-17	4.70E-17	6.15E-17	4.49E-17	4.53E-17	4.76E-17	6.11E-17
La-143	1.87E-18	1.91E-18	1.78E-18	1.78E-18	2.52E-18	1.70E-18	1.72E-18	1.82E-18	1.94E-17
Cerium									
Ce-134	1.21E-19	1.40E-19	5.45E-20	3.91E-20	2.66E-19	6.58E-20	5.74E-20	8.97E-20	1.72E-19
Ce-135	3.37E-17	3.46E-17	3.13E-17	3.09E-17	4.99E-17	2.98E-17	3.01E-17	3.25E-17	3.74E-17
Ce-137m	7.19E-19	7.55E-19	6.19E-19	5.93E-19	1.33E-18	5.96E-19	5.94E-19	6.74E-19	8.22E-19
Ce-137	2.83E-19	3.06E-19	2.04E-19	1.86E-19	5.11E-19	2.08E-19	1.99E-19	2.45E-19	3.51E-19
Ce-139	2.49E-18	2.60E-18	2.22E-18	2.10E-18	5.58E-18	2.10E-18	2.10E-18	2.39E-18	2.78E-18
Ce-141	1.26E-18	1.31E-18	1.14E-18	1.07E-18	3.04E-18	1.07E-18	1.08E-18	1.22E-18	1.39E-18
Ce-143	4.99E-18	5.16E-18	4.57E-18	4.47E-18	8.19E-18	4.35E-18	4.39E-18	4.80E-18	6.97E-18
Ce-144	3.00E-19	3.14E-19	2.65E-19	2.42E-19	7.76E-19	2.51E-19	2.49E-19	2.88E-19	3.33E-19
Praseodymium									
Pr-136	3.91E-17	4.00E-17	3.66E-17	3.64E-17	5.43E-17	3.49E-17	3.54E-17	3.78E-17	5.22E-17
Pr-137	9.21E-18	9.46E-18	8.53E-18	8.41E-18	1.34E-17	8.13E-18	8.20E-18	8.86E-18	1.16E-17
Pr-138m	4.59E-17	4.71E-17	4.32E-17	4.30E-17	6.38E-17	4.10E-17	4.16E-17	4.45E-17	5.20E-17
Pr-138	1.56E-17	1.60E-17	1.44E-17	1.42E-17	2.27E-17	1.37E-17	1.39E-17	1.50E-17	3.32E-17
Pr-139	1.96E-18	2.02E-18	1.77E-18	1.73E-18	2.92E-18	1.69E-18	1.70E-18	1.86E-18	2.32E-18
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	1.11E-18	1.14E-18	1.07E-18	1.07E-18	1.46E-18	1.01E-18	1.03E-18	1.09E-18	8.94E-18
Pr-143	9.09E-21	9.57E-21	7.89E-21	7.19E-21	2.24E-20	7.52E-21	7.44E-21	8.64E-21	5.06E-19
Pr-144m	7.79E-20	8.69E-20	4.75E-20	3.82E-20	1.73E-19	5.11E-20	4.69E-20	6.36E-20	1.03E-19
Pr-144	7.18E-19	7.34E-19	6.79E-19	6.77E-19	1.01E-18	6.48E-19	6.57E-19	6.99E-19	1.58E-17
Pr-145	2.85E-19	2.93E-19	2.66E-19	2.63E-19	4.24E-19	2.53E-19	2.56E-19	2.76E-19	5.41E-18
Pr-147	1.57E-17	1.61E-17	1.47E-17	1.45E-17	2.31E-17	1.39E-17	1.41E-17	1.52E-17	2.39E-17
Neodymium									
Nd-136	4.77E-18	4.93E-18	4.32E-18	4.16E-18	8.33E-18	4.12E-18	4.13E-18	4.56E-18	5.38E-18
Nd-138	4.20E-19	4.50E-19	3.24E-19	2.95E-19	8.44E-19	3.22E-19	3.11E-19	3.75E-19	5.01E-19
Nd-139m	2.86E-17	2.94E-17	2.69E-17	2.67E-17	3.99E-17	2.56E-17	2.59E-17	2.77E-17	3.20E-17
Nd-139	7.39E-18	7.60E-18	6.84E-18	6.74E-18	1.08E-17	6.52E-18	6.58E-18	7.11E-18	9.73E-18
Nd-141m	1.42E-17	1.46E-17	1.34E-17	1.33E-17	1.94E-17	1.27E-17	1.29E-17	1.38E-17	1.61E-17
Nd-141	1.03E-18	1.07E-18	9.04E-19	8.75E-19	1.59E-18	8.73E-19	8.71E-19	9.67E-19	1.18E-18
Nd-147	2.33E-18	2.41E-18	2.11E-18	2.03E-18	4.21E-18	2.02E-18	2.02E-18	2.23E-18	2.76E-18
Nd-149	7.01E-18	7.25E-18	6.45E-18	6.27E-18	1.23E-17	6.11E-18	6.17E-18	6.77E-18	9.74E-18
Nd-151	1.67E-17	1.72E-17	1.57E-17	1.56E-17	2.51E-17	1.49E-17	1.51E-17	1.63E-17	2.29E-17
Promethium									
Pm-141	1.39E-17	1.42E-17	1.29E-17	1.28E-17	1.98E-17	1.23E-17	1.25E-17	1.34E-17	2.29E-17
Pm-142	1.66E-17	1.71E-17	1.54E-17	1.52E-17	2.42E-17	1.47E-17	1.49E-17	1.60E-17	3.83E-17
Pm-143	5.54E-18	5.70E-18	5.14E-18	5.08E-18	7.77E-18	4.90E-18	4.95E-18	5.33E-18	6.17E-18

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Promethium, cont'd									
Pm-144	2.92E-17	3.00E-17	2.72E-17	2.69E-17	4.12E-17	2.59E-17	2.62E-17	2.82E-17	3.23E-17
Pm-145	1.88E-19	2.12E-19	1.11E-19	8.09E-20	5.04E-19	1.20E-19	1.09E-19	1.53E-19	2.44E-19
Pm-146	1.40E-17	1.44E-17	1.30E-17	1.29E-17	2.01E-17	1.24E-17	1.25E-17	1.35E-17	1.56E-17
Pm-147	2.55E-22	2.77E-22	1.91E-22	1.61E-22	7.13E-22	1.89E-22	1.82E-22	2.29E-22	3.30E-22
Pm-148m	3.77E-17	3.87E-17	3.53E-17	3.49E-17	5.34E-17	3.35E-17	3.39E-17	3.64E-17	4.17E-17
Pm-148	1.06E-17	1.09E-17	1.01E-17	1.01E-17	1.41E-17	9.57E-18	9.74E-18	1.03E-17	1.81E-17
Pm-149	2.14E-19	2.21E-19	1.97E-19	1.92E-19	3.69E-19	1.87E-19	1.89E-19	2.07E-19	1.15E-18
Pm-150	2.63E-17	2.69E-17	2.49E-17	2.49E-17	3.59E-17	2.37E-17	2.41E-17	2.56E-17	3.58E-17
Pm-151	5.86E-18	6.05E-18	5.40E-18	5.27E-18	9.87E-18	5.12E-18	5.17E-18	5.65E-18	6.95E-18
Samarium									
Sm-141m	3.65E-17	3.75E-17	3.43E-17	3.41E-17	5.22E-17	3.26E-17	3.31E-17	3.54E-17	4.46E-17
Sm-141	2.62E-17	2.69E-17	2.45E-17	2.43E-17	3.73E-17	2.33E-17	2.36E-17	2.53E-17	3.77E-17
Sm-142	1.41E-18	1.46E-18	1.24E-18	1.20E-18	2.26E-18	1.20E-18	1.20E-18	1.33E-18	1.67E-18
Sm-145	4.28E-19	4.79E-19	2.68E-19	1.95E-19	1.21E-18	2.84E-19	2.59E-19	3.57E-19	5.42E-19
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	9.38E-24	1.14E-23	8.79E-25	1.37E-24	8.77E-24	2.48E-24	2.03E-24	5.27E-24	2.46E-23
Sm-153	7.31E-19	7.75E-19	6.16E-19	5.30E-19	2.12E-18	5.90E-19	5.75E-19	6.90E-19	9.29E-19
Sm-155	1.64E-18	1.71E-18	1.48E-18	1.35E-18	4.40E-18	1.39E-18	1.39E-18	1.59E-18	4.93E-18
Sm-156	2.02E-18	2.11E-18	1.84E-18	1.74E-18	4.52E-18	1.73E-18	1.74E-18	1.96E-18	2.28E-18
Europium									
Eu-145	2.63E-17	2.70E-17	2.49E-17	2.49E-17	3.50E-17	2.37E-17	2.41E-17	2.56E-17	2.91E-17
Eu-146	4.62E-17	4.74E-17	4.35E-17	4.34E-17	6.29E-17	4.14E-17	4.20E-17	4.48E-17	5.12E-17
Eu-147	8.67E-18	8.94E-18	8.06E-18	7.92E-18	1.34E-17	7.65E-18	7.74E-18	8.38E-18	9.63E-18
Eu-148	4.05E-17	4.15E-17	3.79E-17	3.76E-17	5.66E-17	3.60E-17	3.65E-17	3.91E-17	4.47E-17
Eu-149	7.88E-19	8.33E-19	6.61E-19	6.14E-19	1.55E-18	6.42E-19	6.31E-19	7.30E-19	9.06E-19
Eu-150b[1]	2.78E-17	2.86E-17	2.59E-17	2.56E-17	4.13E-17	2.46E-17	2.49E-17	2.69E-17	3.09E-17
Eu-150a[2]	8.49E-19	8.75E-19	7.83E-19	7.70E-19	1.31E-18	7.46E-19	7.53E-19	8.17E-19	1.61E-18
Eu-152m	5.33E-18	5.48E-18	5.02E-18	4.98E-18	7.49E-18	4.76E-18	4.83E-18	5.17E-18	9.77E-18
Eu-152	2.08E-17	2.14E-17	1.97E-17	1.96E-17	2.93E-17	1.87E-17	1.90E-17	2.03E-17	2.31E-17
Eu-154	2.26E-17	2.32E-17	2.15E-17	2.14E-17	3.13E-17	2.04E-17	2.07E-17	2.21E-17	2.58E-17
Eu-155	8.20E-19	8.61E-19	7.24E-19	6.30E-19	2.49E-18	6.83E-19	6.73E-19	7.94E-19	9.06E-19
Eu-156	2.39E-17	2.45E-17	2.29E-17	2.30E-17	3.12E-17	2.18E-17	2.21E-17	2.34E-17	2.93E-17
Eu-157	4.50E-18	4.65E-18	4.09E-18	3.95E-18	7.58E-18	3.90E-18	3.92E-18	4.31E-18	6.10E-18
Eu-158	1.93E-17	1.98E-17	1.84E-17	1.83E-17	2.59E-17	1.74E-17	1.77E-17	1.88E-17	3.11E-17
Gadolinium									
Gd-145	4.05E-17	4.14E-17	3.86E-17	3.88E-17	5.31E-17	3.69E-17	3.75E-17	3.96E-17	5.08E-17
Gd-146	3.42E-18	3.59E-18	2.98E-18	2.68E-18	8.96E-18	2.83E-18	2.79E-18	3.26E-18	3.82E-18
Gd-147	2.45E-17	2.52E-17	2.29E-17	2.27E-17	3.61E-17	2.17E-17	2.21E-17	2.37E-17	2.71E-17
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	7.33E-18	7.58E-18	6.71E-18	6.52E-18	1.26E-17	6.38E-18	6.43E-18	7.05E-18	8.14E-18
Gd-151	7.38E-19	7.86E-19	6.09E-19	5.49E-19	1.71E-18	5.91E-19	5.77E-19	6.83E-19	8.52E-19
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	1.17E-18	1.24E-18	9.63E-19	8.17E-19	3.44E-18	9.28E-19	9.00E-19	1.09E-18	1.33E-18
Gd-159	8.45E-19	8.77E-19	7.61E-19	7.32E-19	1.50E-18	7.27E-19	7.28E-19	8.07E-19	1.38E-18
Terbium									
Tb-147	2.94E-17	3.01E-17	2.76E-17	2.75E-17	4.10E-17	2.62E-17	2.66E-17	2.85E-17	3.94E-17
Tb-149	2.93E-17	3.00E-17	2.77E-17	2.76E-17	4.07E-17	2.63E-17	2.67E-17	2.85E-17	3.38E-17
Tb-150	3.11E-17	3.18E-17	2.92E-17	2.90E-17	4.29E-17	2.78E-17	2.82E-17	3.01E-17	4.10E-17
Tb-151	1.61E-17	1.66E-17	1.49E-17	1.46E-17	2.56E-17	1.42E-17	1.43E-17	1.56E-17	1.79E-17
Tb-153	3.61E-18	3.76E-18	3.25E-18	3.09E-18	7.19E-18	3.09E-18	3.09E-18	3.46E-18	4.03E-18
Tb-154	4.13E-17	4.21E-17	3.95E-17	3.97E-17	5.38E-17	3.78E-17	3.83E-17	4.04E-17	4.51E-17
Tb-155	1.92E-18	2.02E-18	1.68E-18	1.52E-18	4.75E-18	1.60E-18	1.58E-18	1.83E-18	2.16E-18
Tb-156m[3]	2.10E-19	2.32E-19	1.55E-19	1.14E-19	6.90E-19	1.56E-19	1.44E-19	1.88E-19	2.51E-19
Tb-156n[4]	3.39E-20	3.68E-20	2.64E-20	2.10E-20	1.06E-19	2.59E-20	2.46E-20	3.10E-20	3.96E-20
Tb-156	3.30E-17	3.39E-17	3.11E-17	3.09E-17	4.66E-17	2.96E-17	3.00E-17	3.21E-17	3.64E-17
Tb-157	1.79E-20	2.01E-20	1.18E-20	8.48E-21	5.40E-20	1.23E-20	1.12E-20	1.53E-20	2.23E-20
Tb-158	1.43E-17	1.47E-17	1.34E-17	1.33E-17	2.00E-17	1.27E-17	1.29E-17	1.38E-17	1.59E-17

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	2.06E-17	2.12E-17	1.95E-17	1.94E-17	2.86E-17	1.85E-17	1.88E-17	2.01E-17	2.29E-17
Tb-161	2.93E-19	3.19E-19	2.24E-19	1.77E-19	9.09E-19	2.21E-19	2.10E-19	2.66E-19	3.53E-19
Dysprosium									
Dy-155	1.03E-17	1.06E-17	9.56E-18	9.41E-18	1.62E-17	9.08E-18	9.20E-18	9.95E-18	1.14E-17
Dy-157	6.35E-18	6.58E-18	5.78E-18	5.61E-18	1.11E-17	5.49E-18	5.53E-18	6.10E-18	7.05E-18
Dy-159	3.34E-19	3.71E-19	2.30E-19	1.66E-19	1.04E-18	2.36E-19	2.16E-19	2.90E-19	4.09E-19
Dy-165	4.47E-19	4.63E-19	4.07E-19	3.89E-19	8.20E-19	3.87E-19	3.88E-19	4.30E-19	2.26E-18
Dy-166	4.31E-19	4.61E-19	3.55E-19	2.95E-19	1.26E-18	3.44E-19	3.31E-19	4.02E-19	4.94E-19
Holmium									
Ho-155	6.92E-18	7.13E-18	6.35E-18	6.19E-18	1.12E-17	6.05E-18	6.09E-18	6.65E-18	9.53E-18
Ho-157	8.43E-18	8.73E-18	7.72E-18	7.49E-18	1.44E-17	7.34E-18	7.39E-18	8.11E-18	9.49E-18
Ho-159	5.85E-18	6.10E-18	5.29E-18	5.00E-18	1.21E-17	5.02E-18	5.02E-18	5.63E-18	6.51E-18
Ho-161	4.92E-19	5.39E-19	3.63E-19	2.84E-19	1.49E-18	3.64E-19	3.41E-19	4.40E-19	5.95E-19
Ho-162m	9.99E-18	1.03E-17	9.37E-18	9.25E-18	1.51E-17	8.89E-18	9.02E-18	9.70E-18	1.11E-17
Ho-162	2.60E-18	2.70E-18	2.38E-18	2.30E-18	4.31E-18	2.27E-18	2.28E-18	2.50E-18	2.98E-18
Ho-164m	3.59E-19	3.97E-19	2.59E-19	1.91E-19	1.15E-18	2.62E-19	2.43E-19	3.18E-19	4.32E-19
Ho-164	2.53E-19	2.78E-19	1.89E-19	1.44E-19	8.04E-19	1.89E-19	1.77E-19	2.28E-19	5.05E-19
Ho-166m	3.25E-17	3.34E-17	3.04E-17	3.00E-17	4.80E-17	2.88E-17	2.92E-17	3.15E-17	3.59E-17
Ho-166	4.91E-19	5.09E-19	4.55E-19	4.37E-19	8.87E-19	4.32E-19	4.35E-19	4.76E-19	5.66E-18
Ho-167	6.82E-18	7.05E-18	6.26E-18	6.11E-18	1.16E-17	5.95E-18	6.00E-18	6.58E-18	7.69E-18
Erbium									
Er-161	1.65E-17	1.69E-17	1.55E-17	1.54E-17	2.33E-17	1.47E-17	1.49E-17	1.60E-17	1.83E-17
Er-165	3.01E-19	3.33E-19	2.19E-19	1.61E-19	9.78E-19	2.21E-19	2.05E-19	2.68E-19	3.62E-19
Er-169	6.86E-22	7.40E-22	5.37E-22	4.55E-22	1.95E-21	5.25E-22	5.07E-22	6.28E-22	8.53E-22
Er-171	6.91E-18	7.15E-18	6.33E-18	6.12E-18	1.28E-17	5.99E-18	6.04E-18	6.67E-18	8.55E-18
Er-172	9.71E-18	9.98E-18	8.98E-18	8.81E-18	1.48E-17	8.55E-18	8.62E-18	9.35E-18	1.07E-17
Thulium									
Tm-162	3.17E-17	3.23E-17	3.01E-17	3.01E-17	4.26E-17	2.88E-17	2.91E-17	3.09E-17	3.86E-17
Tm-166	3.34E-17	3.42E-17	3.17E-17	3.17E-17	4.52E-17	3.02E-17	3.07E-17	3.25E-17	3.69E-17
Tm-167	2.17E-18	2.29E-18	1.92E-18	1.79E-18	4.85E-18	1.83E-18	1.82E-18	2.08E-18	2.44E-18
Tm-170	7.12E-20	7.56E-20	6.10E-20	5.10E-20	2.25E-19	5.81E-20	5.66E-20	6.81E-20	6.24E-19
Tm-171	6.07E-21	6.61E-21	4.84E-21	3.70E-21	2.06E-20	4.72E-21	4.48E-21	5.64E-21	7.02E-21
Tm-172	8.57E-18	8.78E-18	8.19E-18	8.22E-18	1.13E-17	7.77E-18	7.93E-18	8.38E-18	1.29E-17
Tm-173	7.38E-18	7.59E-18	6.80E-18	6.67E-18	1.16E-17	6.47E-18	6.53E-18	7.10E-18	8.59E-18
Tm-175	1.96E-17	2.01E-17	1.84E-17	1.83E-17	2.76E-17	1.75E-17	1.77E-17	1.90E-17	2.39E-17
Ytterbium									
Yb-162	1.95E-18	2.05E-18	1.73E-18	1.56E-18	5.08E-18	1.63E-18	1.62E-18	1.88E-18	2.18E-18
Yb-166	8.13E-19	8.84E-19	6.45E-19	4.99E-19	2.70E-18	6.31E-19	5.98E-19	7.53E-19	9.43E-19
Yb-167	3.68E-18	3.87E-18	3.25E-18	2.91E-18	9.68E-18	3.09E-18	3.04E-18	3.54E-18	4.11E-18
Yb-169	4.49E-18	4.72E-18	3.97E-18	3.61E-18	1.10E-17	3.77E-18	3.74E-18	4.31E-18	5.02E-18
Yb-175	7.31E-19	7.54E-19	6.70E-19	6.51E-19	1.28E-18	6.36E-19	6.41E-19	7.04E-19	8.07E-19
Yb-177	3.38E-18	3.48E-18	3.19E-18	3.15E-18	5.24E-18	3.02E-18	3.07E-18	3.30E-18	5.60E-18
Yb-178	6.65E-19	6.85E-19	6.12E-19	5.99E-19	1.08E-18	5.81E-19	5.87E-19	6.40E-19	7.64E-19
Lutetium									
Lu-169	1.83E-17	1.88E-17	1.73E-17	1.72E-17	2.63E-17	1.65E-17	1.67E-17	1.79E-17	2.03E-17
Lu-170	4.35E-17	4.43E-17	4.17E-17	4.20E-17	5.63E-17	4.00E-17	4.05E-17	4.26E-17	4.79E-17
Lu-171	1.23E-17	1.26E-17	1.14E-17	1.12E-17	1.83E-17	1.09E-17	1.10E-17	1.18E-17	1.36E-17
Lu-172	3.42E-17	3.51E-17	3.23E-17	3.21E-17	4.77E-17	3.06E-17	3.11E-17	3.32E-17	3.78E-17
Lu-173	1.72E-18	1.82E-18	1.49E-18	1.33E-18	4.24E-18	1.43E-18	1.40E-18	1.63E-18	1.94E-18
Lu-174m	6.61E-19	7.09E-19	5.52E-19	4.61E-19	1.89E-18	5.34E-19	5.15E-19	6.20E-19	7.57E-19
Lu-174	1.84E-18	1.92E-18	1.69E-18	1.61E-18	3.34E-18	1.61E-18	1.61E-18	1.77E-18	2.06E-18
Lu-176m	1.90E-19	2.01E-19	1.66E-19	1.40E-19	5.96E-19	1.57E-19	1.54E-19	1.83E-19	1.90E-18
Lu-176	9.02E-18	9.35E-18	8.26E-18	8.00E-18	1.71E-17	7.81E-18	7.89E-18	8.72E-18	9.98E-18
Lu-177m	1.80E-17	1.86E-17	1.64E-17	1.58E-17	3.47E-17	1.56E-17	1.57E-17	1.74E-17	1.99E-17
Lu-177	6.04E-19	6.29E-19	5.50E-19	5.20E-19	1.35E-18	5.18E-19	5.21E-19	5.86E-19	6.68E-19
Lu-178m	2.04E-17	2.11E-17	1.87E-17	1.82E-17	3.66E-17	1.78E-17	1.79E-17	1.97E-17	2.42E-17
Lu-178	2.53E-18	2.59E-18	2.41E-18	2.40E-18	3.55E-18	2.28E-18	2.32E-18	2.47E-18	9.38E-18
Lu-179	5.87E-19	6.10E-19	5.38E-19	5.20E-19	1.16E-18	5.08E-19	5.14E-19	5.70E-19	2.64E-18

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	9.54E-18	9.86E-18	8.76E-18	8.44E-18	1.69E-17	8.32E-18	8.37E-18	9.19E-18	1.06E-17
Hf-172	1.23E-18	1.32E-18	1.02E-18	8.36E-19	3.88E-18	9.84E-19	9.50E-19	1.16E-18	1.40E-18
Hf-173	6.87E-18	7.13E-18	6.26E-18	5.92E-18	1.45E-17	5.92E-18	5.93E-18	6.64E-18	7.59E-18
Hf-175	6.54E-18	6.78E-18	5.97E-18	5.76E-18	1.17E-17	5.67E-18	5.70E-18	6.29E-18	7.25E-18
Hf-177m	4.13E-17	4.27E-17	3.79E-17	3.67E-17	7.52E-17	3.59E-17	3.62E-17	3.99E-17	4.56E-17
Hf-178m	4.39E-17	4.53E-17	4.05E-17	3.96E-17	7.26E-17	3.85E-17	3.89E-17	4.24E-17	4.85E-17
Hf-179m	1.63E-17	1.69E-17	1.50E-17	1.45E-17	2.93E-17	1.42E-17	1.43E-17	1.58E-17	1.81E-17
Hf-180m	1.85E-17	1.92E-17	1.70E-17	1.66E-17	3.21E-17	1.62E-17	1.63E-17	1.79E-17	2.05E-17
Hf-181	1.03E-17	1.06E-17	9.49E-18	9.25E-18	1.70E-17	9.02E-18	9.09E-18	9.92E-18	1.13E-17
Hf-182m	1.70E-17	1.76E-17	1.58E-17	1.54E-17	2.77E-17	1.50E-17	1.51E-17	1.65E-17	1.89E-17
Hf-182	4.44E-18	4.61E-18	4.07E-18	3.96E-18	8.32E-18	3.85E-18	3.89E-18	4.30E-18	4.91E-18
Hf-183	1.38E-17	1.42E-17	1.29E-17	1.28E-17	2.02E-17	1.23E-17	1.24E-17	1.34E-17	1.70E-17
Hf-184	4.35E-18	4.51E-18	3.97E-18	3.80E-18	8.67E-18	3.75E-18	3.78E-18	4.20E-18	5.34E-18
Tantalum									
Ta-172	2.81E-17	2.89E-17	2.65E-17	2.63E-17	4.07E-17	2.51E-17	2.55E-17	2.73E-17	3.56E-17
Ta-173	1.03E-17	1.06E-17	9.54E-18	9.31E-18	1.66E-17	9.07E-18	9.15E-18	9.94E-18	1.45E-17
Ta-174	1.12E-17	1.16E-17	1.04E-17	1.02E-17	1.86E-17	9.87E-18	9.97E-18	1.09E-17	1.54E-17
Ta-175	1.63E-17	1.68E-17	1.54E-17	1.52E-17	2.45E-17	1.46E-17	1.48E-17	1.59E-17	1.80E-17
Ta-176	3.80E-17	3.89E-17	3.63E-17	3.65E-17	5.02E-17	3.46E-17	3.52E-17	3.72E-17	4.20E-17
Ta-177	7.90E-19	8.40E-19	6.76E-19	5.73E-19	2.27E-18	6.48E-19	6.30E-19	7.50E-19	8.91E-19
Ta-178b[1]	1.83E-17	1.90E-17	1.68E-17	1.62E-17	3.39E-17	1.59E-17	1.60E-17	1.77E-17	2.03E-17
Ta-178a[2]	1.52E-18	1.59E-18	1.38E-18	1.28E-18	3.16E-18	1.31E-18	1.31E-18	1.46E-18	1.70E-18
Ta-179	3.10E-19	3.36E-19	2.51E-19	1.93E-19	1.06E-18	2.44E-19	2.32E-19	2.90E-19	3.56E-19
Ta-180m	4.97E-19	5.36E-19	4.10E-19	3.23E-19	1.67E-18	3.96E-19	3.79E-19	4.68E-19	5.75E-19
Ta-180	1.00E-17	1.04E-17	9.15E-18	8.82E-18	1.90E-17	8.66E-18	8.73E-18	9.67E-18	1.11E-17
Ta-182m	4.06E-18	4.24E-18	3.67E-18	3.42E-18	9.54E-18	3.46E-18	3.46E-18	3.93E-18	4.49E-18
Ta-182	2.32E-17	2.38E-17	2.20E-17	2.19E-17	3.26E-17	2.09E-17	2.13E-17	2.26E-17	2.57E-17
Ta-183	4.89E-18	5.10E-18	4.44E-18	4.19E-18	1.04E-17	4.20E-18	4.21E-18	4.73E-18	5.44E-18
Ta-184	3.00E-17	3.09E-17	2.80E-17	2.76E-17	4.57E-17	2.66E-17	2.69E-17	2.90E-17	3.44E-17
Ta-185	3.20E-18	3.33E-18	2.91E-18	2.74E-18	6.91E-18	2.75E-18	2.76E-18	3.10E-18	8.03E-18
Ta-186	2.92E-17	3.00E-17	2.72E-17	2.67E-17	4.55E-17	2.58E-17	2.61E-17	2.82E-17	4.13E-17
Tungsten									
W-176	2.23E-18	2.35E-18	1.94E-18	1.64E-18	7.05E-18	1.84E-18	1.80E-18	2.15E-18	2.47E-18
W-177	1.58E-17	1.63E-17	1.47E-17	1.44E-17	2.64E-17	1.40E-17	1.41E-17	1.53E-17	1.76E-17
W-178	1.33E-19	1.43E-19	1.09E-19	8.45E-20	4.55E-19	1.05E-19	1.01E-19	1.25E-19	1.52E-19
W-179	5.22E-19	5.68E-19	4.09E-19	3.18E-19	1.72E-18	4.01E-19	3.82E-19	4.81E-19	6.13E-19
W-181	4.04E-19	4.36E-19	3.32E-19	2.58E-19	1.38E-18	3.20E-19	3.07E-19	3.80E-19	4.61E-19
W-185	2.00E-21	2.12E-21	1.67E-21	1.45E-21	5.69E-21	1.60E-21	1.57E-21	1.88E-21	2.34E-21
W-187	8.84E-18	9.09E-18	8.23E-18	8.08E-18	1.33E-17	7.82E-18	7.90E-18	8.54E-18	1.03E-17
W-188	3.49E-20	3.63E-20	3.19E-20	3.07E-20	6.77E-20	3.02E-20	3.04E-20	3.37E-20	3.88E-20
Rhenium									
Re-177	1.08E-17	1.11E-17	1.01E-17	9.86E-18	1.71E-17	9.59E-18	9.68E-18	1.05E-17	1.47E-17
Re-178	2.17E-17	2.22E-17	2.04E-17	2.03E-17	3.18E-17	1.96E-17	1.97E-17	2.11E-17	3.01E-17
Re-180	2.15E-17	2.21E-17	2.02E-17	2.00E-17	3.08E-17	1.92E-17	1.95E-17	2.09E-17	2.44E-17
Re-181	1.38E-17	1.43E-17	1.29E-17	1.26E-17	2.20E-17	1.22E-17	1.23E-17	1.34E-17	1.53E-17
Re-182b[3]	3.35E-17	3.45E-17	3.15E-17	3.11E-17	5.22E-17	2.98E-17	3.03E-17	3.26E-17	3.70E-17
Re-182a[4]	2.07E-17	2.13E-17	1.97E-17	1.95E-17	2.98E-17	1.86E-17	1.90E-17	2.02E-17	2.30E-17
Re-184m	6.75E-18	6.98E-18	6.26E-18	6.08E-18	1.17E-17	5.93E-18	5.99E-18	6.54E-18	7.48E-18
Re-184	1.61E-17	1.65E-17	1.51E-17	1.50E-17	2.34E-17	1.43E-17	1.46E-17	1.56E-17	1.78E-17
Re-186m	1.45E-19	1.56E-19	1.18E-19	9.24E-20	4.82E-19	1.14E-19	1.09E-19	1.35E-19	1.69E-19
Re-186	3.23E-19	3.38E-19	2.91E-19	2.64E-19	8.63E-19	2.74E-19	2.73E-19	3.14E-19	1.12E-18
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	9.32E-19	9.91E-19	8.06E-19	6.67E-19	3.05E-18	7.65E-19	7.47E-19	8.97E-19	1.04E-18
Re-188	1.09E-18	1.12E-18	1.01E-18	9.75E-19	1.99E-18	9.52E-19	9.62E-19	1.05E-18	7.88E-18
Re-189	1.23E-18	1.27E-18	1.12E-18	1.07E-18	2.52E-18	1.06E-18	1.07E-18	1.19E-18	1.89E-18
Osmium									
Os-180	7.20E-19	7.65E-19	6.19E-19	5.22E-19	2.12E-18	5.92E-19	5.77E-19	6.86E-19	8.23E-19

[1] $T_{½}$ = 2.2 h
[2] $T_{½}$ = 9.31 m
[3] $T_{½}$ = 64.0 h
[4] $T_{½}$ = 12.7 h

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	2.19E-17	2.25E-17	2.06E-17	2.04E-17	3.29E-17	1.95E-17	1.98E-17	2.13E-17	2.43E-17
Os-182	7.72E-18	7.97E-18	7.08E-18	6.84E-18	1.36E-17	6.73E-18	6.77E-18	7.44E-18	8.53E-18
Os-185	1.32E-17	1.35E-17	1.23E-17	1.21E-17	1.93E-17	1.17E-17	1.18E-17	1.27E-17	1.46E-17
Os-189m	1.05E-23	2.38E-23	1.58E-25	8.20E-25	4.96E-24	1.02E-24	2.64E-24	7.28E-24	5.34E-22
Os-190m	3.00E-17	3.09E-17	2.78E-17	2.74E-17	4.62E-17	2.64E-17	2.67E-17	2.90E-17	3.32E-17
Os-191m	8.16E-20	8.74E-20	6.94E-20	5.55E-20	2.80E-19	6.62E-20	6.42E-20	7.81E-20	9.26E-20
Os-191	1.06E-18	1.12E-18	9.47E-19	8.27E-19	3.16E-18	8.92E-19	8.81E-19	1.03E-18	1.18E-18
Os-193	1.30E-18	1.34E-18	1.19E-18	1.14E-18	2.43E-18	1.13E-18	1.13E-18	1.25E-18	2.30E-18
Os-194	7.26E-21	8.14E-21	4.71E-21	3.39E-21	2.15E-20	4.94E-21	4.49E-21	6.15E-21	9.62E-21
Iridium									
Ir-182	2.49E-17	2.56E-17	2.32E-17	2.29E-17	3.80E-17	2.20E-17	2.23E-17	2.41E-17	3.97E-17
Ir-184	3.47E-17	3.56E-17	3.26E-17	3.24E-17	5.09E-17	3.10E-17	3.15E-17	3.37E-17	4.03E-17
Ir-185	1.02E-17	1.04E-17	9.62E-18	9.51E-18	1.56E-17	9.15E-18	9.28E-18	9.93E-18	1.12E-17
Ir-186a[1]	2.97E-17	3.05E-17	2.79E-17	2.76E-17	4.41E-17	2.66E-17	2.69E-17	2.89E-17	3.28E-17
Ir-186b[2]	1.75E-17	1.80E-17	1.64E-17	1.62E-17	2.63E-17	1.56E-17	1.58E-17	1.70E-17	2.08E-17
Ir-187	6.27E-18	6.47E-18	5.81E-18	5.64E-18	1.04E-17	5.52E-18	5.57E-18	6.06E-18	6.96E-18
Ir-188	2.80E-17	2.87E-17	2.67E-17	2.67E-17	3.86E-17	2.55E-17	2.58E-17	2.74E-17	3.07E-17
Ir-189	1.06E-18	1.12E-18	9.31E-19	8.16E-19	2.96E-18	8.84E-19	8.71E-19	1.02E-18	1.19E-18
Ir-190n[3]	2.90E-17	2.98E-17	2.68E-17	2.63E-17	4.56E-17	2.55E-17	2.57E-17	2.80E-17	3.20E-17
Ir-190m[4]	1.34E-23	2.97E-23	5.65E-26	9.87E-25	5.83E-24	1.09E-24	3.13E-24	9.07E-24	5.86E-22
Ir-190	2.67E-17	2.75E-17	2.47E-17	2.42E-17	4.24E-17	2.35E-17	2.37E-17	2.58E-17	2.95E-17
Ir-191m	1.01E-18	1.06E-18	8.99E-19	7.88E-19	2.97E-18	8.46E-19	8.37E-19	9.79E-19	1.11E-18
Ir-192m	2.88E-18	2.99E-18	2.64E-18	2.50E-18	6.56E-18	2.48E-18	2.50E-18	2.81E-18	3.16E-18
Ir-192	1.55E-17	1.60E-17	1.43E-17	1.41E-17	2.52E-17	1.36E-17	1.37E-17	1.50E-17	1.72E-17
Ir-194m	4.43E-17	4.55E-17	4.12E-17	4.05E-17	6.65E-17	3.91E-17	3.95E-17	4.27E-17	4.90E-17
Ir-194	1.76E-18	1.81E-18	1.64E-18	1.62E-18	2.75E-18	1.56E-18	1.58E-18	1.71E-18	9.47E-18
Ir-195m	7.41E-18	7.66E-18	6.81E-18	6.58E-18	1.33E-17	6.46E-18	6.51E-18	7.15E-18	8.42E-18
Ir-195	7.48E-19	7.90E-19	6.59E-19	5.64E-19	2.32E-18	6.23E-19	6.13E-19	7.24E-19	1.49E-18
Platinum									
Pt-186	1.36E-17	1.39E-17	1.27E-17	1.25E-17	2.00E-17	1.20E-17	1.22E-17	1.31E-17	1.50E-17
Pt-188	3.22E-18	3.36E-18	2.91E-18	2.72E-18	7.26E-18	2.76E-18	2.76E-18	3.11E-18	3.57E-18
Pt-189	5.41E-18	5.60E-18	4.98E-18	4.76E-18	1.01E-17	4.72E-18	4.75E-18	5.23E-18	6.00E-18
Pt-191	4.93E-18	5.12E-18	4.48E-18	4.21E-18	1.01E-17	4.25E-18	4.25E-18	4.75E-18	5.46E-18
Pt-193m	1.26E-19	1.34E-19	1.09E-19	8.92E-20	4.28E-19	1.04E-19	1.01E-19	1.22E-19	1.42E-19
Pt-193	4.65E-23	9.70E-23	1.62E-25	3.52E-24	2.06E-23	3.60E-24	1.00E-23	3.03E-23	1.66E-21
Pt-195m	8.92E-19	9.44E-19	7.82E-19	6.56E-19	2.90E-18	7.39E-19	7.25E-19	8.64E-19	9.94E-19
Pt-197m	1.26E-18	1.32E-18	1.14E-18	1.06E-18	2.81E-18	1.08E-18	1.08E-18	1.22E-18	1.41E-18
Pt-197	3.44E-19	3.61E-19	3.09E-19	2.75E-19	9.69E-19	2.91E-19	2.89E-19	3.35E-19	4.18E-19
Pt-199	3.82E-18	3.93E-18	3.55E-18	3.49E-18	5.88E-18	3.37E-18	3.41E-18	3.69E-18	7.09E-18
Pt-200	8.98E-19	9.39E-19	8.09E-19	7.38E-19	2.27E-18	7.63E-19	7.61E-19	8.70E-19	1.02E-18
Gold									
Au-193	2.40E-18	2.51E-18	2.16E-18	1.97E-18	5.92E-18	2.05E-18	2.04E-18	2.32E-18	2.67E-18
Au-194	1.91E-17	1.96E-17	1.81E-17	1.80E-17	2.79E-17	1.72E-17	1.75E-17	1.86E-17	2.11E-17
Au-195m	3.64E-18	3.78E-18	3.33E-18	3.22E-18	6.99E-18	3.15E-18	3.18E-18	3.52E-18	4.03E-18
Au-195	9.97E-19	1.06E-18	8.70E-19	7.23E-19	3.31E-18	8.23E-19	8.07E-19	9.65E-19	1.11E-18
Au-198m	9.96E-18	1.04E-17	9.09E-18	8.60E-18	2.21E-17	8.56E-18	8.62E-18	9.67E-18	1.10E-17
Au-198	7.74E-18	7.96E-18	7.15E-18	7.01E-18	1.20E-17	6.80E-18	6.86E-18	7.45E-18	9.07E-18
Au-199	1.51E-18	1.58E-18	1.38E-18	1.30E-18	3.54E-18	1.30E-18	1.30E-18	1.47E-18	1.67E-18
Au-200m	3.93E-17	4.04E-17	3.66E-17	3.60E-17	5.97E-17	3.47E-17	3.51E-17	3.80E-17	4.34E-17
Au-200	5.07E-18	5.20E-18	4.80E-18	4.79E-18	7.04E-18	4.55E-18	4.63E-18	4.93E-18	1.23E-17
Au-201	1.01E-18	1.04E-18	9.35E-19	9.17E-19	1.55E-18	8.89E-19	8.97E-19	9.72E-19	2.62E-18
Mercury									
Hg-193m	1.89E-17	1.94E-17	1.77E-17	1.74E-17	2.92E-17	1.68E-17	1.70E-17	1.83E-17	2.09E-17
Hg-193	3.09E-18	3.23E-18	2.78E-18	2.56E-18	7.53E-18	2.63E-18	2.63E-18	2.99E-18	3.47E-18
Hg-194	9.47E-23	1.82E-22	4.09E-25	7.60E-24	4.40E-23	7.13E-24	1.83E-23	5.89E-23	2.32E-21
Hg-195m	3.65E-18	3.78E-18	3.36E-18	3.23E-18	6.78E-18	3.18E-18	3.21E-18	3.53E-18	4.05E-18
Hg-195	3.32E-18	3.44E-18	3.07E-18	2.94E-18	6.14E-18	2.91E-18	2.93E-18	3.22E-18	3.69E-18

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	1.44E-18	1.50E-18	1.30E-18	1.19E-18	3.73E-18	1.22E-18	1.22E-18	1.40E-18	1.58E-18
Hg-197	8.24E-19	8.74E-19	7.22E-19	5.99E-19	2.76E-18	6.83E-19	6.70E-19	8.00E-19	9.19E-19
Hg-199m	3.08E-18	3.20E-18	2.80E-18	2.63E-18	7.01E-18	2.64E-18	2.65E-18	2.99E-18	3.40E-18
Hg-203	4.45E-18	4.61E-18	4.09E-18	3.98E-18	8.14E-18	3.87E-18	3.91E-18	4.31E-18	4.92E-18
Thallium									
Tl-194m	4.34E-17	4.46E-17	4.04E-17	3.98E-17	6.46E-17	3.84E-17	3.88E-17	4.19E-17	5.06E-17
Tl-194	1.44E-17	1.48E-17	1.33E-17	1.30E-17	2.25E-17	1.27E-17	1.28E-17	1.39E-17	1.59E-17
Tl-195	2.26E-17	2.32E-17	2.15E-17	2.14E-17	3.16E-17	2.05E-17	2.08E-17	2.21E-17	2.52E-17
Tl-197	7.12E-18	7.34E-18	6.63E-18	6.45E-18	1.21E-17	6.29E-18	6.35E-18	6.91E-18	7.93E-18
Tl-198m	2.22E-17	2.29E-17	2.06E-17	2.03E-17	3.44E-17	1.96E-17	1.98E-17	2.15E-17	2.46E-17
Tl-198	3.61E-17	3.69E-17	3.43E-17	3.42E-17	4.95E-17	3.26E-17	3.31E-17	3.52E-17	3.96E-17
Tl-199	4.20E-18	4.35E-18	3.85E-18	3.66E-18	8.39E-18	3.64E-18	3.66E-18	4.06E-18	4.65E-18
Tl-200	2.39E-17	2.46E-17	2.25E-17	2.23E-17	3.48E-17	2.14E-17	2.17E-17	2.32E-17	2.64E-17
Tl-201	1.23E-18	1.30E-18	1.10E-18	9.49E-19	3.76E-18	1.03E-18	1.02E-18	1.20E-18	1.37E-18
Tl-202	8.52E-18	8.77E-18	7.84E-18	7.60E-18	1.43E-17	7.45E-18	7.50E-18	8.20E-18	9.40E-18
Tl-204	1.88E-20	1.99E-20	1.64E-20	1.39E-20	5.87E-20	1.55E-20	1.52E-20	1.81E-20	1.92E-19
Tl-206	2.96E-20	3.09E-20	2.64E-20	2.46E-20	6.59E-20	2.50E-20	2.50E-20	2.84E-20	3.03E-18
Tl-207	6.47E-20	6.69E-20	5.99E-20	5.83E-20	1.08E-19	5.68E-20	5.73E-20	6.26E-20	2.48E-18
Tl-208	5.93E-17	6.00E-17	5.67E-17	5.72E-17	7.56E-17	5.48E-17	5.51E-17	5.79E-17	6.74E-17
Tl-209	3.67E-17	3.76E-17	3.49E-17	3.49E-17	5.08E-17	3.32E-17	3.38E-17	3.58E-17	4.51E-17
Lead									
Pb-195m	2.96E-17	3.05E-17	2.76E-17	2.72E-17	4.48E-17	2.62E-17	2.65E-17	2.87E-17	3.37E-17
Pb-198	7.77E-18	8.04E-18	7.15E-18	6.89E-18	1.45E-17	6.77E-18	6.82E-18	7.52E-18	8.60E-18
Pb-199	2.67E-17	2.74E-17	2.53E-17	2.51E-17	3.81E-17	2.40E-17	2.44E-17	2.60E-17	2.94E-17
Pb-200	3.30E-18	3.44E-18	3.00E-18	2.76E-18	8.05E-18	2.82E-18	2.82E-18	3.21E-18	3.64E-18
Pb-201	1.38E-17	1.42E-17	1.29E-17	1.26E-17	2.21E-17	1.22E-17	1.23E-17	1.34E-17	1.53E-17
Pb-202m	3.82E-17	3.92E-17	3.59E-17	3.57E-17	5.34E-17	3.41E-17	3.46E-17	3.70E-17	4.23E-17
Pb-202	4.97E-23	1.06E-22	1.71E-25	3.72E-24	2.18E-23	3.97E-24	1.11E-23	3.30E-23	2.07E-21
Pb-203	5.46E-18	5.67E-18	4.99E-18	4.77E-18	1.10E-17	4.72E-18	4.75E-18	5.28E-18	6.04E-18
Pb-205	5.76E-23	1.21E-22	2.14E-25	4.38E-24	2.57E-23	4.58E-24	1.26E-23	3.78E-23	2.24E-21
Pb-209	3.40E-21	3.60E-21	2.87E-21	2.55E-21	8.97E-21	2.75E-21	2.70E-21	3.20E-21	3.80E-20
Pb-210	1.49E-20	1.67E-20	1.01E-20	7.37E-21	4.62E-20	1.04E-20	9.57E-21	1.29E-20	2.22E-20
Pb-211	9.69E-19	9.96E-19	9.05E-19	8.95E-19	1.41E-18	8.59E-19	8.71E-19	9.37E-19	3.08E-18
Pb-212	2.61E-18	2.71E-18	2.38E-18	2.28E-18	5.47E-18	2.25E-18	2.27E-18	2.53E-18	2.88E-18
Pb-214	4.63E-18	4.79E-18	4.26E-18	4.15E-18	8.09E-18	4.04E-18	4.08E-18	4.47E-18	5.23E-18
Bismuth									
Bi-200	4.44E-17	4.56E-17	4.16E-17	4.11E-17	6.57E-17	3.94E-17	4.00E-17	4.30E-17	5.03E-17
Bi-201	2.44E-17	2.50E-17	2.30E-17	2.28E-17	3.49E-17	2.18E-17	2.21E-17	2.37E-17	2.76E-17
Bi-202	5.00E-17	5.13E-17	4.71E-17	4.67E-17	7.07E-17	4.47E-17	4.54E-17	4.85E-17	5.56E-17
Bi-203	4.29E-17	4.39E-17	4.09E-17	4.09E-17	5.77E-17	3.89E-17	3.95E-17	4.19E-17	4.74E-17
Bi-205	3.03E-17	3.11E-17	2.89E-17	2.89E-17	4.10E-17	2.75E-17	2.80E-17	2.96E-17	3.34E-17
Bi-206	6.02E-17	6.18E-17	5.68E-17	5.65E-17	8.41E-17	5.40E-17	5.48E-17	5.85E-17	6.65E-17
Bi-207	2.82E-17	2.90E-17	2.66E-17	2.64E-17	3.96E-17	2.53E-17	2.57E-17	2.74E-17	3.21E-17
Bi-210m	4.81E-18	4.98E-18	4.42E-18	4.31E-18	8.60E-18	4.18E-18	4.23E-18	4.65E-18	5.32E-18
Bi-210	1.44E-20	1.52E-20	1.27E-20	1.17E-20	3.41E-20	1.21E-20	1.20E-20	1.38E-20	1.20E-18
Bi-211	8.80E-19	9.08E-19	8.09E-19	7.90E-19	1.48E-18	7.68E-19	7.75E-19	8.48E-19	9.71E-19
Bi-212	3.44E-18	3.53E-18	3.26E-18	3.25E-18	4.63E-18	3.09E-18	3.14E-18	3.34E-18	7.85E-18
Bi-213	2.54E-18	2.61E-18	2.35E-18	2.30E-18	3.94E-18	2.23E-18	2.25E-18	2.44E-18	4.53E-18
Bi-214	2.74E-17	2.80E-17	2.61E-17	2.63E-17	3.58E-17	2.49E-17	2.53E-17	2.68E-17	3.53E-17
Polonium									
Po-203	2.98E-17	3.06E-17	2.82E-17	2.81E-17	4.18E-17	2.68E-17	2.72E-17	2.90E-17	3.37E-17
Po-205	2.87E-17	2.94E-17	2.72E-17	2.70E-17	4.01E-17	2.58E-17	2.62E-17	2.79E-17	3.18E-17
Po-207	2.43E-17	2.49E-17	2.29E-17	2.28E-17	3.44E-17	2.17E-17	2.21E-17	2.36E-17	2.70E-17
Po-210	1.59E-22	1.63E-22	1.50E-22	1.49E-22	2.16E-22	1.42E-22	1.45E-22	1.54E-22	1.77E-22
Po-211	1.46E-19	1.50E-19	1.38E-19	1.37E-19	2.01E-19	1.31E-19	1.33E-19	1.42E-19	1.63E-19
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	1.56E-21	1.60E-21	1.47E-21	1.46E-21	2.12E-21	1.40E-21	1.42E-21	1.51E-21	1.73E-21
Po-215	3.37E-21	3.46E-21	3.11E-21	3.06E-21	5.15E-21	2.96E-21	2.99E-21	3.24E-21	3.71E-21
Po-216	3.17E-22	3.25E-22	2.99E-22	2.97E-22	4.29E-22	2.83E-22	2.88E-22	3.07E-22	3.51E-22
Po-218	1.70E-22	1.75E-22	1.61E-22	1.60E-22	2.30E-22	1.53E-22	1.55E-22	1.65E-22	1.89E-22

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	2.40E-17	2.46E-17	2.27E-17	2.25E-17	3.43E-17	2.16E-17	2.19E-17	2.34E-17	2.65E-17
At-211	5.19E-19	5.45E-19	4.65E-19	4.01E-19	1.62E-18	4.37E-19	4.32E-19	5.07E-19	5.73E-19
At-215	3.69E-21	3.79E-21	3.40E-21	3.34E-21	5.79E-21	3.23E-21	3.27E-21	3.55E-21	4.07E-21
At-216	2.04E-20	2.14E-20	1.83E-20	1.58E-20	6.43E-20	1.72E-20	1.70E-20	2.00E-20	2.25E-20
At-217	5.79E-21	5.96E-21	5.38E-21	5.28E-21	8.95E-21	5.11E-21	5.16E-21	5.59E-21	6.40E-21
At-218	3.28E-20	3.61E-20	2.53E-20	1.89E-20	1.10E-19	2.49E-20	2.34E-20	3.00E-20	4.28E-20
Radon									
Rn-218	1.44E-20	1.47E-20	1.34E-20	1.33E-20	2.03E-20	1.28E-20	1.29E-20	1.39E-20	1.59E-20
Rn-219	1.06E-18	1.09E-18	9.76E-19	9.53E-19	1.82E-18	9.25E-19	9.35E-19	1.02E-18	1.17E-18
Rn-220	7.35E-21	7.54E-21	6.83E-21	6.74E-21	1.06E-20	6.50E-21	6.57E-21	7.08E-21	8.12E-21
Rn-222	7.62E-21	7.81E-21	7.06E-21	6.95E-21	1.12E-20	6.72E-21	6.79E-21	7.33E-21	8.40E-21
Francium									
Fr-219	6.57E-20	6.76E-20	6.06E-20	5.93E-20	1.07E-19	5.76E-20	5.81E-20	6.33E-20	7.25E-20
Fr-220	1.80E-19	1.87E-19	1.64E-19	1.53E-19	4.42E-19	1.54E-19	1.55E-19	1.76E-19	2.00E-19
Fr-221	5.63E-19	5.85E-19	5.16E-19	4.97E-19	1.15E-18	4.86E-19	4.91E-19	5.46E-19	6.22E-19
Fr-222	5.29E-20	5.51E-20	4.75E-20	4.49E-20	1.11E-19	4.51E-20	4.51E-20	5.08E-20	6.16E-18
Fr-223	7.88E-19	8.28E-19	6.95E-19	6.32E-19	1.89E-18	6.62E-19	6.55E-19	7.54E-19	1.69E-18
Radium									
Ra-222	1.75E-19	1.80E-19	1.61E-19	1.57E-19	2.97E-19	1.52E-19	1.54E-19	1.69E-19	1.93E-19
Ra-223	2.27E-18	2.35E-18	2.07E-18	1.95E-18	5.01E-18	1.95E-18	1.96E-18	2.20E-18	2.50E-18
Ra-224	1.84E-19	1.91E-19	1.69E-19	1.64E-19	3.54E-19	1.59E-19	1.61E-19	1.78E-19	2.03E-19
Ra-225	7.27E-20	8.24E-20	4.18E-20	2.96E-20	1.95E-19	4.57E-20	4.09E-20	5.86E-20	9.80E-20
Ra-226	1.19E-19	1.24E-19	1.09E-19	1.04E-19	2.61E-19	1.03E-19	1.04E-19	1.16E-19	1.32E-19
Ra-227	2.90E-18	3.00E-18	2.66E-18	2.60E-18	4.95E-18	2.53E-18	2.55E-18	2.80E-18	4.34E-18
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	7.83E-20	8.12E-20	7.15E-20	6.82E-20	1.59E-19	6.76E-20	6.80E-20	7.57E-20	8.91E-20
Ac-224	3.31E-18	3.44E-18	3.02E-18	2.82E-18	7.93E-18	2.83E-18	2.85E-18	3.22E-18	3.64E-18
Ac-225	2.57E-19	2.68E-19	2.34E-19	2.14E-19	6.66E-19	2.19E-19	2.19E-19	2.50E-19	2.86E-19
Ac-226	2.30E-18	2.39E-18	2.11E-18	2.01E-18	4.89E-18	1.98E-18	2.00E-18	2.23E-18	3.00E-18
Ac-227	2.05E-21	2.14E-21	1.83E-21	1.67E-21	5.34E-21	1.72E-21	1.72E-21	1.98E-21	2.45E-21
Ac-228	1.78E-17	1.83E-17	1.69E-17	1.68E-17	2.46E-17	1.60E-17	1.63E-17	1.73E-17	2.15E-17
Thorium									
Th-226	1.31E-19	1.36E-19	1.20E-19	1.11E-19	3.25E-19	1.12E-19	1.13E-19	1.28E-19	1.46E-19
Th-227	1.88E-18	1.95E-18	1.72E-18	1.66E-18	3.67E-18	1.62E-18	1.64E-18	1.82E-18	2.09E-18
Th-228	3.24E-20	3.40E-20	2.91E-20	2.67E-20	8.41E-20	2.74E-20	2.74E-20	3.14E-20	3.81E-20
Th-229	1.34E-18	1.40E-18	1.21E-18	1.10E-18	3.67E-18	1.14E-18	1.13E-18	1.30E-18	1.49E-18
Th-230	5.53E-21	5.97E-21	4.61E-21	4.03E-21	1.56E-20	4.38E-21	4.34E-21	5.22E-21	8.32E-21
Th-231	1.69E-19	1.79E-19	1.41E-19	1.24E-19	4.91E-19	1.35E-19	1.33E-19	1.59E-19	2.15E-19
Th-232	2.60E-21	2.89E-21	1.97E-21	1.70E-21	7.19E-21	1.91E-21	1.88E-21	2.36E-21	5.04E-21
Th-234	1.10E-19	1.16E-19	9.75E-20	8.39E-20	3.45E-19	9.18E-20	9.05E-20	1.07E-19	1.24E-19
Protactinium									
Pa-227	2.84E-19	2.97E-19	2.54E-19	2.22E-19	8.70E-19	2.38E-19	2.36E-19	2.77E-19	3.16E-19
Pa-228	2.06E-17	2.11E-17	1.94E-17	1.92E-17	3.03E-17	1.84E-17	1.87E-17	2.00E-17	2.28E-17
Pa-230	1.18E-17	1.21E-17	1.11E-17	1.09E-17	1.76E-17	1.05E-17	1.07E-17	1.14E-17	1.30E-17
Pa-231	6.73E-19	6.99E-19	6.10E-19	5.95E-19	1.19E-18	5.80E-19	5.85E-19	6.46E-19	7.69E-19
Pa-232	1.73E-17	1.78E-17	1.63E-17	1.62E-17	2.41E-17	1.55E-17	1.57E-17	1.68E-17	1.92E-17
Pa-233	3.63E-18	3.76E-18	3.33E-18	3.22E-18	6.89E-18	3.15E-18	3.18E-18	3.51E-18	4.02E-18
Pa-234m	2.78E-19	2.87E-19	2.61E-19	2.57E-19	4.31E-19	2.47E-19	2.51E-19	2.70E-19	8.02E-18
Pa-234	3.51E-17	3.60E-17	3.31E-17	3.28E-17	5.02E-17	3.14E-17	3.19E-17	3.41E-17	3.93E-17
Uranium									
U-230	1.81E-20	1.92E-20	1.57E-20	1.45E-20	4.48E-20	1.49E-20	1.49E-20	1.73E-20	2.38E-20
U-231	1.00E-18	1.05E-18	9.02E-19	8.03E-19	2.95E-18	8.46E-19	8.39E-19	9.79E-19	1.13E-18
U-232	4.35E-21	4.85E-21	3.18E-21	2.86E-21	1.06E-20	3.09E-21	3.06E-21	3.87E-21	8.66E-21
U-233	5.68E-21	6.06E-21	4.75E-21	4.46E-21	1.24E-20	4.54E-21	4.54E-21	5.30E-21	8.26E-21
U-234	2.17E-21	2.52E-21	1.35E-21	1.21E-21	4.98E-21	1.35E-21	1.33E-21	1.82E-21	5.61E-21
U-235	2.73E-18	2.84E-18	2.50E-18	2.38E-18	6.03E-18	2.34E-18	2.37E-18	2.65E-18	3.01E-18
U-236	1.32E-21	1.61E-21	6.30E-22	5.79E-22	2.60E-21	6.70E-22	6.62E-22	1.01E-21	4.46E-21
U-237	2.13E-18	2.23E-18	1.93E-18	1.77E-18	5.36E-18	1.81E-18	1.81E-18	2.07E-18	2.37E-18
U-238	8.10E-22	1.05E-21	2.29E-22	2.14E-22	1.29E-21	2.86E-22	2.81E-22	5.45E-22	3.54E-21
U-239	7.17E-19	7.54E-19	6.41E-19	5.64E-19	1.99E-18	6.06E-19	5.99E-19	6.95E-19	2.10E-18
U-240	1.02E-20	1.22E-20	4.24E-21	3.47E-21	2.11E-20	4.94E-21	4.55E-21	7.45E-21	2.64E-20

Table III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	2.20E-17	2.26E-17	2.07E-17	2.04E-17	3.32E-17	1.96E-17	1.99E-17	2.14E-17	2.44E-17
Np-233	1.35E-18	1.41E-18	1.23E-18	1.11E-18	3.74E-18	1.15E-18	1.15E-18	1.32E-18	1.49E-18
Np-234	2.57E-17	2.63E-17	2.46E-17	2.47E-17	3.44E-17	2.33E-17	2.38E-17	2.52E-17	2.85E-17
Np-235	1.59E-20	1.75E-20	1.15E-20	1.04E-20	3.95E-20	1.12E-20	1.10E-20	1.41E-20	3.02E-20
Np-236a[1]	1.90E-18	1.98E-18	1.73E-18	1.58E-18	5.12E-18	1.62E-18	1.62E-18	1.86E-18	2.12E-18
Np-236b[2]	7.55E-19	7.84E-19	6.90E-19	6.30E-19	1.98E-18	6.47E-19	6.45E-19	7.37E-19	8.38E-19
Np-237	3.45E-19	3.63E-19	3.01E-19	2.67E-19	9.88E-19	2.84E-19	2.81E-19	3.31E-19	4.03E-19
Np-238	1.01E-17	1.04E-17	9.60E-18	9.60E-18	1.34E-17	9.10E-18	9.26E-18	9.84E-18	1.19E-17
Np-239	2.87E-18	2.98E-18	2.62E-18	2.47E-18	6.53E-18	2.47E-18	2.48E-18	2.79E-18	3.17E-18
Np-240m	6.23E-18	6.40E-18	5.84E-18	5.79E-18	8.78E-18	5.55E-18	5.62E-18	6.03E-18	1.16E-17
Np-240	2.40E-17	2.47E-17	2.26E-17	2.23E-17	3.50E-17	2.14E-17	2.17E-17	2.33E-17	2.69E-17
Plutonium									
Pu-234	9.87E-19	1.03E-18	8.98E-19	8.04E-19	2.86E-18	8.39E-19	8.34E-19	9.66E-19	1.09E-18
Pu-235	1.37E-18	1.42E-18	1.25E-18	1.13E-18	3.72E-18	1.17E-18	1.17E-18	1.34E-18	1.52E-18
Pu-236	1.62E-21	2.03E-21	4.95E-22	5.07E-22	2.32E-21	6.12E-22	6.00E-22	1.10E-21	6.04E-21
Pu-237	6.95E-19	7.25E-19	6.28E-19	5.61E-19	2.02E-18	5.88E-19	5.84E-19	6.79E-19	7.74E-19
Pu-238	1.20E-21	1.55E-21	2.54E-22	2.91E-22	1.43E-21	3.62E-22	3.58E-22	7.60E-22	5.03E-21
Pu-239	1.35E-21	1.51E-21	9.07E-22	8.72E-22	2.45E-21	9.04E-22	8.99E-22	1.15E-21	2.87E-21
Pu-240	1.17E-21	1.50E-21	2.56E-22	2.85E-22	1.46E-21	3.60E-22	3.55E-22	7.44E-22	4.83E-21
Pu-241	2.51E-23	2.63E-23	2.25E-23	2.03E-23	6.99E-23	2.11E-23	2.10E-23	2.44E-23	2.95E-23
Pu-242	9.96E-22	1.27E-21	2.37E-22	2.59E-22	1.28E-21	3.22E-22	3.17E-22	6.43E-22	4.03E-21
Pu-243	3.45E-19	3.61E-19	3.09E-19	2.72E-19	1.01E-18	2.91E-19	2.88E-19	3.36E-19	3.91E-19
Pu-244	7.00E-22	9.28E-22	7.02E-23	1.05E-22	6.54E-22	1.49E-22	1.49E-22	4.04E-22	3.27E-21
Pu-245	7.68E-18	7.90E-18	7.16E-18	7.05E-18	1.20E-17	6.79E-18	6.87E-18	7.43E-18	8.92E-18
Pu-246	2.21E-18	2.30E-18	2.00E-18	1.87E-18	5.15E-18	1.88E-18	1.89E-18	2.14E-18	2.46E-18
Americium									
Am-237	6.52E-18	6.74E-18	6.01E-18	5.79E-18	1.25E-17	5.68E-18	5.72E-18	6.32E-18	7.21E-18
Am-238	1.61E-17	1.65E-17	1.52E-17	1.51E-17	2.34E-17	1.44E-17	1.46E-17	1.57E-17	1.79E-17
Am-239	3.80E-18	3.95E-18	3.47E-18	3.23E-18	9.23E-18	3.26E-18	3.26E-18	3.70E-18	4.20E-18
Am-240	1.86E-17	1.91E-17	1.76E-17	1.75E-17	2.62E-17	1.67E-17	1.70E-17	1.81E-17	2.07E-17
Am-241	2.34E-19	2.54E-19	1.87E-19	1.46E-19	7.86E-19	1.82E-19	1.74E-19	2.18E-19	2.89E-19
Am-242m	9.36E-21	1.07E-20	5.32E-21	4.97E-21	1.93E-20	5.55E-21	5.39E-21	7.54E-21	2.05E-20
Am-242	2.14E-19	2.23E-19	1.91E-19	1.72E-19	6.03E-19	1.79E-19	1.78E-19	2.07E-19	2.69E-19
Am-243	6.79E-19	7.19E-19	5.95E-19	4.96E-19	2.25E-18	5.62E-19	5.52E-19	6.59E-19	7.59E-19
Am-244m	2.62E-20	2.77E-20	2.22E-20	2.07E-20	5.70E-20	2.13E-20	2.11E-20	2.45E-20	2.61E-18
Am-244	1.47E-17	1.51E-17	1.38E-17	1.37E-17	2.07E-17	1.31E-17	1.33E-17	1.43E-17	1.65E-17
Am-245	5.49E-19	5.70E-19	5.02E-19	4.75E-19	1.23E-18	4.72E-19	4.75E-19	5.34E-19	8.76E-19
Am-246m	1.87E-17	1.92E-17	1.77E-17	1.77E-17	2.49E-17	1.68E-17	1.71E-17	1.82E-17	2.28E-17
Am-246	1.26E-17	1.30E-17	1.18E-17	1.16E-17	1.95E-17	1.12E-17	1.13E-17	1.22E-17	1.50E-17
Curium									
Cm-238	1.14E-18	1.19E-18	1.04E-18	9.39E-19	3.22E-18	9.72E-19	9.68E-19	1.12E-18	1.26E-18
Cm-240	1.46E-21	1.88E-21	1.55E-22	2.26E-22	1.40E-21	3.38E-22	3.18E-22	8.39E-22	5.87E-21
Cm-241	8.99E-18	9.25E-18	8.30E-18	8.05E-18	1.55E-17	7.87E-18	7.93E-18	8.68E-18	9.94E-18
Cm-242	1.42E-21	1.81E-21	2.37E-22	2.98E-22	1.49E-21	3.97E-22	3.78E-22	8.60E-22	5.42E-21
Cm-243	2.21E-18	2.29E-18	2.02E-18	1.91E-18	4.93E-18	1.90E-18	1.91E-18	2.14E-18	2.44E-18
Cm-244	1.19E-21	1.54E-21	1.05E-22	1.71E-22	1.06E-21	2.58E-22	2.44E-22	6.74E-22	4.89E-21
Cm-245	1.41E-18	1.46E-18	1.28E-18	1.17E-18	3.82E-18	1.20E-18	1.19E-18	1.37E-18	1.55E-18
Cm-246	1.08E-21	1.40E-21	1.10E-22	1.65E-22	1.02E-21	2.48E-22	2.33E-22	6.21E-22	4.38E-21
Cm-247	5.99E-18	6.16E-18	5.52E-18	5.41E-18	9.53E-18	5.25E-18	5.30E-18	5.77E-18	6.61E-18
Cm-248	8.22E-22	1.06E-21	7.99E-23	1.23E-22	7.63E-22	1.85E-22	1.74E-22	4.70E-22	3.34E-21
Cm-249	3.68E-19	3.78E-19	3.43E-19	3.37E-19	5.48E-19	3.26E-19	3.29E-19	3.55E-19	7.31E-19
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	3.83E-18	3.97E-18	3.50E-18	3.28E-18	9.06E-18	3.29E-18	3.30E-18	3.73E-18	4.22E-18
Bk-246	1.73E-17	1.77E-17	1.63E-17	1.61E-17	2.49E-17	1.54E-17	1.57E-17	1.68E-17	1.92E-17
Bk-247	1.71E-18	1.78E-18	1.56E-18	1.44E-18	4.20E-18	1.46E-18	1.47E-18	1.66E-18	1.88E-18
Bk-249	2.91E-23	3.30E-23	1.62E-23	1.29E-23	7.12E-23	1.77E-23	1.63E-23	2.33E-23	4.80E-23
Bk-250	1.63E-17	1.67E-17	1.55E-17	1.55E-17	2.15E-17	1.47E-17	1.49E-17	1.59E-17	1.86E-17

[1] $T_{½}$ = 1.15E5 y

[2] $T_{½}$ = 22.5 h

tTable III.5. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 5 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	1.72E-21	2.17E-21	1.55E-22	2.47E-22	1.56E-21	4.06E-22	3.60E-22	9.70E-22	6.02E-21
Cf-246	1.44E-21	1.76E-21	3.57E-22	3.95E-22	1.84E-21	5.12E-22	4.76E-22	9.29E-22	4.40E-21
Cf-248	1.18E-21	1.49E-21	1.11E-22	1.72E-22	1.09E-21	2.83E-22	2.50E-22	6.67E-22	4.11E-21
Cf-249	6.29E-18	6.48E-18	5.79E-18	5.67E-18	1.03E-17	5.50E-18	5.55E-18	6.06E-18	6.95E-18
Cf-250	1.12E-21	1.41E-21	1.05E-22	1.63E-22	1.03E-21	2.68E-22	2.38E-22	6.34E-22	3.91E-21
Cf-251	2.06E-18	2.14E-18	1.88E-18	1.76E-18	4.93E-18	1.76E-18	1.77E-18	2.00E-18	2.29E-18
Cf-252	1.34E-21	1.63E-21	3.40E-22	3.72E-22	1.73E-21	4.81E-22	4.47E-22	8.64E-22	4.03E-21
Cf-253	4.05E-22	4.44E-22	2.91E-22	2.44E-22	1.12E-21	2.91E-22	2.79E-22	3.58E-22	5.66E-22
Cf-254	3.65E-24	4.60E-24	3.45E-25	5.33E-25	3.37E-24	8.76E-25	7.76E-25	2.07E-24	1.27E-23
Einsteinium									
Es-250	7.01E-18	7.21E-18	6.60E-18	6.49E-18	1.12E-17	6.24E-18	6.33E-18	6.83E-18	7.78E-18
Es-251	1.48E-18	1.54E-18	1.35E-18	1.24E-18	3.93E-18	1.26E-18	1.26E-18	1.45E-18	1.64E-18
Es-253	6.65E-21	7.05E-21	5.43E-21	5.29E-21	1.12E-20	5.29E-21	5.27E-21	6.08E-21	9.07E-21
Es-254m	8.78E-18	9.01E-18	8.21E-18	8.13E-18	1.23E-17	7.80E-18	7.90E-18	8.48E-18	1.01E-17
Es-254	6.07E-20	6.70E-20	4.18E-20	3.86E-20	1.26E-19	4.22E-20	4.10E-20	5.22E-20	1.01E-19
Fermium									
Fm-252	1.27E-21	1.57E-21	1.35E-22	1.92E-22	1.23E-21	3.30E-22	2.84E-22	7.24E-22	3.93E-21
Fm-253	1.28E-18	1.33E-18	1.16E-18	1.08E-18	3.27E-18	1.09E-18	1.09E-18	1.25E-18	1.41E-18
Fm-254	1.77E-21	2.12E-21	5.31E-22	5.48E-22	2.59E-21	7.13E-22	6.57E-22	1.19E-21	4.63E-21
Fm-255	3.25E-20	3.64E-20	2.13E-20	1.89E-20	7.95E-20	2.15E-20	2.09E-20	2.77E-20	6.14E-20
Fm-257	1.71E-18	1.77E-18	1.55E-18	1.44E-18	4.21E-18	1.46E-18	1.46E-18	1.66E-18	1.89E-18
Mendelevium									
Md-257	1.89E-18	1.95E-18	1.73E-18	1.63E-18	4.16E-18	1.63E-18	1.63E-18	1.83E-18	2.08E-18
Md-258	1.43E-20	1.64E-20	7.21E-21	6.45E-21	3.13E-20	7.96E-21	7.53E-21	1.11E-20	2.83E-20

TABLE III.6

Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units. The coefficients are for soil at a density of 1.6×10^3 kg m^{-3}.

h_T: The tissue dose equivalent coefficient for organ or tissue *T* (Sv per Bq s m^{-3}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-3}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

To convert to a source per unit mass basis (Sv per Bq s kg^{-1}), multiply table entries by 1.6×10^3 (kg m^{-3}).

To convert to conventional units (mrem per µCi y cm^{-3}), multiply table entries by 1.168×10^{23}.

To convert to conventional units for a source per unit mass basis (mrem per µCi y g^{-1}), multiply table entries by 1.868×10^{23}.

Radionuclide dose coefficients for soil contaminated to a finite depth cannot be scaled to account for a different soil density.

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium									
Be-7	1.48E-18	1.52E-18	1.33E-18	1.31E-18	2.26E-18	1.25E-18	1.28E-18	1.40E-18	1.62E-18
Be-10	6.02E-21	6.35E-21	5.09E-21	4.56E-21	1.57E-20	4.83E-21	4.79E-21	5.67E-21	3.16E-20
Carbon									
C-11	3.07E-17	3.14E-17	2.76E-17	2.72E-17	4.60E-17	2.59E-17	2.66E-17	2.91E-17	3.43E-17
C-14	8.60E-23	9.61E-23	5.41E-23	4.28E-23	2.34E-22	5.64E-23	5.26E-23	7.20E-23	1.27E-22
Nitrogen									
N-13	3.07E-17	3.15E-17	2.77E-17	2.73E-17	4.61E-17	2.59E-17	2.66E-17	2.91E-17	3.55E-17
Oxygen									
O-15	3.07E-17	3.15E-17	2.77E-17	2.73E-17	4.62E-17	2.60E-17	2.67E-17	2.92E-17	3.93E-17
Fluorine									
F-18	3.07E-17	3.15E-17	2.77E-17	2.73E-17	4.61E-17	2.59E-17	2.67E-17	2.92E-17	3.37E-17
Neon									
Ne-19	3.08E-17	3.16E-17	2.78E-17	2.74E-17	4.63E-17	2.60E-17	2.68E-17	2.93E-17	4.36E-17
Sodium									
Na-22	6.59E-17	6.72E-17	6.06E-17	6.04E-17	9.10E-17	5.69E-17	5.86E-17	6.31E-17	7.21E-17
Na-24	1.23E-16	1.23E-16	1.15E-16	1.17E-16	1.52E-16	1.11E-16	1.12E-16	1.19E-16	1.34E-16
Magnesium									
Mg-28	4.06E-17	4.14E-17	3.77E-17	3.77E-17	5.43E-17	3.54E-17	3.64E-17	3.90E-17	4.45E-17
Aluminum									
Al-26	8.05E-17	8.17E-17	7.46E-17	7.48E-17	1.07E-16	7.06E-17	7.22E-17	7.73E-17	8.92E-17
Al-28	5.38E-17	5.43E-17	5.04E-17	5.09E-17	6.73E-17	4.79E-17	4.89E-17	5.19E-17	7.33E-17
Silicon									
Si-31	7.19E-20	7.43E-20	6.47E-20	6.23E-20	1.33E-19	6.08E-20	6.19E-20	6.87E-20	3.62E-18
Si-32	2.16E-22	2.37E-22	1.53E-22	1.25E-22	6.16E-22	1.54E-22	1.46E-22	1.90E-22	2.89E-22
Phosphorus									
P-30	3.10E-17	3.18E-17	2.79E-17	2.75E-17	4.66E-17	2.62E-17	2.69E-17	2.94E-17	5.32E-17
P-32	6.30E-20	6.55E-20	5.57E-20	5.25E-20	1.33E-19	5.23E-20	5.29E-20	6.00E-20	5.20E-18
P-33	3.53E-22	3.84E-22	2.62E-22	2.16E-22	1.01E-21	2.59E-22	2.48E-22	3.16E-22	4.55E-22
Sulphur									
S-35	9.42E-23	1.05E-22	6.08E-23	4.84E-23	2.59E-22	6.29E-23	5.89E-23	7.97E-23	1.36E-22
Chlorine									
Cl-36	1.29E-20	1.35E-20	1.13E-20	1.05E-20	2.79E-20	1.06E-20	1.07E-20	1.22E-20	1.80E-19
Cl-38	4.52E-17	4.55E-17	4.23E-17	4.29E-17	5.62E-17	4.04E-17	4.12E-17	4.36E-17	7.01E-17
Cl-39	4.31E-17	4.39E-17	4.02E-17	4.03E-17	5.76E-17	3.78E-17	3.89E-17	4.16E-17	5.46E-17
Argon									
Ar-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar-39	4.84E-21	5.11E-21	4.08E-21	3.64E-21	1.27E-20	3.88E-21	3.84E-21	4.55E-21	2.40E-20
Ar-41	3.86E-17	3.93E-17	3.61E-17	3.62E-17	4.99E-17	3.39E-17	3.49E-17	3.72E-17	4.40E-17
Potassium									
K-38	9.58E-17	9.68E-17	8.88E-17	8.92E-17	1.26E-16	8.45E-17	8.61E-17	9.20E-17	1.18E-16
K-40	4.74E-18	4.81E-18	4.43E-18	4.47E-18	6.07E-18	4.18E-18	4.30E-18	4.57E-18	8.16E-18
K-42	8.63E-18	8.75E-18	8.06E-18	8.11E-18	1.11E-17	7.61E-18	7.81E-18	8.31E-18	2.89E-17
K-43	2.90E-17	2.98E-17	2.62E-17	2.59E-17	4.41E-17	2.46E-17	2.53E-17	2.76E-17	3.23E-17
K-44	6.80E-17	6.84E-17	6.37E-17	6.43E-17	8.59E-17	6.08E-17	6.19E-17	6.56E-17	9.33E-17
K-45	5.57E-17	5.62E-17	5.20E-17	5.24E-17	7.31E-17	4.94E-17	5.05E-17	5.37E-17	7.04E-17
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	3.73E-22	4.05E-22	2.78E-22	2.31E-22	1.07E-21	2.74E-22	2.64E-22	3.35E-22	4.78E-22
Ca-47	3.20E-17	3.25E-17	2.98E-17	2.99E-17	4.17E-17	2.80E-17	2.88E-17	3.08E-17	3.63E-17
Ca-49	9.32E-17	9.25E-17	8.78E-17	8.93E-17	1.12E-16	8.57E-17	8.58E-17	9.01E-17	1.06E-16
Scandium									
Sc-43	3.28E-17	3.37E-17	2.95E-17	2.91E-17	5.05E-17	2.77E-17	2.84E-17	3.12E-17	3.66E-17
Sc-44m	8.07E-18	8.34E-18	7.30E-18	7.13E-18	1.43E-17	6.82E-18	7.00E-18	7.73E-18	8.87E-18
Sc-44	6.42E-17	6.56E-17	5.90E-17	5.87E-17	8.97E-17	5.52E-17	5.69E-17	6.14E-17	7.40E-17
Sc-46	6.03E-17	6.16E-17	5.60E-17	5.60E-17	8.05E-17	5.23E-17	5.41E-17	5.80E-17	6.64E-17
Sc-47	2.73E-18	2.84E-18	2.46E-18	2.32E-18	6.40E-18	2.29E-18	2.33E-18	2.64E-18	3.00E-18
Sc-48	1.01E-16	1.02E-16	9.36E-17	9.37E-17	1.33E-16	8.76E-17	9.05E-17	9.67E-17	1.10E-16
Sc-49	1.22E-19	1.25E-19	1.09E-19	1.06E-19	2.24E-19	1.03E-19	1.05E-19	1.16E-19	7.53E-18

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	2.00E-18	2.11E-18	1.73E-18	1.44E-18	6.62E-18	1.63E-18	1.60E-18	1.92E-18	2.20E-18
Ti-45	2.62E-17	2.68E-17	2.36E-17	2.33E-17	3.93E-17	2.21E-17	2.27E-17	2.48E-17	2.97E-17
Vanadium									
V-47	3.00E-17	3.07E-17	2.70E-17	2.67E-17	4.50E-17	2.53E-17	2.60E-17	2.85E-17	3.98E-17
V-48	8.75E-17	8.92E-17	8.11E-17	8.10E-17	1.18E-16	7.60E-17	7.84E-17	8.40E-17	9.60E-17
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	1.18E-17	1.22E-17	1.06E-17	1.02E-17	2.32E-17	9.91E-18	1.01E-17	1.13E-17	1.29E-17
Cr-49	3.07E-17	3.16E-17	2.77E-17	2.71E-17	4.89E-17	2.59E-17	2.66E-17	2.92E-17	3.74E-17
Cr-51	9.17E-19	9.48E-19	8.24E-19	8.05E-19	1.60E-18	7.71E-19	7.90E-19	8.75E-19	1.01E-18
Manganese									
Mn-51	3.01E-17	3.09E-17	2.71E-17	2.67E-17	4.52E-17	2.54E-17	2.61E-17	2.86E-17	4.24E-17
Mn-52m	7.26E-17	7.40E-17	6.69E-17	6.68E-17	9.95E-17	6.29E-17	6.47E-17	6.96E-17	9.26E-17
Mn-52	1.04E-16	1.06E-16	9.63E-17	9.63E-17	1.39E-16	9.03E-17	9.31E-17	9.98E-17	1.14E-16
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	2.51E-17	2.56E-17	2.31E-17	2.30E-17	3.44E-17	2.16E-17	2.23E-17	2.40E-17	2.76E-17
Mn-56	5.09E-17	5.17E-17	4.74E-17	4.76E-17	6.64E-17	4.47E-17	4.59E-17	4.90E-17	6.41E-17
Iron									
Fe-52	2.15E-17	2.21E-17	1.94E-17	1.89E-17	3.56E-17	1.81E-17	1.86E-17	2.05E-17	2.37E-17
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-59	3.57E-17	3.63E-17	3.33E-17	3.34E-17	4.68E-17	3.12E-17	3.22E-17	3.44E-17	3.91E-17
Fe-60	7.29E-23	8.21E-23	4.37E-23	3.43E-23	1.94E-22	4.64E-23	4.29E-23	6.00E-23	1.11E-22
Cobalt									
Co-55	5.99E-17	6.12E-17	5.49E-17	5.46E-17	8.42E-17	5.14E-17	5.30E-17	5.72E-17	6.79E-17
Co-56	1.07E-16	1.08E-16	9.98E-17	1.00E-16	1.39E-16	9.45E-17	9.67E-17	1.03E-16	1.17E-16
Co-57	2.74E-18	2.84E-18	2.47E-18	2.26E-18	7.24E-18	2.29E-18	2.31E-18	2.66E-18	2.98E-18
Co-58m	2.26E-23	2.69E-23	4.07E-24	4.23E-24	2.85E-23	7.90E-24	6.46E-24	1.37E-23	4.57E-23
Co-58	2.93E-17	3.00E-17	2.69E-17	2.67E-17	4.08E-17	2.51E-17	2.59E-17	2.80E-17	3.22E-17
Co-60m	1.16E-19	1.19E-19	1.07E-19	1.05E-19	1.79E-19	1.01E-19	1.03E-19	1.11E-19	1.37E-19
Co-60	7.53E-17	7.66E-17	7.03E-17	7.05E-17	9.75E-17	6.59E-17	6.80E-17	7.25E-17	8.23E-17
Co-61	1.78E-18	1.85E-18	1.58E-18	1.45E-18	4.02E-18	1.49E-18	1.50E-18	1.70E-18	3.77E-18
Co-62m	8.12E-17	8.24E-17	7.58E-17	7.62E-17	1.05E-16	7.14E-17	7.34E-17	7.82E-17	1.00E-16
Nickel									
Ni-56	5.08E-17	5.20E-17	4.65E-17	4.61E-17	7.53E-17	4.35E-17	4.48E-17	4.86E-17	5.57E-17
Ni-57	5.77E-17	5.86E-17	5.35E-17	5.36E-17	7.66E-17	5.04E-17	5.18E-17	5.54E-17	6.29E-17
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	1.66E-17	1.68E-17	1.54E-17	1.55E-17	2.15E-17	1.45E-17	1.50E-17	1.59E-17	2.32E-17
Ni-66	2.59E-22	2.83E-22	1.88E-22	1.54E-22	7.41E-22	1.87E-22	1.79E-22	2.30E-22	3.40E-22
Copper									
Cu-60	1.17E-16	1.19E-16	1.09E-16	1.09E-16	1.55E-16	1.03E-16	1.05E-16	1.12E-16	1.36E-16
Cu-61	2.48E-17	2.54E-17	2.24E-17	2.21E-17	3.71E-17	2.10E-17	2.16E-17	2.36E-17	2.84E-17
Cu-62	3.05E-17	3.12E-17	2.75E-17	2.71E-17	4.58E-17	2.58E-17	2.65E-17	2.89E-17	4.97E-17
Cu-64	5.69E-18	5.83E-18	5.14E-18	5.07E-18	8.50E-18	4.81E-18	4.95E-18	5.41E-18	6.25E-18
Cu-66	2.70E-18	2.76E-18	2.51E-18	2.50E-18	3.69E-18	2.34E-18	2.42E-18	2.60E-18	1.51E-17
Cu-67	2.88E-18	2.99E-18	2.59E-18	2.44E-18	6.60E-18	2.41E-18	2.45E-18	2.78E-18	3.16E-18
Zinc									
Zn-62	1.28E-17	1.32E-17	1.16E-17	1.14E-17	1.93E-17	1.08E-17	1.11E-17	1.22E-17	1.41E-17
Zn-63	3.32E-17	3.40E-17	3.00E-17	2.96E-17	4.92E-17	2.81E-17	2.89E-17	3.15E-17	4.59E-17
Zn-65	1.74E-17	1.78E-17	1.62E-17	1.62E-17	2.30E-17	1.52E-17	1.57E-17	1.68E-17	1.92E-17
Zn-69m	1.24E-17	1.28E-17	1.12E-17	1.10E-17	1.94E-17	1.05E-17	1.07E-17	1.18E-17	1.36E-17
Zn-69	1.24E-20	1.30E-20	1.07E-20	9.81E-21	3.01E-20	1.01E-20	1.01E-20	1.18E-20	4.93E-19
Zn-71m	4.65E-17	4.76E-17	4.21E-17	4.16E-17	6.97E-17	3.94E-17	4.05E-17	4.42E-17	5.41E-17
Zn-72	3.56E-18	3.70E-18	3.20E-18	2.99E-18	8.68E-18	2.98E-18	3.02E-18	3.44E-18	3.89E-18
Gallium									
Ga-65	3.46E-17	3.55E-17	3.13E-17	3.08E-17	5.36E-17	2.93E-17	3.01E-17	3.29E-17	4.56E-17
Ga-66	7.37E-17	7.42E-17	6.85E-17	6.89E-17	9.61E-17	6.56E-17	6.65E-17	7.08E-17	9.32E-17
Ga-67	3.95E-18	4.10E-18	3.55E-18	3.38E-18	8.31E-18	3.32E-18	3.38E-18	3.80E-18	4.33E-18
Ga-68	2.86E-17	2.93E-17	2.58E-17	2.55E-17	4.28E-17	2.42E-17	2.49E-17	2.72E-17	3.78E-17
Ga-70	2.80E-19	2.87E-19	2.57E-19	2.54E-19	4.29E-19	2.41E-19	2.48E-19	2.69E-19	4.76E-18
Ga-72	8.13E-17	8.24E-17	7.57E-17	7.61E-17	1.06E-16	7.17E-17	7.34E-17	7.82E-17	9.17E-17
Ga-73	8.93E-18	9.23E-18	8.03E-18	7.84E-18	1.57E-17	7.52E-18	7.71E-18	8.53E-18	1.15E-17

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	1.98E-17	2.03E-17	1.78E-17	1.75E-17	3.14E-17	1.67E-17	1.71E-17	1.88E-17	2.18E-17
Ge-67	4.19E-17	4.29E-17	3.80E-17	3.75E-17	6.38E-17	3.57E-17	3.66E-17	4.00E-17	6.28E-17
Ge-68	5.68E-24	1.48E-23	1.35E-26	3.75E-25	2.28E-24	5.32E-25	1.65E-24	4.26E-24	4.59E-22
Ge-69	2.62E-17	2.67E-17	2.40E-17	2.38E-17	3.68E-17	2.25E-17	2.31E-17	2.50E-17	2.94E-17
Ge-71	5.75E-24	1.49E-23	1.36E-26	3.80E-25	2.31E-24	5.39E-25	1.67E-24	4.31E-24	4.65E-22
Ge-75	9.95E-19	1.03E-18	8.94E-19	8.69E-19	1.86E-18	8.36E-19	8.56E-19	9.53E-19	2.47E-18
Ge-77	3.21E-17	3.29E-17	2.93E-17	2.89E-17	4.96E-17	2.74E-17	2.82E-17	3.07E-17	4.03E-17
Ge-78	7.98E-18	8.27E-18	7.18E-18	6.99E-18	1.47E-17	6.71E-18	6.87E-18	7.64E-18	8.87E-18
Arsenic									
As-69	3.06E-17	3.13E-17	2.75E-17	2.71E-17	4.63E-17	2.58E-17	2.65E-17	2.90E-17	4.96E-17
As-70	1.23E-16	1.25E-16	1.14E-16	1.14E-16	1.67E-16	1.07E-16	1.10E-16	1.18E-16	1.43E-16
As-71	1.65E-17	1.69E-17	1.49E-17	1.46E-17	2.74E-17	1.39E-17	1.43E-17	1.57E-17	1.82E-17
As-72	5.40E-17	5.52E-17	4.93E-17	4.89E-17	7.71E-17	4.62E-17	4.76E-17	5.16E-17	7.13E-17
As-73	5.50E-20	6.02E-20	4.26E-20	3.19E-20	1.85E-19	4.19E-20	3.94E-20	5.04E-20	6.56E-20
As-74	2.28E-17	2.34E-17	2.06E-17	2.04E-17	3.35E-17	1.93E-17	1.99E-17	2.17E-17	2.59E-17
As-76	1.31E-17	1.34E-17	1.20E-17	1.19E-17	1.86E-17	1.12E-17	1.16E-17	1.25E-17	2.68E-17
As-77	2.56E-19	2.65E-19	2.31E-19	2.24E-19	4.64E-19	2.16E-19	2.21E-19	2.45E-19	3.58E-19
As-78	3.80E-17	3.86E-17	3.51E-17	3.51E-17	5.11E-17	3.30E-17	3.39E-17	3.64E-17	5.97E-17
Selenium									
Se-70	2.92E-17	3.00E-17	2.63E-17	2.58E-17	4.54E-17	2.46E-17	2.53E-17	2.77E-17	3.47E-17
Se-73m	7.29E-18	7.47E-18	6.57E-18	6.48E-18	1.10E-17	6.16E-18	6.33E-18	6.92E-18	9.21E-18
Se-73	3.15E-17	3.24E-17	2.84E-17	2.78E-17	5.03E-17	2.66E-17	2.72E-17	3.00E-17	3.63E-17
Se-75	1.06E-17	1.09E-17	9.50E-18	9.14E-18	2.12E-17	8.87E-18	9.06E-18	1.01E-17	1.16E-17
Se-77m	2.15E-18	2.24E-18	1.94E-18	1.83E-18	4.99E-18	1.80E-18	1.83E-18	2.08E-18	2.36E-18
Se-79	1.18E-22	1.31E-22	7.62E-23	6.05E-23	3.25E-22	7.87E-23	7.37E-23	9.96E-23	1.69E-22
Se-81m	2.80E-19	2.90E-19	2.51E-19	2.24E-19	8.03E-19	2.33E-19	2.33E-19	2.72E-19	3.10E-19
Se-81	3.21E-19	3.31E-19	2.90E-19	2.83E-19	5.43E-19	2.71E-19	2.78E-19	3.07E-19	4.27E-18
Se-83	7.27E-17	7.41E-17	6.70E-17	6.69E-17	1.01E-16	6.31E-17	6.48E-17	6.97E-17	8.24E-17
Bromine									
Br-74m	1.22E-16	1.24E-16	1.13E-16	1.13E-16	1.65E-16	1.07E-16	1.09E-16	1.17E-16	1.52E-16
Br-74	1.35E-16	1.36E-16	1.25E-16	1.26E-16	1.76E-16	1.21E-16	1.22E-16	1.30E-16	1.58E-16
Br-75	3.61E-17	3.71E-17	3.26E-17	3.20E-17	5.67E-17	3.05E-17	3.13E-17	3.43E-17	4.33E-17
Br-76	7.89E-17	7.99E-17	7.28E-17	7.29E-17	1.06E-16	6.91E-17	7.05E-17	7.56E-17	9.40E-17
Br-77	9.27E-18	9.54E-18	8.38E-18	8.24E-18	1.49E-17	7.84E-18	8.06E-18	8.84E-18	1.02E-17
Br-80m	8.04E-20	9.21E-20	4.11E-20	2.91E-20	1.95E-19	4.70E-20	4.16E-20	6.21E-20	1.20E-19
Br-80	2.40E-18	2.46E-18	2.18E-18	2.15E-18	3.51E-18	2.04E-18	2.10E-18	2.29E-18	3.51E-18
Br-82	7.95E-17	8.12E-17	7.31E-17	7.29E-17	1.09E-16	6.85E-17	7.06E-17	7.61E-17	8.72E-17
Br-83	2.38E-19	2.44E-19	2.15E-19	2.11E-19	3.66E-19	2.01E-19	2.06E-19	2.26E-19	7.70E-19
Br-84	5.35E-17	5.38E-17	5.00E-17	5.05E-17	6.78E-17	4.79E-17	4.86E-17	5.16E-17	7.35E-17
Krypton									
Kr-74	3.42E-17	3.51E-17	3.08E-17	3.02E-17	5.48E-17	2.88E-17	2.96E-17	3.25E-17	4.48E-17
Kr-76	1.22E-17	1.26E-17	1.10E-17	1.08E-17	2.10E-17	1.03E-17	1.06E-17	1.17E-17	1.35E-17
Kr-77	2.94E-17	3.02E-17	2.65E-17	2.59E-17	4.84E-17	2.48E-17	2.54E-17	2.80E-17	3.74E-17
Kr-79	7.44E-18	7.65E-18	6.73E-18	6.62E-18	1.17E-17	6.30E-18	6.47E-18	7.09E-18	8.17E-18
Kr-81m	3.42E-18	3.56E-18	3.08E-18	2.94E-18	7.37E-18	2.87E-18	2.93E-18	3.30E-18	3.76E-18
Kr-81	1.59E-19	1.65E-19	1.42E-19	1.38E-19	2.92E-19	1.33E-19	1.36E-19	1.52E-19	1.82E-19
Kr-83m	2.57E-22	4.21E-22	2.74E-23	3.51E-23	2.24E-22	4.79E-23	6.28E-23	1.62E-22	3.47E-21
Kr-85m	4.08E-18	4.23E-18	3.67E-18	3.48E-18	9.03E-18	3.42E-18	3.48E-18	3.93E-18	4.71E-18
Kr-85	7.35E-20	7.55E-20	6.59E-20	6.45E-20	1.17E-19	6.18E-20	6.33E-20	6.97E-20	1.95E-19
Kr-87	2.39E-17	2.42E-17	2.22E-17	2.23E-17	3.22E-17	2.11E-17	2.15E-17	2.30E-17	4.34E-17
Kr-88	5.83E-17	5.87E-17	5.46E-17	5.52E-17	7.42E-17	5.22E-17	5.31E-17	5.63E-17	6.52E-17
Rubidium									
Rb-79	4.03E-17	4.13E-17	3.64E-17	3.58E-17	6.21E-17	3.41E-17	3.50E-17	3.83E-17	5.17E-17
Rb-80	3.81E-17	3.90E-17	3.44E-17	3.39E-17	5.68E-17	3.22E-17	3.31E-17	3.62E-17	7.26E-17
Rb-81m	7.42E-20	7.80E-20	6.48E-20	5.58E-20	2.33E-19	6.07E-20	6.02E-20	7.16E-20	9.08E-20
Rb-81	1.81E-17	1.86E-17	1.63E-17	1.60E-17	2.94E-17	1.52E-17	1.56E-17	1.72E-17	2.02E-17
Rb-82m	8.73E-17	8.92E-17	8.03E-17	8.00E-17	1.21E-16	7.52E-17	7.76E-17	8.36E-17	9.60E-17
Rb-82	3.31E-17	3.40E-17	2.99E-17	2.95E-17	4.94E-17	2.80E-17	2.88E-17	3.15E-17	5.54E-17
Rb-83	1.49E-17	1.53E-17	1.35E-17	1.33E-17	2.22E-17	1.26E-17	1.30E-17	1.42E-17	1.64E-17
Rb-84	2.74E-17	2.81E-17	2.52E-17	2.50E-17	3.84E-17	2.35E-17	2.43E-17	2.62E-17	3.04E-17
Rb-86	2.90E-18	2.96E-18	2.70E-18	2.70E-18	3.88E-18	2.52E-18	2.61E-18	2.79E-18	8.41E-18
Rb-87	8.25E-22	8.87E-22	6.40E-22	5.40E-22	2.36E-21	6.23E-22	6.04E-22	7.52E-22	1.02E-21

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	1.96E-17	1.98E-17	1.83E-17	1.85E-17	2.50E-17	1.74E-17	1.78E-17	1.89E-17	5.26E-17
Rb-89	6.22E-17	6.30E-17	5.81E-17	5.84E-17	8.02E-17	5.49E-17	5.63E-17	5.99E-17	7.93E-17
Strontium									
Sr-80	1.13E-21	1.90E-21	6.86E-24	9.87E-23	5.68E-22	8.60E-23	1.86E-22	6.55E-22	1.48E-20
Sr-81	4.10E-17	4.21E-17	3.71E-17	3.65E-17	6.42E-17	3.47E-17	3.57E-17	3.91E-17	5.64E-17
Sr-82	1.11E-21	1.87E-21	6.74E-24	9.71E-23	5.58E-22	8.46E-23	1.83E-22	6.44E-22	1.45E-20
Sr-83	2.37E-17	2.42E-17	2.16E-17	2.15E-17	3.41E-17	2.03E-17	2.09E-17	2.26E-17	2.65E-17
Sr-85m	6.03E-18	6.26E-18	5.42E-18	5.23E-18	1.21E-17	5.06E-18	5.18E-18	5.79E-18	6.63E-18
Sr-85	1.51E-17	1.55E-17	1.37E-17	1.35E-17	2.27E-17	1.28E-17	1.31E-17	1.44E-17	1.66E-17
Sr-87m	9.44E-18	9.71E-18	8.47E-18	8.31E-18	1.54E-17	7.94E-18	8.14E-18	8.97E-18	1.03E-17
Sr-89	4.85E-20	5.04E-20	4.28E-20	4.04E-20	1.03E-19	4.02E-20	4.07E-20	4.62E-20	3.70E-18
Sr-90	3.96E-21	4.19E-21	3.33E-21	2.96E-21	1.05E-20	3.16E-21	3.13E-21	3.72E-21	1.50E-20
Sr-91	2.10E-17	2.15E-17	1.94E-17	1.94E-17	2.87E-17	1.82E-17	1.88E-17	2.02E-17	2.85E-17
Sr-92	4.03E-17	4.09E-17	3.76E-17	3.78E-17	5.20E-17	3.54E-17	3.64E-17	3.88E-17	4.42E-17
Yttrium									
Y-86m	6.05E-18	6.28E-18	5.46E-18	5.28E-18	1.20E-17	5.10E-18	5.21E-18	5.82E-18	6.68E-18
Y-86	1.08E-16	1.10E-16	9.96E-17	9.96E-17	1.45E-16	9.37E-17	9.63E-17	1.03E-16	1.19E-16
Y-87	1.34E-17	1.38E-17	1.21E-17	1.19E-17	2.05E-17	1.13E-17	1.16E-17	1.28E-17	1.47E-17
Y-88	8.07E-17	8.17E-17	7.53E-17	7.59E-17	1.03E-16	7.13E-17	7.31E-17	7.77E-17	8.75E-17
Y-90m	1.82E-17	1.88E-17	1.64E-17	1.60E-17	3.08E-17	1.54E-17	1.58E-17	1.74E-17	2.00E-17
Y-90	1.26E-19	1.30E-19	1.12E-19	1.07E-19	2.47E-19	1.05E-19	1.07E-19	1.20E-19	9.90E-18
Y-91m	1.60E-17	1.64E-17	1.44E-17	1.43E-17	2.35E-17	1.35E-17	1.39E-17	1.52E-17	1.75E-17
Y-91	1.58E-19	1.62E-19	1.45E-19	1.43E-19	2.48E-19	1.36E-19	1.39E-19	1.52E-19	4.13E-18
Y-92	7.88E-18	8.05E-18	7.30E-18	7.29E-18	1.07E-17	6.84E-18	7.05E-18	7.57E-18	2.86E-17
Y-93	2.85E-18	2.90E-18	2.63E-18	2.63E-18	4.09E-18	2.49E-18	2.55E-18	2.74E-18	1.76E-17
Y-94	3.38E-17	3.44E-17	3.13E-17	3.13E-17	4.51E-17	2.94E-17	3.03E-17	3.24E-17	6.12E-17
Y-95	2.70E-17	2.71E-17	2.53E-17	2.56E-17	3.39E-17	2.43E-17	2.46E-17	2.61E-17	5.08E-17
Zirconium									
Zr-86	7.53E-18	7.81E-18	6.77E-18	6.58E-18	1.42E-17	6.33E-18	6.48E-18	7.21E-18	8.33E-18
Zr-88	1.16E-17	1.20E-17	1.04E-17	1.02E-17	1.89E-17	9.79E-18	1.00E-17	1.11E-17	1.28E-17
Zr-89	3.48E-17	3.55E-17	3.20E-17	3.19E-17	4.80E-17	2.99E-17	3.09E-17	3.33E-17	3.85E-17
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	2.23E-17	2.28E-17	2.04E-17	2.03E-17	3.10E-17	1.90E-17	1.97E-17	2.13E-17	2.45E-17
Zr-97	5.45E-18	5.56E-18	5.02E-18	5.01E-18	7.55E-18	4.72E-18	4.85E-18	5.22E-18	1.16E-17
Niobium									
Nb-88	1.23E-16	1.26E-16	1.13E-16	1.13E-16	1.75E-16	1.06E-16	1.09E-16	1.18E-16	1.51E-16
Nb-89b[1]	4.18E-17	4.25E-17	3.84E-17	3.82E-17	5.82E-17	3.63E-17	3.71E-17	4.00E-17	6.05E-17
Nb-89a[2]	5.80E-17	5.94E-17	5.24E-17	5.17E-17	8.59E-17	4.91E-17	5.04E-17	5.51E-17	7.19E-17
Nb-90	1.26E-16	1.27E-16	1.17E-16	1.18E-16	1.65E-16	1.11E-16	1.14E-16	1.21E-16	1.38E-16
Nb-93m	1.03E-21	1.41E-21	2.51E-23	1.12E-22	6.70E-22	1.37E-22	1.58E-22	5.57E-22	5.26E-21
Nb-94	4.73E-17	4.84E-17	4.35E-17	4.33E-17	6.55E-17	4.06E-17	4.20E-17	4.53E-17	5.21E-17
Nb-95m	1.70E-18	1.77E-18	1.53E-18	1.48E-18	3.35E-18	1.42E-18	1.46E-18	1.63E-18	1.89E-18
Nb-95	2.30E-17	2.36E-17	2.12E-17	2.10E-17	3.20E-17	1.98E-17	2.04E-17	2.20E-17	2.54E-17
Nb-96	7.43E-17	7.59E-17	6.83E-17	6.80E-17	1.03E-16	6.39E-17	6.60E-17	7.11E-17	8.18E-17
Nb-97m	2.19E-17	2.24E-17	2.01E-17	2.00E-17	3.06E-17	1.88E-17	1.94E-17	2.10E-17	2.42E-17
Nb-97	1.98E-17	2.03E-17	1.80E-17	1.79E-17	2.82E-17	1.69E-17	1.74E-17	1.89E-17	2.37E-17
Nb-98	7.31E-17	7.45E-17	6.75E-17	6.74E-17	9.92E-17	6.33E-17	6.52E-17	7.01E-17	8.90E-17
Molybdenum									
Mo-90	2.34E-17	2.41E-17	2.12E-17	2.08E-17	3.90E-17	1.99E-17	2.04E-17	2.24E-17	2.61E-17
Mo-93m	6.74E-17	6.86E-17	6.25E-17	6.26E-17	9.09E-17	5.88E-17	6.05E-17	6.48E-17	7.36E-17
Mo-93	5.84E-21	8.00E-21	1.42E-22	6.37E-22	3.80E-21	7.78E-22	8.98E-22	3.16E-21	2.99E-20
Mo-99	4.42E-18	4.53E-18	4.04E-18	3.99E-18	6.63E-18	3.77E-18	3.89E-18	4.23E-18	6.22E-18
Mo-101	4.10E-17	4.17E-17	3.79E-17	3.80E-17	5.55E-17	3.57E-17	3.67E-17	3.93E-17	4.88E-17
Technetium									
Tc-93m	2.14E-17	2.15E-17	1.98E-17	1.99E-17	2.88E-17	1.90E-17	1.92E-17	2.05E-17	2.29E-17
Tc-93	4.35E-17	4.42E-17	4.07E-17	4.10E-17	5.56E-17	3.84E-17	3.94E-17	4.20E-17	4.74E-17
Tc-94m	5.58E-17	5.69E-17	5.12E-17	5.10E-17	7.77E-17	4.81E-17	4.94E-17	5.33E-17	6.93E-17
Tc-94	8.00E-17	8.18E-17	7.36E-17	7.32E-17	1.10E-16	6.87E-17	7.10E-17	7.65E-17	8.81E-17
Tc-95m	1.96E-17	2.01E-17	1.79E-17	1.77E-17	2.98E-17	1.67E-17	1.72E-17	1.87E-17	2.16E-17

[1] $T_{½}$ = 122 m

[2] $T_{½}$ = 66 m

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Technetium, cont'd									
Tc-95	2.36E-17	2.42E-17	2.17E-17	2.16E-17	3.27E-17	2.03E-17	2.09E-17	2.26E-17	2.60E-17
Tc-96m	1.35E-18	1.38E-18	1.24E-18	1.24E-18	1.83E-18	1.16E-18	1.20E-18	1.29E-18	1.50E-18
Tc-96	7.50E-17	7.67E-17	6.91E-17	6.88E-17	1.03E-16	6.45E-17	6.67E-17	7.18E-17	8.26E-17
Tc-97m	1.41E-20	1.66E-20	5.68E-21	5.66E-21	2.39E-20	6.47E-21	6.28E-21	1.02E-20	3.64E-20
Tc-97	8.02E-21	1.06E-20	2.78E-22	9.22E-22	5.59E-21	1.28E-21	1.30E-21	4.33E-21	3.44E-20
Tc-98	4.26E-17	4.36E-17	3.89E-17	3.86E-17	6.00E-17	3.64E-17	3.75E-17	4.06E-17	4.68E-17
Tc-99m	3.01E-18	3.12E-18	2.71E-18	2.52E-18	7.49E-18	2.52E-18	2.55E-18	2.91E-18	3.28E-18
Tc-99	7.35E-22	7.90E-22	5.71E-22	4.83E-22	2.10E-21	5.56E-22	5.39E-22	6.70E-22	9.06E-22
Tc-101	9.74E-18	1.01E-17	8.77E-18	8.57E-18	1.69E-17	8.20E-18	8.41E-18	9.30E-18	1.27E-17
Tc-104	5.96E-17	6.05E-17	5.51E-17	5.52E-17	8.13E-17	5.22E-17	5.34E-17	5.72E-17	8.71E-17
Ruthenium									
Ru-94	1.55E-17	1.60E-17	1.42E-17	1.40E-17	2.34E-17	1.32E-17	1.36E-17	1.48E-17	1.71E-17
Ru-97	6.31E-18	6.56E-18	5.67E-18	5.48E-18	1.24E-17	5.30E-18	5.42E-18	6.06E-18	6.97E-18
Ru-103	1.41E-17	1.44E-17	1.27E-17	1.25E-17	2.12E-17	1.19E-17	1.22E-17	1.33E-17	1.54E-17
Ru-105	2.35E-17	2.41E-17	2.14E-17	2.12E-17	3.43E-17	2.00E-17	2.06E-17	2.24E-17	2.71E-17
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	2.00E-17	2.05E-17	1.83E-17	1.81E-17	2.98E-17	1.71E-17	1.76E-17	1.91E-17	2.20E-17
Rh-99	1.71E-17	1.75E-17	1.54E-17	1.52E-17	2.72E-17	1.45E-17	1.48E-17	1.63E-17	1.87E-17
Rh-100	8.26E-17	8.37E-17	7.68E-17	7.72E-17	1.08E-16	7.28E-17	7.44E-17	7.94E-17	9.00E-17
Rh-101m	8.54E-18	8.83E-18	7.66E-18	7.49E-18	1.50E-17	7.17E-18	7.35E-18	8.15E-18	9.41E-18
Rh-101	6.60E-18	6.85E-18	5.92E-18	5.63E-18	1.44E-17	5.52E-18	5.62E-18	6.35E-18	7.27E-18
Rh-102m	1.44E-17	1.47E-17	1.30E-17	1.28E-17	2.13E-17	1.22E-17	1.25E-17	1.37E-17	1.65E-17
Rh-102	6.39E-17	6.54E-17	5.85E-17	5.80E-17	9.05E-17	5.47E-17	5.64E-17	6.10E-17	7.02E-17
Rh-103m	2.27E-21	2.77E-21	2.69E-22	3.61E-22	2.31E-21	6.23E-22	5.25E-22	1.30E-21	6.22E-21
Rh-105	2.26E-18	2.34E-18	2.03E-18	1.98E-18	3.97E-18	1.90E-18	1.95E-18	2.16E-18	2.49E-18
Rh-106m	8.75E-17	8.94E-17	8.05E-17	8.02E-17	1.21E-16	7.55E-17	7.78E-17	8.38E-17	9.63E-17
Rh-106	6.46E-18	6.62E-18	5.87E-18	5.80E-18	9.48E-18	5.50E-18	5.65E-18	6.15E-18	2.62E-17
Rh-107	9.12E-18	9.42E-18	8.20E-18	8.02E-18	1.58E-17	7.68E-18	7.87E-18	8.71E-18	1.17E-17
Palladium									
Pd-100	1.83E-18	1.92E-18	1.58E-18	1.36E-18	5.65E-18	1.49E-18	1.47E-18	1.75E-18	2.05E-18
Pd-101	9.32E-18	9.57E-18	8.45E-18	8.36E-18	1.40E-17	7.92E-18	8.14E-18	8.89E-18	1.03E-17
Pd-103	2.16E-20	2.59E-20	4.37E-21	5.37E-21	2.16E-20	7.22E-21	6.46E-21	1.33E-20	5.62E-20
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	1.06E-19	1.13E-19	8.40E-20	7.63E-20	2.61E-19	8.10E-20	8.01E-20	9.70E-20	9.62E-19
Silver									
Ag-102	1.01E-16	1.03E-16	9.27E-17	9.25E-17	1.38E-16	8.74E-17	8.96E-17	9.64E-17	1.19E-16
Ag-103	2.22E-17	2.28E-17	2.03E-17	2.00E-17	3.38E-17	1.90E-17	1.95E-17	2.12E-17	2.61E-17
Ag-104m	3.52E-17	3.58E-17	3.22E-17	3.20E-17	4.95E-17	3.04E-17	3.11E-17	3.36E-17	4.42E-17
Ag-104	8.03E-17	8.20E-17	7.39E-17	7.36E-17	1.11E-16	6.92E-17	7.13E-17	7.69E-17	8.84E-17
Ag-105	1.49E-17	1.53E-17	1.35E-17	1.32E-17	2.40E-17	1.26E-17	1.29E-17	1.42E-17	1.64E-17
Ag-106m	8.43E-17	8.61E-17	7.75E-17	7.71E-17	1.17E-16	7.26E-17	7.48E-17	8.07E-17	9.24E-17
Ag-106	2.12E-17	2.18E-17	1.91E-17	1.89E-17	3.19E-17	1.79E-17	1.84E-17	2.02E-17	2.77E-17
Ag-108m	4.84E-17	4.96E-17	4.40E-17	4.35E-17	7.06E-17	4.11E-17	4.24E-17	4.61E-17	5.32E-17
Ag-108	5.79E-19	5.94E-19	5.24E-19	5.16E-19	8.79E-19	4.90E-19	5.04E-19	5.51E-19	4.72E-18
Ag-109m	7.11E-20	7.63E-20	5.26E-20	4.62E-20	1.94E-19	5.16E-20	5.03E-20	6.35E-20	9.49E-20
Ag-110m	8.27E-17	8.45E-17	7.63E-17	7.61E-17	1.13E-16	7.14E-17	7.37E-17	7.93E-17	9.09E-17
Ag-110	1.12E-18	1.15E-18	1.02E-18	1.01E-18	1.69E-18	9.56E-19	9.83E-19	1.07E-18	1.56E-17
Ag-111	7.83E-19	8.09E-19	7.03E-19	6.86E-19	1.36E-18	6.58E-19	6.74E-19	7.47E-19	1.66E-18
Ag-112	2.01E-17	2.04E-17	1.85E-17	1.85E-17	2.72E-17	1.75E-17	1.79E-17	1.92E-17	4.06E-17
Ag-115	2.11E-17	2.15E-17	1.96E-17	1.96E-17	2.97E-17	1.85E-17	1.89E-17	2.03E-17	3.49E-17
Cadmium									
Cd-104	6.62E-18	6.80E-18	5.98E-18	5.85E-18	1.06E-17	5.60E-18	5.75E-18	6.31E-18	7.32E-18
Cd-107	2.77E-19	2.92E-19	2.17E-19	2.08E-19	5.16E-19	2.11E-19	2.11E-19	2.49E-19	3.57E-19
Cd-109	9.75E-20	1.08E-19	5.59E-20	5.05E-20	2.22E-19	5.94E-20	5.66E-20	7.88E-20	1.57E-19
Cd-113m	3.65E-21	3.85E-21	3.06E-21	2.72E-21	9.64E-21	2.91E-21	2.88E-21	3.42E-21	1.80E-20
Cd-113	6.63E-22	7.13E-22	5.17E-22	4.37E-22	1.89E-21	5.02E-22	4.88E-22	6.05E-22	8.18E-22
Cd-115m	7.10E-19	7.25E-19	6.56E-19	6.54E-19	9.89E-19	6.14E-19	6.34E-19	6.82E-19	4.74E-18
Cd-115	6.97E-18	7.15E-18	6.28E-18	6.19E-18	1.05E-17	5.89E-18	6.05E-18	6.62E-18	8.27E-18
Cd-117m	6.14E-17	6.21E-17	5.72E-17	5.76E-17	7.92E-17	5.41E-17	5.55E-17	5.91E-17	6.70E-17
Cd-117	3.25E-17	3.31E-17	3.01E-17	3.01E-17	4.46E-17	2.83E-17	2.91E-17	3.12E-17	3.84E-17

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	1.92E-17	1.97E-17	1.75E-17	1.73E-17	2.97E-17	1.64E-17	1.69E-17	1.84E-17	2.11E-17
In-110b[1]	9.12E-17	9.33E-17	8.39E-17	8.35E-17	1.26E-16	7.84E-17	8.10E-17	8.73E-17	1.00E-16
In-110a[2]	4.67E-17	4.77E-17	4.26E-17	4.23E-17	6.64E-17	4.00E-17	4.11E-17	4.45E-17	5.75E-17
In-111	1.05E-17	1.09E-17	9.44E-18	9.08E-18	2.17E-17	8.82E-18	9.01E-18	1.01E-17	1.16E-17
In-112	7.90E-18	8.09E-18	7.12E-18	7.02E-18	1.18E-17	6.67E-18	6.86E-18	7.49E-18	9.68E-18
In-113m	7.46E-18	7.68E-18	6.69E-18	6.56E-18	1.21E-17	6.27E-18	6.43E-18	7.09E-18	8.19E-18
In-114m	2.48E-18	2.56E-18	2.24E-18	2.19E-18	4.12E-18	2.10E-18	2.15E-18	2.37E-18	2.75E-18
In-114	8.25E-20	8.40E-20	7.67E-20	7.69E-20	1.09E-19	7.21E-20	7.43E-20	7.94E-20	9.07E-20
In-115m	4.49E-18	4.64E-18	4.02E-18	3.93E-18	7.69E-18	3.77E-18	3.86E-18	4.28E-18	4.96E-18
In-115	2.27E-21	2.41E-21	1.88E-21	1.65E-21	6.18E-21	1.79E-21	1.77E-21	2.12E-21	3.57E-21
In-116m	7.42E-17	7.54E-17	6.92E-17	6.94E-17	9.72E-17	6.51E-17	6.69E-17	7.15E-17	8.15E-17
In-117m	2.44E-18	2.53E-18	2.18E-18	2.11E-18	4.66E-18	2.04E-18	2.09E-18	2.33E-18	5.17E-18
In-117	2.01E-17	2.06E-17	1.81E-17	1.78E-17	3.26E-17	1.70E-17	1.74E-17	1.92E-17	2.22E-17
In-119m	3.74E-19	3.87E-19	3.33E-19	3.26E-19	6.29E-19	3.14E-19	3.21E-19	3.55E-19	1.23E-17
In-119	2.31E-17	2.36E-17	2.12E-17	2.11E-17	3.21E-17	1.98E-17	2.04E-17	2.21E-17	2.95E-17
Tin									
Sn-110	8.18E-18	8.48E-18	7.32E-18	7.13E-18	1.49E-17	6.85E-18	7.02E-18	7.81E-18	9.03E-18
Sn-111	1.50E-17	1.53E-17	1.36E-17	1.35E-17	2.14E-17	1.28E-17	1.32E-17	1.43E-17	1.78E-17
Sn-113	1.74E-19	1.87E-19	1.28E-19	1.24E-19	3.06E-19	1.27E-19	1.26E-19	1.52E-19	2.29E-19
Sn-117m	3.57E-18	3.72E-18	3.19E-18	3.00E-18	8.34E-18	2.98E-18	3.02E-18	3.44E-18	3.95E-18
Sn-119m	2.61E-20	3.10E-20	5.21E-21	5.15E-21	3.46E-20	9.47E-21	7.81E-21	1.61E-20	5.17E-20
Sn-121m	1.56E-20	1.82E-20	5.02E-21	4.06E-21	2.72E-20	7.04E-21	5.99E-21	1.05E-20	2.62E-20
Sn-121	1.13E-21	1.21E-21	9.07E-22	7.81E-22	3.17E-21	8.74E-22	8.55E-22	1.04E-21	1.36E-21
Sn-123m	3.49E-18	3.63E-18	3.13E-18	2.95E-18	8.12E-18	2.92E-18	2.97E-18	3.37E-18	5.65E-18
Sn-123	2.44E-19	2.49E-19	2.25E-19	2.23E-19	3.54E-19	2.10E-19	2.17E-19	2.34E-19	3.09E-18
Sn-125	9.49E-18	9.67E-18	8.81E-18	8.82E-18	1.27E-17	8.27E-18	8.52E-18	9.12E-18	1.87E-17
Sn-126	8.26E-19	8.67E-19	7.11E-19	6.10E-19	2.56E-18	6.70E-19	6.61E-19	7.90E-19	9.22E-19
Sn-127	5.71E-17	5.81E-17	5.30E-17	5.30E-17	7.69E-17	4.98E-17	5.13E-17	5.49E-17	6.69E-17
Sn-128	1.82E-17	1.87E-17	1.63E-17	1.60E-17	2.83E-17	1.53E-17	1.57E-17	1.72E-17	2.00E-17
Antimony									
Sb-115	2.70E-17	2.76E-17	2.43E-17	2.40E-17	4.04E-17	2.28E-17	2.34E-17	2.56E-17	3.10E-17
Sb-116m	9.31E-17	9.50E-17	8.60E-17	8.58E-17	1.28E-16	8.06E-17	8.31E-17	8.93E-17	1.02E-16
Sb-116	6.46E-17	6.57E-17	5.98E-17	5.99E-17	8.61E-17	5.63E-17	5.79E-17	6.20E-17	7.44E-17
Sb-117	4.29E-18	4.46E-18	3.84E-18	3.65E-18	9.29E-18	3.59E-18	3.65E-18	4.12E-18	4.74E-18
Sb-118m	7.60E-17	7.76E-17	7.05E-17	7.05E-17	1.04E-16	6.60E-17	6.81E-17	7.31E-17	8.35E-17
Sb-119	5.55E-20	6.59E-20	1.14E-20	1.10E-20	7.47E-20	2.04E-20	1.68E-20	3.43E-20	1.08E-19
Sb-120b[3]	7.20E-17	7.36E-17	6.68E-17	6.66E-17	1.01E-16	6.25E-17	6.45E-17	6.93E-17	7.92E-17
Sb-120a[4]	1.33E-17	1.36E-17	1.20E-17	1.18E-17	1.98E-17	1.12E-17	1.15E-17	1.26E-17	1.68E-17
Sb-122	1.33E-17	1.37E-17	1.21E-17	1.19E-17	1.94E-17	1.13E-17	1.16E-17	1.27E-17	1.82E-17
Sb-124n[5]	1.74E-22	2.07E-22	3.19E-23	3.28E-23	2.21E-22	6.12E-23	5.01E-23	1.06E-22	3.50E-22
Sb-124m[6]	1.06E-17	1.09E-17	9.61E-18	9.50E-18	1.54E-17	8.99E-18	9.26E-18	1.01E-17	1.19E-17
Sb-124	5.48E-17	5.57E-17	5.07E-17	5.08E-17	7.30E-17	4.78E-17	4.90E-17	5.25E-17	6.20E-17
Sb-125	1.25E-17	1.28E-17	1.12E-17	1.11E-17	1.90E-17	1.05E-17	1.08E-17	1.18E-17	1.37E-17
Sb-126m	4.66E-17	4.77E-17	4.24E-17	4.19E-17	6.77E-17	3.96E-17	4.08E-17	4.44E-17	5.55E-17
Sb-126	8.52E-17	8.72E-17	7.77E-17	7.70E-17	1.22E-16	7.27E-17	7.49E-17	8.13E-17	9.47E-17
Sb-127	2.06E-17	2.11E-17	1.88E-17	1.86E-17	3.01E-17	1.75E-17	1.81E-17	1.97E-17	2.32E-17
Sb-128b[7]	9.29E-17	9.51E-17	8.49E-17	8.43E-17	1.33E-16	7.94E-17	8.19E-17	8.87E-17	1.04E-16
Sb-128a[8]	5.96E-17	6.11E-17	5.45E-17	5.41E-17	8.60E-17	5.09E-17	5.26E-17	5.70E-17	7.50E-17
Sb-129	4.32E-17	4.40E-17	3.99E-17	3.99E-17	5.86E-17	3.74E-17	3.86E-17	4.14E-17	4.96E-17
Sb-130	9.74E-17	9.96E-17	8.96E-17	8.90E-17	1.39E-16	8.38E-17	8.64E-17	9.33E-17	1.13E-16
Sb-131	5.60E-17	5.69E-17	5.19E-17	5.20E-17	7.45E-17	4.88E-17	5.02E-17	5.38E-17	6.51E-17
Tellurium									
Te-116	1.05E-18	1.10E-18	8.87E-19	8.18E-19	2.44E-18	8.42E-19	8.42E-19	9.82E-19	1.20E-18
Te-121m	5.64E-18	5.86E-18	5.08E-18	4.92E-18	1.09E-17	4.75E-18	4.86E-18	5.42E-18	6.24E-18

[1] $T_{1/2}$ = 4.9 h
[2] $T_{1/2}$ = 69.1 m
[3] $T_{1/2}$ = 5.76 d
[4] $T_{1/2}$ = 15.89 m
[5] $T_{1/2}$ = 20.2 m
[6] $T_{1/2}$ = 93 s
[7] $T_{1/2}$ = 9.01 h
[8] $T_{1/2}$ = 10.4 m

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	1.68E-17	1.73E-17	1.52E-17	1.50E-17	2.47E-17	1.42E-17	1.46E-17	1.60E-17	1.85E-17
Te-123m	3.41E-18	3.55E-18	3.05E-18	2.87E-18	7.97E-18	2.85E-18	2.88E-18	3.29E-18	3.76E-18
Te-123	5.49E-20	6.49E-20	1.36E-20	1.19E-20	8.20E-20	2.20E-20	1.83E-20	3.51E-20	9.87E-20
Te-125m	1.19E-19	1.39E-19	3.97E-20	3.26E-20	2.07E-19	5.46E-20	4.69E-20	8.10E-20	1.95E-19
Te-127m	4.05E-20	4.67E-20	1.60E-20	1.36E-20	7.29E-20	2.03E-20	1.79E-20	2.89E-20	6.81E-20
Te-127	1.49E-19	1.53E-19	1.33E-19	1.30E-19	2.46E-19	1.25E-19	1.28E-19	1.41E-19	2.38E-19
Te-129m	9.28E-19	9.54E-19	8.32E-19	8.24E-19	1.33E-18	7.82E-19	8.04E-19	8.78E-19	2.33E-18
Te-129	1.69E-18	1.73E-18	1.52E-18	1.49E-18	2.59E-18	1.42E-18	1.46E-18	1.60E-18	4.61E-18
Te-131m	4.23E-17	4.32E-17	3.90E-17	3.88E-17	5.93E-17	3.65E-17	3.77E-17	4.06E-17	4.69E-17
Te-131	1.20E-17	1.23E-17	1.10E-17	1.07E-17	1.97E-17	1.02E-17	1.05E-17	1.15E-17	1.88E-17
Te-132	5.81E-18	6.06E-18	5.18E-18	4.99E-18	1.17E-17	4.85E-18	4.95E-18	5.56E-18	6.44E-18
Te-133m	6.90E-17	7.05E-17	6.38E-17	6.36E-17	9.53E-17	5.97E-17	6.16E-17	6.62E-17	8.13E-17
Te-133	2.77E-17	2.84E-17	2.55E-17	2.53E-17	4.05E-17	2.39E-17	2.46E-17	2.66E-17	3.80E-17
Te-134	2.57E-17	2.64E-17	2.34E-17	2.30E-17	4.01E-17	2.19E-17	2.25E-17	2.46E-17	2.85E-17
Iodine									
I-120m	1.59E-16	1.62E-16	1.47E-16	1.46E-16	2.17E-16	1.38E-16	1.42E-16	1.52E-16	1.90E-16
I-120	8.20E-17	8.32E-17	7.55E-17	7.54E-17	1.12E-16	7.16E-17	7.31E-17	7.85E-17	1.09E-16
I-121	1.16E-17	1.19E-17	1.04E-17	1.02E-17	2.00E-17	9.73E-18	9.97E-18	1.10E-17	1.29E-17
I-122	2.85E-17	2.92E-17	2.57E-17	2.54E-17	4.24E-17	2.41E-17	2.48E-17	2.71E-17	4.49E-17
I-123	3.86E-18	4.01E-18	3.43E-18	3.24E-18	8.59E-18	3.21E-18	3.25E-18	3.70E-18	4.27E-18
I-124	3.26E-17	3.33E-17	2.99E-17	2.98E-17	4.52E-17	2.82E-17	2.89E-17	3.12E-17	3.72E-17
I-125	1.33E-19	1.57E-19	3.99E-20	3.23E-20	2.23E-19	5.82E-20	4.91E-20	8.86E-20	2.24E-19
I-126	1.33E-17	1.37E-17	1.21E-17	1.19E-17	1.98E-17	1.13E-17	1.16E-17	1.27E-17	1.50E-17
I-128	2.59E-18	2.66E-18	2.33E-18	2.29E-18	4.03E-18	2.18E-18	2.24E-18	2.46E-18	9.51E-18
I-129	9.74E-20	1.13E-19	3.81E-20	2.84E-20	1.94E-19	4.88E-20	4.21E-20	6.93E-20	1.48E-19
I-130	6.44E-17	6.59E-17	5.87E-17	5.81E-17	9.21E-17	5.49E-17	5.65E-17	6.14E-17	7.12E-17
I-131	1.12E-17	1.15E-17	1.01E-17	9.89E-18	1.84E-17	9.44E-18	9.69E-18	1.07E-17	1.23E-17
I-132m	9.35E-18	9.59E-18	8.51E-18	8.42E-18	1.37E-17	7.96E-18	8.20E-18	8.92E-18	1.06E-17
I-132	6.87E-17	7.02E-17	6.30E-17	6.27E-17	9.52E-17	5.90E-17	6.08E-17	6.57E-17	7.81E-17
I-133	1.83E-17	1.87E-17	1.66E-17	1.64E-17	2.67E-17	1.55E-17	1.60E-17	1.74E-17	2.15E-17
I-134	7.88E-17	8.05E-17	7.28E-17	7.27E-17	1.07E-16	6.82E-17	7.04E-17	7.56E-17	9.09E-17
I-135	4.74E-17	4.81E-17	4.41E-17	4.43E-17	6.17E-17	4.16E-17	4.27E-17	4.56E-17	5.29E-17
Xenon									
Xe-120	1.15E-17	1.19E-17	1.04E-17	1.03E-17	1.79E-17	9.77E-18	1.00E-17	1.10E-17	1.28E-17
Xe-121	5.35E-17	5.43E-17	4.94E-17	4.94E-17	7.40E-17	4.68E-17	4.78E-17	5.13E-17	6.44E-17
Xe-122	1.37E-18	1.42E-18	1.18E-18	1.14E-18	2.44E-18	1.12E-18	1.13E-18	1.28E-18	1.54E-18
Xe-123	1.79E-17	1.84E-17	1.64E-17	1.62E-17	2.77E-17	1.54E-17	1.58E-17	1.72E-17	2.05E-17
Xe-125	6.77E-18	7.02E-18	6.05E-18	5.86E-18	1.28E-17	5.67E-18	5.79E-18	6.47E-18	7.50E-18
Xe-127	7.04E-18	7.31E-18	6.28E-18	6.04E-18	1.41E-17	5.87E-18	5.99E-18	6.73E-18	7.78E-18
Xe-129m	4.04E-19	4.40E-19	2.79E-19	2.54E-19	8.27E-19	2.82E-19	2.73E-19	3.46E-19	5.15E-19
Xe-131m	1.41E-19	1.55E-19	9.31E-20	8.40E-20	2.97E-19	9.57E-20	9.19E-20	1.19E-19	1.83E-19
Xe-133m	7.14E-19	7.50E-19	6.07E-19	5.83E-19	1.40E-18	5.76E-19	5.83E-19	6.68E-19	8.15E-19
Xe-133	5.71E-19	6.06E-19	4.71E-19	3.98E-19	1.76E-18	4.50E-19	4.41E-19	5.37E-19	6.50E-19
Xe-135m	1.28E-17	1.31E-17	1.15E-17	1.14E-17	1.91E-17	1.08E-17	1.11E-17	1.21E-17	1.41E-17
Xe-135	7.03E-18	7.29E-18	6.32E-18	6.14E-18	1.32E-17	5.91E-18	6.05E-18	6.74E-18	8.16E-18
Xe-138	3.36E-17	3.40E-17	3.12E-17	3.14E-17	4.52E-17	2.96E-17	3.03E-17	3.23E-17	4.23E-17
Cesium									
Cs-125	1.99E-17	2.04E-17	1.80E-17	1.77E-17	2.99E-17	1.69E-17	1.73E-17	1.89E-17	2.48E-17
Cs-126	3.28E-17	3.37E-17	2.96E-17	2.91E-17	4.99E-17	2.77E-17	2.84E-17	3.12E-17	5.72E-17
Cs-127	1.18E-17	1.21E-17	1.06E-17	1.04E-17	1.88E-17	9.90E-18	1.01E-17	1.12E-17	1.29E-17
Cs-128	2.70E-17	2.76E-17	2.43E-17	2.40E-17	4.06E-17	2.28E-17	2.34E-17	2.56E-17	3.98E-17
Cs-129	7.46E-18	7.70E-18	6.64E-18	6.50E-18	1.21E-17	6.24E-18	6.39E-18	7.06E-18	8.24E-18
Cs-130	1.52E-17	1.56E-17	1.37E-17	1.35E-17	2.27E-17	1.29E-17	1.32E-17	1.45E-17	2.04E-17
Cs-131	8.37E-20	9.78E-20	2.94E-20	2.23E-20	1.54E-19	3.96E-20	3.37E-20	5.77E-20	1.31E-19
Cs-132	2.07E-17	2.12E-17	1.88E-17	1.86E-17	2.93E-17	1.76E-17	1.81E-17	1.97E-17	2.27E-17
Cs-134m	4.09E-19	4.29E-19	3.47E-19	3.16E-19	1.04E-18	3.29E-19	3.27E-19	3.85E-19	4.61E-19
Cs-134	4.68E-17	4.79E-17	4.28E-17	4.25E-17	6.60E-17	4.00E-17	4.13E-17	4.47E-17	5.15E-17
Cs-135m	4.76E-17	4.87E-17	4.39E-17	4.37E-17	6.56E-17	4.09E-17	4.23E-17	4.56E-17	5.28E-17
Cs-135	2.33E-22	2.55E-22	1.65E-22	1.35E-22	6.65E-22	1.66E-22	1.58E-22	2.05E-22	3.11E-22
Cs-136	6.43E-17	6.58E-17	5.94E-17	5.91E-17	9.02E-17	5.55E-17	5.73E-17	6.17E-17	7.08E-17

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	4.19E-21	4.42E-21	3.54E-21	3.18E-21	1.07E-20	3.36E-21	3.34E-21	3.94E-21	9.34E-20
Cs-138	7.10E-17	7.20E-17	6.62E-17	6.65E-17	9.24E-17	6.26E-17	6.41E-17	6.84E-17	9.19E-17
Barium									
Ba-126	4.16E-18	4.30E-18	3.70E-18	3.61E-18	6.97E-18	3.47E-18	3.55E-18	3.94E-18	4.61E-18
Ba-128	1.58E-18	1.65E-18	1.37E-18	1.32E-18	2.93E-18	1.29E-18	1.31E-18	1.48E-18	1.77E-18
Ba-131m	1.34E-18	1.40E-18	1.17E-18	1.05E-18	3.77E-18	1.10E-18	1.09E-18	1.29E-18	1.48E-18
Ba-131	1.25E-17	1.29E-17	1.12E-17	1.09E-17	2.09E-17	1.05E-17	1.08E-17	1.19E-17	1.37E-17
Ba-133m	1.46E-18	1.52E-18	1.28E-18	1.24E-18	2.72E-18	1.20E-18	1.23E-18	1.38E-18	1.64E-18
Ba-133	1.04E-17	1.08E-17	9.25E-18	8.98E-18	1.85E-17	8.68E-18	8.87E-18	9.88E-18	1.15E-17
Ba-135m	1.28E-18	1.33E-18	1.11E-18	1.07E-18	2.40E-18	1.05E-18	1.06E-18	1.20E-18	1.43E-18
Ba-137m	1.79E-17	1.84E-17	1.63E-17	1.62E-17	2.55E-17	1.53E-17	1.57E-17	1.71E-17	1.99E-17
Ba-139	1.19E-18	1.24E-18	1.07E-18	1.02E-18	2.56E-18	1.00E-18	1.02E-18	1.15E-18	1.01E-17
Ba-140	5.29E-18	5.43E-18	4.76E-18	4.68E-18	8.25E-18	4.46E-18	4.58E-18	5.02E-18	6.29E-18
Ba-141	2.49E-17	2.55E-17	2.28E-17	2.26E-17	3.82E-17	2.14E-17	2.20E-17	2.39E-17	3.62E-17
Ba-142	3.09E-17	3.16E-17	2.85E-17	2.84E-17	4.36E-17	2.67E-17	2.75E-17	2.96E-17	3.56E-17
Lanthanum									
La-131	1.91E-17	1.96E-17	1.72E-17	1.69E-17	3.05E-17	1.61E-17	1.65E-17	1.82E-17	2.23E-17
La-132	6.00E-17	6.10E-17	5.50E-17	5.49E-17	8.31E-17	5.20E-17	5.32E-17	5.73E-17	7.16E-17
La-134	2.08E-17	2.14E-17	1.88E-17	1.85E-17	3.11E-17	1.76E-17	1.81E-17	1.98E-17	3.16E-17
La-135	4.18E-19	4.43E-19	3.24E-19	3.08E-19	6.90E-19	3.18E-19	3.15E-19	3.71E-19	4.98E-19
La-137	1.04E-19	1.21E-19	4.34E-20	3.16E-20	2.16E-19	5.42E-20	4.69E-20	7.54E-20	1.52E-19
La-138	3.69E-17	3.75E-17	3.43E-17	3.45E-17	4.79E-17	3.23E-17	3.32E-17	3.55E-17	4.02E-17
La-140	6.96E-17	7.06E-17	6.47E-17	6.49E-17	9.17E-17	6.10E-17	6.26E-17	6.69E-17	7.85E-17
La-141	1.42E-18	1.45E-18	1.33E-18	1.33E-18	1.91E-18	1.25E-18	1.28E-18	1.37E-18	1.15E-17
La-142	8.24E-17	8.29E-17	7.70E-17	7.77E-17	1.04E-16	7.36E-17	7.48E-17	7.94E-17	9.68E-17
La-143	3.08E-18	3.13E-18	2.86E-18	2.87E-18	4.15E-18	2.70E-18	2.77E-18	2.96E-18	2.07E-17
Cerium									
Ce-134	1.22E-19	1.40E-19	5.46E-20	3.92E-20	2.67E-19	6.59E-20	5.75E-20	8.99E-20	1.73E-19
Ce-135	5.30E-17	5.43E-17	4.79E-17	4.73E-17	8.03E-17	4.49E-17	4.61E-17	5.04E-17	5.83E-17
Ce-137m	1.04E-18	1.08E-18	8.94E-19	8.59E-19	1.95E-18	8.46E-19	8.58E-19	9.73E-19	1.17E-18
Ce-137	3.74E-19	4.00E-19	2.82E-19	2.62E-19	6.57E-19	2.79E-19	2.73E-19	3.29E-19	4.50E-19
Ce-139	3.48E-18	3.63E-18	3.07E-18	2.89E-18	7.98E-18	2.88E-18	2.92E-18	3.33E-18	3.86E-18
Ce-141	1.74E-18	1.81E-18	1.55E-18	1.44E-18	4.26E-18	1.45E-18	1.46E-18	1.68E-18	1.91E-18
Ce-143	7.64E-18	7.88E-18	6.86E-18	6.71E-18	1.27E-17	6.43E-18	6.59E-18	7.27E-18	9.85E-18
Ce-144	3.97E-19	4.14E-19	3.48E-19	3.17E-19	1.04E-18	3.27E-19	3.27E-19	3.80E-19	4.38E-19
Praseodymium									
Pr-136	6.29E-17	6.42E-17	5.75E-17	5.72E-17	8.88E-17	5.42E-17	5.55E-17	6.01E-17	7.79E-17
Pr-137	1.45E-17	1.49E-17	1.31E-17	1.29E-17	2.15E-17	1.23E-17	1.26E-17	1.38E-17	1.74E-17
Pr-138m	7.35E-17	7.53E-17	6.76E-17	6.72E-17	1.04E-16	6.32E-17	6.52E-17	7.04E-17	8.22E-17
Pr-138	2.45E-17	2.51E-17	2.21E-17	2.18E-17	3.67E-17	2.07E-17	2.13E-17	2.33E-17	4.29E-17
Pr-139	3.03E-18	3.12E-18	2.69E-18	2.65E-18	4.56E-18	2.54E-18	2.60E-18	2.86E-18	3.48E-18
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	1.86E-18	1.88E-18	1.73E-18	1.74E-18	2.42E-18	1.64E-18	1.68E-18	1.79E-18	9.73E-18
Pr-143	1.21E-20	1.27E-20	1.04E-20	9.56E-21	2.94E-20	9.86E-21	9.86E-21	1.15E-20	5.09E-19
Pr-144m	8.85E-20	9.77E-20	5.66E-20	4.72E-20	1.88E-19	5.94E-20	5.55E-20	7.33E-20	1.15E-19
Pr-144	1.17E-18	1.19E-18	1.08E-18	1.08E-18	1.64E-18	1.03E-18	1.05E-18	1.13E-18	1.63E-17
Pr-145	4.49E-19	4.60E-19	4.11E-19	4.06E-19	6.67E-19	3.85E-19	3.96E-19	4.30E-19	5.59E-18
Pr-147	2.49E-17	2.55E-17	2.27E-17	2.25E-17	3.69E-17	2.13E-17	2.19E-17	2.38E-17	3.38E-17
Neodymium									
Nd-136	7.15E-18	7.38E-18	6.37E-18	6.17E-18	1.24E-17	5.98E-18	6.10E-18	6.78E-18	7.97E-18
Nd-138	5.57E-19	5.92E-19	4.41E-19	4.08E-19	1.10E-18	4.29E-19	4.23E-19	5.03E-19	6.50E-19
Nd-139m	4.59E-17	4.69E-17	4.22E-17	4.19E-17	6.45E-17	3.95E-17	4.07E-17	4.39E-17	5.08E-17
Nd-139	1.16E-17	1.19E-17	1.05E-17	1.04E-17	1.73E-17	9.86E-18	1.01E-17	1.11E-17	1.43E-17
Nd-141m	2.28E-17	2.33E-17	2.09E-17	2.08E-17	3.17E-17	1.95E-17	2.02E-17	2.18E-17	2.55E-17
Nd-141	1.56E-18	1.61E-18	1.37E-18	1.34E-18	2.37E-18	1.30E-18	1.32E-18	1.46E-18	1.76E-18
Nd-147	3.47E-18	3.58E-18	3.09E-18	2.98E-18	6.16E-18	2.90E-18	2.96E-18	3.29E-18	4.00E-18
Nd-149	1.06E-17	1.10E-17	9.55E-18	9.28E-18	1.89E-17	8.93E-18	9.14E-18	1.01E-17	1.36E-17
Nd-151	2.65E-17	2.72E-17	2.44E-17	2.42E-17	3.98E-17	2.29E-17	2.35E-17	2.55E-17	3.36E-17
Promethium									
Pm-141	2.21E-17	2.26E-17	2.01E-17	1.99E-17	3.21E-17	1.88E-17	1.93E-17	2.10E-17	3.17E-17
Pm-142	2.63E-17	2.69E-17	2.37E-17	2.34E-17	3.91E-17	2.22E-17	2.28E-17	2.49E-17	4.87E-17
Pm-143	8.77E-18	8.99E-18	7.98E-18	7.90E-18	1.24E-17	7.47E-18	7.69E-18	8.35E-18	9.70E-18

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Promethium, cont'd									
Pm-144	4.63E-17	4.75E-17	4.21E-17	4.17E-17	6.68E-17	3.94E-17	4.06E-17	4.41E-17	5.09E-17
Pm-145	1.93E-19	2.17E-19	1.14E-19	8.34E-20	5.16E-19	1.23E-19	1.11E-19	1.57E-19	2.49E-19
Pm-146	2.22E-17	2.27E-17	2.01E-17	1.99E-17	3.24E-17	1.88E-17	1.94E-17	2.11E-17	2.44E-17
Pm-147	2.96E-22	3.19E-22	2.25E-22	1.90E-22	8.28E-22	2.20E-22	2.13E-22	2.67E-22	3.74E-22
Pm-148m	6.00E-17	6.14E-17	5.46E-17	5.41E-17	8.66E-17	5.11E-17	5.26E-17	5.72E-17	6.59E-17
Pm-148	1.74E-17	1.77E-17	1.61E-17	1.61E-17	2.33E-17	1.51E-17	1.56E-17	1.67E-17	2.54E-17
Pm-149	3.25E-19	3.36E-19	2.93E-19	2.86E-19	5.73E-19	2.74E-19	2.81E-19	3.11E-19	1.27E-18
Pm-150	4.28E-17	4.36E-17	3.96E-17	3.96E-17	5.89E-17	3.73E-17	3.83E-17	4.11E-17	5.37E-17
Pm-151	8.95E-18	9.23E-18	8.07E-18	7.87E-18	1.53E-17	7.55E-18	7.74E-18	8.54E-18	1.03E-17
Samarium									
Sm-141m	5.85E-17	5.98E-17	5.36E-17	5.33E-17	8.44E-17	5.03E-17	5.18E-17	5.60E-17	6.84E-17
Sm-141	4.19E-17	4.28E-17	3.82E-17	3.79E-17	6.06E-17	3.59E-17	3.68E-17	4.00E-17	5.46E-17
Sm-142	2.12E-18	2.19E-18	1.86E-18	1.81E-18	3.36E-18	1.76E-18	1.79E-18	1.99E-18	2.44E-18
Sm-145	4.38E-19	4.90E-19	2.74E-19	2.00E-19	1.24E-18	2.90E-19	2.65E-19	3.65E-19	5.54E-19
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	9.38E-24	1.14E-23	8.79E-25	1.37E-24	8.76E-24	2.48E-24	2.03E-24	5.27E-24	2.46E-23
Sm-153	8.95E-19	9.44E-19	7.51E-19	6.49E-19	2.57E-18	7.15E-19	7.02E-19	8.42E-19	1.11E-18
Sm-155	2.18E-18	2.26E-18	1.94E-18	1.76E-18	5.80E-18	1.81E-18	1.81E-18	2.10E-18	5.51E-18
Sm-156	2.86E-18	2.98E-18	2.55E-18	2.41E-18	6.43E-18	2.39E-18	2.42E-18	2.75E-18	3.20E-18
Europium									
Eu-145	4.30E-17	4.38E-17	3.98E-17	3.99E-17	5.75E-17	3.75E-17	3.85E-17	4.13E-17	4.72E-17
Eu-146	7.46E-17	7.62E-17	6.86E-17	6.83E-17	1.03E-16	6.43E-17	6.62E-17	7.14E-17	8.20E-17
Eu-147	1.36E-17	1.39E-17	1.24E-17	1.22E-17	2.08E-17	1.16E-17	1.19E-17	1.30E-17	1.50E-17
Eu-148	6.47E-17	6.62E-17	5.91E-17	5.86E-17	9.20E-17	5.54E-17	5.70E-17	6.18E-17	7.10E-17
Eu-149	1.10E-18	1.15E-18	9.27E-19	8.73E-19	2.11E-18	8.85E-19	8.87E-19	1.02E-18	1.24E-18
Eu-150b[1]	4.39E-17	4.50E-17	3.98E-17	3.93E-17	6.63E-17	3.73E-17	3.83E-17	4.18E-17	4.82E-17
Eu-150a[2]	1.32E-18	1.36E-18	1.19E-18	1.18E-18	2.07E-18	1.12E-18	1.15E-18	1.26E-18	2.12E-18
Eu-152m	8.52E-18	8.72E-18	7.85E-18	7.80E-18	1.20E-17	7.33E-18	7.57E-18	8.17E-18	1.33E-17
Eu-152	3.36E-17	3.43E-17	3.10E-17	3.09E-17	4.73E-17	2.90E-17	2.99E-17	3.22E-17	3.69E-17
Eu-154	3.66E-17	3.74E-17	3.39E-17	3.38E-17	5.08E-17	3.18E-17	3.27E-17	3.52E-17	4.10E-17
Eu-155	1.02E-18	1.06E-18	8.85E-19	7.68E-19	3.06E-18	8.31E-19	8.22E-19	9.75E-19	1.12E-18
Eu-156	3.97E-17	4.03E-17	3.70E-17	3.72E-17	5.18E-17	3.49E-17	3.58E-17	3.82E-17	4.62E-17
Eu-157	6.81E-18	7.03E-18	6.07E-18	5.89E-18	1.14E-17	5.70E-18	5.82E-18	6.45E-18	8.60E-18
Eu-158	3.15E-17	3.21E-17	2.92E-17	2.92E-17	4.24E-17	2.74E-17	2.82E-17	3.03E-17	4.43E-17
Gadolinium									
Gd-145	6.75E-17	6.83E-17	6.26E-17	6.29E-17	8.85E-17	5.94E-17	6.07E-17	6.48E-17	7.95E-17
Gd-146	4.46E-18	4.67E-18	3.86E-18	3.49E-18	1.17E-17	3.64E-18	3.62E-18	4.25E-18	4.95E-18
Gd-147	3.88E-17	3.98E-17	3.55E-17	3.51E-17	5.78E-17	3.32E-17	3.42E-17	3.71E-17	4.27E-17
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	1.11E-17	1.15E-17	9.99E-18	9.72E-18	1.91E-17	9.35E-18	9.58E-18	1.06E-17	1.22E-17
Gd-151	9.72E-19	1.03E-18	8.09E-19	7.39E-19	2.22E-18	7.74E-19	7.67E-19	9.03E-19	1.11E-18
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	1.40E-18	1.48E-18	1.15E-18	9.83E-19	4.11E-18	1.10E-18	1.08E-18	1.31E-18	1.58E-18
Gd-159	1.26E-18	1.30E-18	1.11E-18	1.08E-18	2.23E-18	1.05E-18	1.07E-18	1.19E-18	1.83E-18
Terbium									
Tb-147	4.71E-17	4.82E-17	4.33E-17	4.30E-17	6.64E-17	4.05E-17	4.18E-17	4.51E-17	5.87E-17
Tb-149	4.76E-17	4.85E-17	4.39E-17	4.38E-17	6.64E-17	4.14E-17	4.24E-17	4.57E-17	5.35E-17
Tb-150	5.01E-17	5.11E-17	4.59E-17	4.57E-17	7.01E-17	4.32E-17	4.43E-17	4.79E-17	6.16E-17
Tb-151	2.50E-17	2.57E-17	2.26E-17	2.22E-17	3.99E-17	2.12E-17	2.17E-17	2.38E-17	2.75E-17
Tb-153	5.23E-18	5.44E-18	4.66E-18	4.45E-18	1.03E-17	4.37E-18	4.44E-18	4.99E-18	5.80E-18
Tb-154	6.92E-17	6.99E-17	6.45E-17	6.50E-17	8.95E-17	6.14E-17	6.26E-17	6.66E-17	7.48E-17
Tb-155	2.56E-18	2.69E-18	2.22E-18	2.03E-18	6.23E-18	2.09E-18	2.09E-18	2.43E-18	2.85E-18
Tb-156m[3]	2.16E-19	2.39E-19	1.59E-19	1.17E-19	7.08E-19	1.59E-19	1.48E-19	1.93E-19	2.58E-19
Tb-156n[4]	3.77E-20	4.07E-20	2.94E-20	2.35E-20	1.17E-19	2.87E-20	2.75E-20	3.45E-20	4.38E-20
Tb-156	5.32E-17	5.43E-17	4.90E-17	4.87E-17	7.52E-17	4.60E-17	4.73E-17	5.10E-17	5.82E-17
Tb-157	1.82E-20	2.03E-20	1.19E-20	8.57E-21	5.45E-20	1.24E-20	1.13E-20	1.55E-20	2.26E-20
Tb-158	2.28E-17	2.33E-17	2.10E-17	2.09E-17	3.21E-17	1.97E-17	2.03E-17	2.19E-17	2.52E-17

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	3.32E-17	3.40E-17	3.07E-17	3.06E-17	4.64E-17	2.87E-17	2.97E-17	3.19E-17	3.67E-17
Tb-161	3.22E-19	3.49E-19	2.46E-19	1.97E-19	9.88E-19	2.42E-19	2.31E-19	2.92E-19	3.85E-19
Dysprosium									
Dy-155	1.61E-17	1.65E-17	1.47E-17	1.45E-17	2.53E-17	1.38E-17	1.41E-17	1.54E-17	1.77E-17
Dy-157	9.56E-18	9.89E-18	8.52E-18	8.28E-18	1.70E-17	7.99E-18	8.17E-18	9.09E-18	1.05E-17
Dy-159	3.41E-19	3.79E-19	2.33E-19	1.69E-19	1.05E-18	2.40E-19	2.20E-19	2.95E-19	4.17E-19
Dy-165	6.65E-19	6.86E-19	5.95E-19	5.73E-19	1.18E-18	5.59E-19	5.69E-19	6.32E-19	2.49E-18
Dy-166	5.12E-19	5.46E-19	4.21E-19	3.56E-19	1.45E-18	4.05E-19	3.94E-19	4.77E-19	5.82E-19
Holmium									
Ho-155	1.06E-17	1.09E-17	9.55E-18	9.33E-18	1.72E-17	8.95E-18	9.17E-18	1.01E-17	1.36E-17
Ho-157	1.28E-17	1.32E-17	1.15E-17	1.12E-17	2.17E-17	1.08E-17	1.10E-17	1.22E-17	1.42E-17
Ho-159	8.42E-18	8.74E-18	7.50E-18	7.13E-18	1.71E-17	7.04E-18	7.14E-18	8.04E-18	9.30E-18
Ho-161	5.35E-19	5.84E-19	3.97E-19	3.13E-19	1.61E-18	3.95E-19	3.74E-19	4.79E-19	6.43E-19
Ho-162m	1.58E-17	1.62E-17	1.45E-17	1.44E-17	2.36E-17	1.36E-17	1.40E-17	1.52E-17	1.74E-17
Ho-162	3.99E-18	4.10E-18	3.59E-18	3.51E-18	6.30E-18	3.39E-18	3.46E-18	3.79E-18	4.48E-18
Ho-164m	3.70E-19	4.09E-19	2.67E-19	1.97E-19	1.18E-18	2.69E-19	2.49E-19	3.28E-19	4.45E-19
Ho-164	2.70E-19	2.95E-19	2.02E-19	1.55E-19	8.51E-19	2.01E-19	1.89E-19	2.43E-19	5.24E-19
Ho-166m	5.13E-17	5.26E-17	4.68E-17	4.63E-17	7.68E-17	4.38E-17	4.51E-17	4.90E-17	5.64E-17
Ho-166	7.49E-19	7.68E-19	6.83E-19	6.64E-19	1.26E-18	6.45E-19	6.56E-19	7.18E-19	5.94E-18
Ho-167	1.04E-17	1.07E-17	9.31E-18	9.08E-18	1.80E-17	8.72E-18	8.93E-18	9.89E-18	1.16E-17
Erbium									
Er-161	2.63E-17	2.69E-17	2.42E-17	2.41E-17	3.73E-17	2.27E-17	2.34E-17	2.52E-17	2.90E-17
Er-165	3.10E-19	3.43E-19	2.24E-19	1.65E-19	1.00E-18	2.26E-19	2.10E-19	2.75E-19	3.72E-19
Er-169	8.09E-22	8.67E-22	6.38E-22	5.44E-22	2.29E-21	6.18E-22	6.02E-22	7.42E-22	9.87E-22
Er-171	1.03E-17	1.07E-17	9.24E-18	8.94E-18	1.93E-17	8.65E-18	8.84E-18	9.85E-18	1.22E-17
Er-172	1.51E-17	1.55E-17	1.37E-17	1.34E-17	2.34E-17	1.28E-17	1.31E-17	1.44E-17	1.66E-17
Thulium									
Tm-162	5.23E-17	5.30E-17	4.85E-17	4.86E-17	7.01E-17	4.60E-17	4.70E-17	5.02E-17	6.06E-17
Tm-166	5.48E-17	5.57E-17	5.08E-17	5.08E-17	7.39E-17	4.80E-17	4.92E-17	5.27E-17	5.99E-17
Tm-167	3.02E-18	3.17E-18	2.65E-18	2.48E-18	6.66E-18	2.50E-18	2.52E-18	2.88E-18	3.36E-18
Tm-170	8.39E-20	8.89E-20	7.13E-20	5.98E-20	2.61E-19	6.76E-20	6.62E-20	7.98E-20	6.37E-19
Tm-171	6.47E-21	7.03E-21	5.12E-21	3.91E-21	2.18E-20	4.99E-21	4.74E-21	5.98E-21	7.47E-21
Tm-172	1.42E-17	1.44E-17	1.32E-17	1.33E-17	1.86E-17	1.24E-17	1.28E-17	1.36E-17	1.89E-17
Tm-173	1.14E-17	1.17E-17	1.02E-17	1.00E-17	1.85E-17	9.60E-18	9.84E-18	1.08E-17	1.30E-17
Tm-175	3.13E-17	3.21E-17	2.87E-17	2.84E-17	4.48E-17	2.68E-17	2.76E-17	2.99E-17	3.67E-17
Ytterbium									
Yb-162	2.57E-18	2.70E-18	2.25E-18	2.04E-18	6.65E-18	2.12E-18	2.12E-18	2.46E-18	2.85E-18
Yb-166	8.77E-19	9.51E-19	6.93E-19	5.37E-19	2.89E-18	6.75E-19	6.42E-19	8.09E-19	1.01E-18
Yb-167	4.83E-18	5.05E-18	4.23E-18	3.81E-18	1.24E-17	3.98E-18	3.97E-18	4.61E-18	5.35E-18
Yb-169	6.03E-18	6.33E-18	5.28E-18	4.84E-18	1.46E-17	4.97E-18	4.98E-18	5.75E-18	6.69E-18
Yb-175	1.10E-18	1.14E-18	9.90E-19	9.61E-19	1.95E-18	9.27E-19	9.48E-19	1.05E-18	1.21E-18
Yb-177	5.35E-18	5.47E-18	4.94E-18	4.89E-18	8.18E-18	4.62E-18	4.76E-18	5.15E-18	7.74E-18
Yb-178	1.02E-18	1.05E-18	9.17E-19	8.97E-19	1.70E-18	8.59E-19	8.80E-19	9.72E-19	1.15E-18
Lutetium									
Lu-169	2.96E-17	3.02E-17	2.73E-17	2.72E-17	4.18E-17	2.57E-17	2.64E-17	2.84E-17	3.24E-17
Lu-170	7.31E-17	7.38E-17	6.84E-17	6.89E-17	9.38E-17	6.51E-17	6.64E-17	7.05E-17	7.94E-17
Lu-171	1.92E-17	1.97E-17	1.75E-17	1.72E-17	2.85E-17	1.64E-17	1.69E-17	1.83E-17	2.12E-17
Lu-172	5.50E-17	5.62E-17	5.09E-17	5.06E-17	7.68E-17	4.76E-17	4.91E-17	5.28E-17	6.05E-17
Lu-173	2.27E-18	2.39E-18	1.96E-18	1.78E-18	5.37E-18	1.86E-18	1.85E-18	2.15E-18	2.54E-18
Lu-174m	7.98E-19	8.50E-19	6.67E-19	5.70E-19	2.15E-18	6.40E-19	6.24E-19	7.46E-19	9.07E-19
Lu-174	2.77E-18	2.85E-18	2.51E-18	2.43E-18	4.61E-18	2.37E-18	2.41E-18	2.65E-18	3.06E-18
Lu-176m	2.28E-19	2.40E-19	1.96E-19	1.67E-19	7.06E-19	1.85E-19	1.82E-19	2.18E-19	1.94E-18
Lu-176	1.34E-17	1.39E-17	1.20E-17	1.16E-17	2.59E-17	1.12E-17	1.15E-17	1.28E-17	1.47E-17
Lu-177m	2.65E-17	2.75E-17	2.38E-17	2.29E-17	5.16E-17	2.22E-17	2.27E-17	2.54E-17	2.92E-17
Lu-177	8.56E-19	8.91E-19	7.66E-19	7.23E-19	1.93E-18	7.16E-19	7.27E-19	8.24E-19	9.42E-19
Lu-178m	3.07E-17	3.17E-17	2.75E-17	2.67E-17	5.57E-17	2.58E-17	2.63E-17	2.93E-17	3.54E-17
Lu-178	4.12E-18	4.19E-18	3.83E-18	3.83E-18	5.68E-18	3.61E-18	3.70E-18	3.97E-18	1.11E-17
Lu-179	8.65E-19	8.98E-19	7.79E-19	7.50E-19	1.74E-18	7.27E-19	7.43E-19	8.31E-19	2.94E-18

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	1.44E-17	1.48E-17	1.29E-17	1.25E-17	2.51E-17	1.21E-17	1.24E-17	1.37E-17	1.58E-17
Hf-172	1.41E-18	1.51E-18	1.17E-18	9.64E-19	4.41E-18	1.12E-18	1.09E-18	1.33E-18	1.60E-18
Hf-173	9.87E-18	1.02E-17	8.83E-18	8.38E-18	2.06E-17	8.27E-18	8.40E-18	9.45E-18	1.08E-17
Hf-175	9.81E-18	1.01E-17	8.75E-18	8.47E-18	1.76E-17	8.21E-18	8.38E-18	9.33E-18	1.08E-17
Hf-177m	6.19E-17	6.40E-17	5.55E-17	5.38E-17	1.14E-16	5.20E-17	5.31E-17	5.91E-17	6.80E-17
Hf-178m	6.74E-17	6.94E-17	6.07E-17	5.93E-17	1.13E-16	5.68E-17	5.82E-17	6.42E-17	7.40E-17
Hf-179m	2.46E-17	2.54E-17	2.20E-17	2.13E-17	4.44E-17	2.06E-17	2.11E-17	2.34E-17	2.70E-17
Hf-180m	2.81E-17	2.90E-17	2.52E-17	2.45E-17	4.92E-17	2.36E-17	2.42E-17	2.68E-17	3.09E-17
Hf-181	1.58E-17	1.62E-17	1.42E-17	1.38E-17	2.64E-17	1.33E-17	1.36E-17	1.50E-17	1.73E-17
Hf-182m	2.63E-17	2.70E-17	2.38E-17	2.33E-17	4.30E-17	2.23E-17	2.29E-17	2.51E-17	2.89E-17
Hf-182	6.63E-18	6.87E-18	5.95E-18	5.76E-18	1.27E-17	5.56E-18	5.69E-18	6.35E-18	7.29E-18
Hf-183	2.18E-17	2.24E-17	2.00E-17	1.97E-17	3.21E-17	1.87E-17	1.92E-17	2.09E-17	2.58E-17
Hf-184	6.36E-18	6.58E-18	5.69E-18	5.44E-18	1.28E-17	5.32E-18	5.42E-18	6.08E-18	7.52E-18
Tantalum									
Ta-172	4.50E-17	4.60E-17	4.14E-17	4.11E-17	6.51E-17	3.89E-17	4.00E-17	4.32E-17	5.39E-17
Ta-173	1.59E-17	1.64E-17	1.45E-17	1.42E-17	2.53E-17	1.36E-17	1.39E-17	1.52E-17	2.06E-17
Ta-174	1.73E-17	1.78E-17	1.57E-17	1.53E-17	2.85E-17	1.47E-17	1.51E-17	1.65E-17	2.20E-17
Ta-175	2.61E-17	2.67E-17	2.41E-17	2.39E-17	3.84E-17	2.27E-17	2.32E-17	2.51E-17	2.85E-17
Ta-176	6.32E-17	6.40E-17	5.89E-17	5.91E-17	8.28E-17	5.57E-17	5.70E-17	6.08E-17	6.88E-17
Ta-177	9.68E-19	1.02E-18	8.26E-19	7.12E-19	2.66E-18	7.85E-19	7.71E-19	9.15E-19	1.09E-18
Ta-178b[1]	2.74E-17	2.83E-17	2.45E-17	2.36E-17	5.06E-17	2.29E-17	2.34E-17	2.61E-17	3.00E-17
Ta-178a[2]	2.19E-18	2.27E-18	1.97E-18	1.87E-18	4.14E-18	1.87E-18	1.88E-18	2.10E-18	2.43E-18
Ta-179	3.32E-19	3.60E-19	2.66E-19	2.04E-19	1.13E-18	2.58E-19	2.46E-19	3.09E-19	3.80E-19
Ta-180m	5.47E-19	5.89E-19	4.48E-19	3.53E-19	1.82E-18	4.31E-19	4.14E-19	5.13E-19	6.30E-19
Ta-180	1.48E-17	1.54E-17	1.33E-17	1.28E-17	2.84E-17	1.24E-17	1.27E-17	1.42E-17	1.63E-17
Ta-182m	5.62E-18	5.86E-18	5.00E-18	4.67E-18	1.32E-17	4.68E-18	4.73E-18	5.40E-18	6.19E-18
Ta-182	3.75E-17	3.83E-17	3.49E-17	3.47E-17	5.23E-17	3.27E-17	3.37E-17	3.61E-17	4.13E-17
Ta-183	6.99E-18	7.28E-18	6.23E-18	5.91E-18	1.48E-17	5.84E-18	5.93E-18	6.69E-18	7.73E-18
Ta-184	4.71E-17	4.83E-17	4.29E-17	4.23E-17	7.26E-17	4.01E-17	4.13E-17	4.50E-17	5.30E-17
Ta-185	4.56E-18	4.74E-18	4.08E-18	3.86E-18	9.68E-18	3.82E-18	3.88E-18	4.37E-18	9.51E-18
Ta-186	4.55E-17	4.68E-17	4.14E-17	4.07E-17	7.19E-17	3.87E-17	3.98E-17	4.35E-17	5.90E-17
Tungsten									
W-176	2.66E-18	2.81E-18	2.30E-18	1.94E-18	8.34E-18	2.17E-18	2.13E-18	2.55E-18	2.94E-18
W-177	2.44E-17	2.51E-17	2.22E-17	2.17E-17	3.98E-17	2.08E-17	2.13E-17	2.34E-17	2.69E-17
W-178	1.43E-19	1.55E-19	1.17E-19	9.03E-20	4.88E-19	1.12E-19	1.08E-19	1.34E-19	1.63E-19
W-179	5.61E-19	6.10E-19	4.38E-19	3.40E-19	1.84E-18	4.27E-19	4.08E-19	5.15E-19	6.56E-19
W-181	4.37E-19	4.72E-19	3.56E-19	2.77E-19	1.48E-18	3.43E-19	3.29E-19	4.09E-19	4.98E-19
W-185	2.45E-21	2.59E-21	2.05E-21	1.78E-21	6.92E-21	1.95E-21	1.92E-21	2.30E-21	2.83E-21
W-187	1.39E-17	1.42E-17	1.26E-17	1.24E-17	2.10E-17	1.18E-17	1.21E-17	1.32E-17	1.57E-17
W-188	5.15E-20	5.35E-20	4.60E-20	4.43E-20	1.01E-19	4.31E-20	4.40E-20	4.92E-20	5.67E-20
Rhenium									
Re-177	1.70E-17	1.73E-17	1.55E-17	1.52E-17	2.62E-17	1.46E-17	1.49E-17	1.62E-17	2.13E-17
Re-178	3.51E-17	3.56E-17	3.23E-17	3.21E-17	5.10E-17	3.06E-17	3.12E-17	3.36E-17	4.44E-17
Re-180	3.42E-17	3.50E-17	3.15E-17	3.12E-17	4.90E-17	2.94E-17	3.04E-17	3.28E-17	3.83E-17
Re-181	2.15E-17	2.21E-17	1.95E-17	1.91E-17	3.40E-17	1.83E-17	1.88E-17	2.05E-17	2.36E-17
Re-182b[3]	5.28E-17	5.41E-17	4.87E-17	4.81E-17	8.12E-17	4.56E-17	4.69E-17	5.08E-17	5.81E-17
Re-182a[4]	3.34E-17	3.41E-17	3.10E-17	3.08E-17	4.71E-17	2.91E-17	2.99E-17	3.21E-17	3.67E-17
Re-184m	1.03E-17	1.06E-17	9.36E-18	9.11E-18	1.75E-17	8.75E-18	8.97E-18	9.85E-18	1.13E-17
Re-184	2.55E-17	2.61E-17	2.35E-17	2.33E-17	3.69E-17	2.19E-17	2.26E-17	2.45E-17	2.82E-17
Re-186m	1.59E-19	1.71E-19	1.28E-19	1.01E-19	5.23E-19	1.24E-19	1.19E-19	1.48E-19	1.84E-19
Re-186	4.27E-19	4.46E-19	3.80E-19	3.44E-19	1.13E-18	3.55E-19	3.56E-19	4.12E-19	1.23E-18
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	1.08E-18	1.15E-18	9.26E-19	7.68E-19	3.50E-18	8.77E-19	8.58E-19	1.04E-18	1.21E-18
Re-188	1.64E-18	1.69E-18	1.49E-18	1.44E-18	2.98E-18	1.39E-18	1.42E-18	1.57E-18	8.48E-18
Re-189	1.78E-18	1.85E-18	1.60E-18	1.53E-18	3.69E-18	1.49E-18	1.52E-18	1.71E-18	2.50E-18
Osmium									
Os-180	8.77E-19	9.27E-19	7.46E-19	6.40E-19	2.44E-18	7.09E-19	6.97E-19	8.28E-19	9.93E-19

[1] $T_{½}$ = 2.2 h
[2] $T_{½}$ = 9.31 m
[3] $T_{½}$ = 64.0 h
[4] $T_{½}$ = 12.7 h

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	3.48E-17	3.56E-17	3.20E-17	3.17E-17	5.18E-17	3.00E-17	3.08E-17	3.34E-17	3.83E-17
Os-182	1.16E-17	1.20E-17	1.04E-17	1.01E-17	2.04E-17	9.77E-18	9.99E-18	1.11E-17	1.28E-17
Os-185	2.08E-17	2.13E-17	1.89E-17	1.87E-17	3.06E-17	1.77E-17	1.82E-17	1.98E-17	2.29E-17
Os-189m	1.05E-23	2.38E-23	1.58E-25	8.20E-25	4.96E-24	1.02E-24	2.64E-24	7.28E-24	5.34E-22
Os-190m	4.68E-17	4.81E-17	4.23E-17	4.15E-17	7.36E-17	3.96E-17	4.06E-17	4.45E-17	5.13E-17
Os-191m	9.07E-20	9.70E-20	7.61E-20	6.08E-20	3.08E-19	7.25E-20	7.05E-20	8.62E-20	1.03E-19
Os-191	1.33E-18	1.40E-18	1.17E-18	1.02E-18	3.89E-18	1.10E-18	1.09E-18	1.28E-18	1.47E-18
Os-193	1.92E-18	1.99E-18	1.72E-18	1.66E-18	3.55E-18	1.61E-18	1.65E-18	1.83E-18	2.98E-18
Os-194	7.38E-21	8.27E-21	4.76E-21	3.43E-21	2.17E-20	5.00E-21	4.55E-21	6.23E-21	9.77E-21
Iridium									
Ir-182	3.91E-17	4.01E-17	3.56E-17	3.51E-17	6.01E-17	3.33E-17	3.43E-17	3.73E-17	5.51E-17
Ir-184	5.55E-17	5.67E-17	5.10E-17	5.06E-17	8.13E-17	4.79E-17	4.92E-17	5.32E-17	6.27E-17
Ir-185	1.64E-17	1.67E-17	1.52E-17	1.51E-17	2.41E-17	1.44E-17	1.46E-17	1.58E-17	1.78E-17
Ir-186a[1]	4.74E-17	4.84E-17	4.36E-17	4.32E-17	7.02E-17	4.10E-17	4.20E-17	4.55E-17	5.19E-17
Ir-186b[2]	2.77E-17	2.83E-17	2.53E-17	2.50E-17	4.14E-17	2.37E-17	2.44E-17	2.65E-17	3.18E-17
Ir-187	9.61E-18	9.88E-18	8.73E-18	8.52E-18	1.56E-17	8.17E-18	8.38E-18	9.18E-18	1.06E-17
Ir-188	4.62E-17	4.69E-17	4.29E-17	4.30E-17	6.28E-17	4.07E-17	4.16E-17	4.45E-17	5.01E-17
Ir-189	1.35E-18	1.42E-18	1.17E-18	1.03E-18	3.62E-18	1.10E-18	1.10E-18	1.28E-18	1.50E-18
Ir-190n[3]	4.50E-17	4.62E-17	4.06E-17	3.98E-17	7.17E-17	3.80E-17	3.90E-17	4.28E-17	4.93E-17
Ir-190m[4]	1.34E-23	2.97E-23	5.64E-26	9.87E-25	5.83E-24	1.09E-24	3.13E-24	9.07E-24	5.86E-22
Ir-190	4.14E-17	4.25E-17	3.74E-17	3.66E-17	6.63E-17	3.50E-17	3.59E-17	3.94E-17	4.54E-17
Ir-191m	1.27E-18	1.33E-18	1.11E-18	9.78E-19	3.68E-18	1.04E-18	1.04E-18	1.22E-18	1.39E-18
Ir-192m	4.07E-18	4.23E-18	3.67E-18	3.46E-18	9.48E-18	3.41E-18	3.47E-18	3.93E-18	4.46E-18
Ir-192	2.39E-17	2.47E-17	2.15E-17	2.11E-17	3.97E-17	2.02E-17	2.07E-17	2.28E-17	2.63E-17
Ir-194m	6.95E-17	7.13E-17	6.28E-17	6.19E-17	1.07E-16	5.88E-17	6.04E-17	6.61E-17	7.63E-17
Ir-194	2.75E-18	2.83E-18	2.50E-18	2.47E-18	4.38E-18	2.34E-18	2.41E-18	2.63E-18	1.06E-17
Ir-195m	1.11E-17	1.15E-17	1.00E-17	9.70E-18	1.98E-17	9.38E-18	9.59E-18	1.06E-17	1.25E-17
Ir-195	9.09E-19	9.57E-19	7.90E-19	6.79E-19	2.76E-18	7.44E-19	7.36E-19	8.73E-19	1.67E-18
Platinum									
Pt-186	2.14E-17	2.19E-17	1.95E-17	1.92E-17	3.15E-17	1.82E-17	1.87E-17	2.04E-17	2.35E-17
Pt-188	4.52E-18	4.70E-18	4.01E-18	3.76E-18	9.95E-18	3.76E-18	3.81E-18	4.32E-18	4.98E-18
Pt-189	8.06E-18	8.31E-18	7.27E-18	7.01E-18	1.44E-17	6.82E-18	6.96E-18	7.70E-18	8.89E-18
Pt-191	7.11E-18	7.36E-18	6.33E-18	6.00E-18	1.40E-17	5.94E-18	6.03E-18	6.77E-18	7.82E-18
Pt-193m	1.43E-19	1.52E-19	1.22E-19	9.99E-20	4.81E-19	1.16E-19	1.13E-19	1.37E-19	1.61E-19
Pt-193	4.65E-23	9.70E-23	1.62E-25	3.52E-24	2.06E-23	3.60E-24	1.00E-23	3.03E-23	1.66E-21
Pt-195m	1.05E-18	1.11E-18	9.09E-19	7.63E-19	3.38E-18	8.57E-19	8.44E-19	1.01E-18	1.17E-18
Pt-197m	1.78E-18	1.85E-18	1.57E-18	1.47E-18	3.81E-18	1.48E-18	1.49E-18	1.69E-18	1.96E-18
Pt-197	4.43E-19	4.64E-19	3.91E-19	3.49E-19	1.22E-18	3.66E-19	3.67E-19	4.27E-19	5.25E-19
Pt-199	5.96E-18	6.12E-18	5.39E-18	5.30E-18	9.32E-18	5.05E-18	5.19E-18	5.68E-18	9.42E-18
Pt-200	1.21E-18	1.26E-18	1.07E-18	9.82E-19	2.98E-18	1.00E-18	1.01E-18	1.16E-18	1.36E-18
Gold									
Au-193	3.26E-18	3.40E-18	2.89E-18	2.66E-18	7.75E-18	2.71E-18	2.73E-18	3.12E-18	3.60E-18
Au-194	3.09E-17	3.15E-17	2.85E-17	2.84E-17	4.47E-17	2.69E-17	2.75E-17	2.97E-17	3.37E-17
Au-195m	5.39E-18	5.59E-18	4.84E-18	4.67E-18	1.05E-17	4.52E-18	4.62E-18	5.16E-18	5.93E-18
Au-195	1.16E-18	1.23E-18	9.97E-19	8.27E-19	3.80E-18	9.41E-19	9.24E-19	1.11E-18	1.29E-18
Au-198m	1.42E-17	1.47E-17	1.27E-17	1.20E-17	3.16E-17	1.18E-17	1.20E-17	1.36E-17	1.56E-17
Au-198	1.20E-17	1.24E-17	1.08E-17	1.06E-17	1.92E-17	1.01E-17	1.04E-17	1.14E-17	1.37E-17
Au-199	2.11E-18	2.20E-18	1.90E-18	1.78E-18	5.00E-18	1.77E-18	1.79E-18	2.04E-18	2.32E-18
Au-200m	6.15E-17	6.32E-17	5.58E-17	5.50E-17	9.52E-17	5.22E-17	5.37E-17	5.87E-17	6.76E-17
Au-200	8.21E-18	8.38E-18	7.58E-18	7.56E-18	1.15E-17	7.11E-18	7.32E-18	7.88E-18	1.57E-17
Au-201	1.57E-18	1.61E-18	1.42E-18	1.39E-18	2.45E-18	1.33E-18	1.36E-18	1.49E-18	3.23E-18
Mercury									
Hg-193m	2.98E-17	3.05E-17	2.72E-17	2.69E-17	4.58E-17	2.55E-17	2.62E-17	2.85E-17	3.26E-17
Hg-193	4.21E-18	4.39E-18	3.73E-18	3.45E-18	1.00E-17	3.50E-18	3.53E-18	4.04E-18	4.69E-18
Hg-194	9.47E-23	1.82E-22	4.09E-25	7.60E-24	4.40E-23	7.13E-24	1.83E-23	5.89E-23	2.32E-21
Hg-195m	5.45E-18	5.64E-18	4.91E-18	4.74E-18	1.00E-17	4.59E-18	4.69E-18	5.21E-18	6.01E-18
Hg-195	4.97E-18	5.12E-18	4.52E-18	4.36E-18	8.72E-18	4.23E-18	4.32E-18	4.76E-18	5.49E-18

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	1.92E-18	2.00E-18	1.72E-18	1.57E-18	4.95E-18	1.60E-18	1.61E-18	1.86E-18	2.11E-18
Hg-197	9.56E-19	1.01E-18	8.24E-19	6.84E-19	3.16E-18	7.77E-19	7.65E-19	9.19E-19	1.06E-18
Hg-199m	4.33E-18	4.50E-18	3.87E-18	3.63E-18	9.74E-18	3.62E-18	3.66E-18	4.16E-18	4.75E-18
Hg-203	6.68E-18	6.93E-18	6.00E-18	5.83E-18	1.25E-17	5.61E-18	5.75E-18	6.40E-18	7.35E-18
Thallium									
Tl-194m	6.82E-17	7.00E-17	6.19E-17	6.10E-17	1.03E-16	5.79E-17	5.96E-17	6.50E-17	7.75E-17
Tl-194	2.23E-17	2.29E-17	2.02E-17	1.98E-17	3.51E-17	1.89E-17	1.94E-17	2.13E-17	2.45E-17
Tl-195	3.70E-17	3.76E-17	3.43E-17	3.42E-17	5.10E-17	3.23E-17	3.31E-17	3.55E-17	4.05E-17
Tl-197	1.10E-17	1.13E-17	9.99E-18	9.76E-18	1.81E-17	9.37E-18	9.59E-18	1.05E-17	1.21E-17
Tl-198m	3.47E-17	3.56E-17	3.13E-17	3.08E-17	5.42E-17	2.93E-17	3.01E-17	3.30E-17	3.81E-17
Tl-198	5.92E-17	6.01E-17	5.48E-17	5.48E-17	8.09E-17	5.18E-17	5.30E-17	5.68E-17	6.43E-17
Tl-199	6.13E-18	6.35E-18	5.51E-18	5.26E-18	1.19E-17	5.16E-18	5.25E-18	5.87E-18	6.75E-18
Tl-200	3.82E-17	3.91E-17	3.51E-17	3.49E-17	5.56E-17	3.29E-17	3.39E-17	3.66E-17	4.19E-17
Tl-201	1.52E-18	1.60E-18	1.33E-18	1.16E-18	4.54E-18	1.25E-18	1.24E-18	1.47E-18	1.68E-18
Tl-202	1.30E-17	1.34E-17	1.16E-17	1.13E-17	2.18E-17	1.09E-17	1.12E-17	1.23E-17	1.42E-17
Tl-204	2.25E-20	2.38E-20	1.94E-20	1.65E-20	6.92E-20	1.83E-20	1.80E-20	2.15E-20	1.96E-19
Tl-206	4.13E-20	4.30E-20	3.64E-20	3.41E-20	9.04E-20	3.42E-20	3.45E-20	3.93E-20	3.04E-18
Tl-207	9.91E-20	1.02E-19	9.01E-20	8.80E-20	1.63E-19	8.43E-20	8.65E-20	9.48E-20	2.52E-18
Tl-208	1.01E-16	1.01E-16	9.38E-17	9.48E-17	1.28E-16	9.01E-17	9.13E-17	9.68E-17	1.11E-16
Tl-209	6.02E-17	6.11E-17	5.58E-17	5.58E-17	8.27E-17	5.27E-17	5.40E-17	5.79E-17	7.02E-17
Lead									
Pb-195m	4.65E-17	4.77E-17	4.23E-17	4.17E-17	7.11E-17	3.96E-17	4.07E-17	4.44E-17	5.21E-17
Pb-198	1.16E-17	1.20E-17	1.04E-17	1.01E-17	2.14E-17	9.76E-18	9.98E-18	1.11E-17	1.28E-17
Pb-199	4.31E-17	4.40E-17	3.98E-17	3.96E-17	6.14E-17	3.75E-17	3.85E-17	4.14E-17	4.72E-17
Pb-200	4.53E-18	4.71E-18	4.03E-18	3.73E-18	1.08E-17	3.77E-18	3.81E-18	4.35E-18	4.97E-18
Pb-201	2.15E-17	2.20E-17	1.95E-17	1.92E-17	3.43E-17	1.83E-17	1.88E-17	2.05E-17	2.36E-17
Pb-202m	6.10E-17	6.25E-17	5.60E-17	5.56E-17	8.68E-17	5.23E-17	5.40E-17	5.84E-17	6.72E-17
Pb-202	4.97E-23	1.06E-22	1.71E-25	3.72E-24	2.18E-23	3.97E-24	1.11E-23	3.30E-23	2.07E-21
Pb-203	7.97E-18	8.27E-18	7.13E-18	6.83E-18	1.60E-17	6.67E-18	6.81E-18	7.63E-18	8.77E-18
Pb-205	5.76E-23	1.21E-22	2.14E-25	4.38E-24	2.57E-23	4.58E-24	1.26E-23	3.78E-23	2.24E-21
Pb-209	4.34E-21	4.58E-21	3.66E-21	3.27E-21	1.13E-20	3.47E-21	3.44E-21	4.08E-21	3.90E-20
Pb-210	1.51E-20	1.70E-20	1.03E-20	7.48E-21	4.68E-20	1.06E-20	9.70E-21	1.31E-20	2.26E-20
Pb-211	1.53E-18	1.57E-18	1.40E-18	1.38E-18	2.27E-18	1.30E-18	1.34E-18	1.46E-18	3.69E-18
Pb-212	3.77E-18	3.92E-18	3.38E-18	3.22E-18	7.95E-18	3.16E-18	3.22E-18	3.62E-18	4.15E-18
Pb-214	7.02E-18	7.25E-18	6.31E-18	6.14E-18	1.24E-17	5.90E-18	6.04E-18	6.70E-18	7.82E-18
Bismuth									
Bi-200	7.02E-17	7.19E-17	6.41E-17	6.34E-17	1.05E-16	6.00E-17	6.17E-17	6.71E-17	7.84E-17
Bi-201	3.89E-17	3.98E-17	3.59E-17	3.56E-17	5.56E-17	3.35E-17	3.46E-17	3.73E-17	4.35E-17
Bi-202	8.01E-17	8.19E-17	7.37E-17	7.32E-17	1.14E-16	6.90E-17	7.11E-17	7.67E-17	8.83E-17
Bi-203	7.05E-17	7.17E-17	6.56E-17	6.57E-17	9.45E-17	6.18E-17	6.35E-17	6.79E-17	7.71E-17
Bi-205	4.99E-17	5.07E-17	4.63E-17	4.64E-17	6.71E-17	4.37E-17	4.48E-17	4.80E-17	5.44E-17
Bi-206	9.70E-17	9.90E-17	8.93E-17	8.89E-17	1.36E-16	8.38E-17	8.62E-17	9.30E-17	1.06E-16
Bi-207	4.54E-17	4.63E-17	4.17E-17	4.15E-17	6.39E-17	3.91E-17	4.03E-17	4.34E-17	5.07E-17
Bi-210m	7.25E-18	7.50E-18	6.52E-18	6.34E-18	1.33E-17	6.09E-18	6.24E-18	6.93E-18	7.97E-18
Bi-210	1.96E-20	2.05E-20	1.71E-20	1.58E-20	4.57E-20	1.61E-20	1.62E-20	1.86E-20	1.20E-18
Bi-211	1.34E-18	1.39E-18	1.20E-18	1.17E-18	2.31E-18	1.13E-18	1.16E-18	1.28E-18	1.47E-18
Bi-212	5.59E-18	5.70E-18	5.16E-18	5.15E-18	7.60E-18	4.84E-18	4.99E-18	5.36E-18	1.02E-17
Bi-213	3.94E-18	4.05E-18	3.55E-18	3.48E-18	6.25E-18	3.32E-18	3.41E-18	3.75E-18	6.05E-18
Bi-214	4.54E-17	4.61E-17	4.22E-17	4.23E-17	5.96E-17	3.98E-17	4.09E-17	4.36E-17	5.46E-17
Polonium									
Po-203	4.81E-17	4.91E-17	4.45E-17	4.44E-17	6.74E-17	4.17E-17	4.30E-17	4.62E-17	5.36E-17
Po-205	4.63E-17	4.73E-17	4.29E-17	4.27E-17	6.46E-17	4.02E-17	4.14E-17	4.45E-17	5.10E-17
Po-207	3.89E-17	3.97E-17	3.59E-17	3.57E-17	5.51E-17	3.36E-17	3.46E-17	3.73E-17	4.29E-17
Po-210	2.56E-22	2.62E-22	2.35E-22	2.34E-22	3.53E-22	2.20E-22	2.27E-22	2.45E-22	2.82E-22
Po-211	2.34E-19	2.40E-19	2.15E-19	2.14E-19	3.29E-19	2.01E-19	2.07E-19	2.24E-19	2.59E-19
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	2.51E-21	2.56E-21	2.31E-21	2.29E-21	3.46E-21	2.15E-21	2.23E-21	2.40E-21	2.77E-21
Po-215	5.25E-21	5.39E-21	4.71E-21	4.63E-21	8.24E-21	4.42E-21	4.53E-21	4.98E-21	5.74E-21
Po-216	5.09E-22	5.21E-22	4.69E-22	4.66E-22	7.02E-22	4.37E-22	4.52E-22	4.87E-22	5.62E-22
Po-218	2.74E-22	2.80E-22	2.53E-22	2.52E-22	3.76E-22	2.36E-22	2.44E-22	2.63E-22	3.03E-22

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	3.87E-17	3.94E-17	3.56E-17	3.54E-17	5.50E-17	3.35E-17	3.44E-17	3.71E-17	4.23E-17
At-211	6.36E-19	6.66E-19	5.61E-19	4.84E-19	1.95E-18	5.25E-19	5.21E-19	6.15E-19	7.00E-19
At-215	5.71E-21	5.88E-21	5.13E-21	5.03E-21	9.22E-21	4.80E-21	4.93E-21	5.43E-21	6.26E-21
At-216	2.50E-20	2.61E-20	2.20E-20	1.90E-20	7.79E-20	2.06E-20	2.04E-20	2.42E-20	2.74E-20
At-217	9.03E-21	9.28E-21	8.17E-21	8.03E-21	1.42E-20	7.65E-21	7.86E-21	8.61E-21	9.92E-21
At-218	3.43E-20	3.77E-20	2.63E-20	1.97E-20	1.14E-19	2.59E-20	2.44E-20	3.13E-20	4.45E-20
Radon									
Rn-218	2.28E-20	2.34E-20	2.07E-20	2.05E-20	3.30E-20	1.94E-20	2.00E-20	2.17E-20	2.51E-20
Rn-219	1.61E-18	1.67E-18	1.45E-18	1.41E-18	2.83E-18	1.36E-18	1.39E-18	1.54E-18	1.77E-18
Rn-220	1.16E-20	1.19E-20	1.05E-20	1.04E-20	1.71E-20	9.83E-21	1.01E-20	1.10E-20	1.27E-20
Rn-222	1.20E-20	1.23E-20	1.08E-20	1.06E-20	1.80E-20	1.01E-20	1.04E-20	1.14E-20	1.31E-20
Francium									
Fr-219	1.01E-19	1.04E-19	9.09E-20	8.88E-20	1.68E-19	8.51E-20	8.72E-20	9.62E-20	1.11E-19
Fr-220	2.48E-19	2.58E-19	2.22E-19	2.06E-19	6.12E-19	2.07E-19	2.10E-19	2.40E-19	2.74E-19
Fr-221	8.21E-19	8.54E-19	7.39E-19	7.09E-19	1.71E-18	6.89E-19	7.04E-19	7.90E-19	9.04E-19
Fr-222	7.56E-20	7.85E-20	6.70E-20	6.35E-20	1.56E-19	6.29E-20	6.38E-20	7.20E-20	6.19E-18
Fr-223	1.06E-18	1.11E-18	9.31E-19	8.56E-19	2.46E-18	8.77E-19	8.80E-19	1.01E-18	1.99E-18
Radium									
Ra-222	2.66E-19	2.75E-19	2.39E-19	2.34E-19	4.65E-19	2.24E-19	2.29E-19	2.54E-19	2.92E-19
Ra-223	3.22E-18	3.34E-18	2.89E-18	2.72E-18	7.05E-18	2.70E-18	2.74E-18	3.10E-18	3.54E-18
Ra-224	2.73E-19	2.83E-19	2.45E-19	2.37E-19	5.39E-19	2.29E-19	2.34E-19	2.62E-19	3.00E-19
Ra-225	7.32E-20	8.30E-20	4.20E-20	2.98E-20	1.96E-19	4.59E-20	4.11E-20	5.90E-20	9.87E-20
Ra-226	1.71E-19	1.78E-19	1.54E-19	1.46E-19	3.81E-19	1.43E-19	1.46E-19	1.65E-19	1.88E-19
Ra-227	4.41E-18	4.55E-18	3.96E-18	3.86E-18	7.64E-18	3.71E-18	3.80E-18	4.21E-18	5.98E-18
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	1.14E-19	1.18E-19	1.02E-19	9.74E-20	2.30E-19	9.54E-20	9.72E-20	1.09E-19	1.28E-19
Ac-224	4.59E-18	4.77E-18	4.11E-18	3.84E-18	1.10E-17	3.84E-18	3.89E-18	4.43E-18	5.04E-18
Ac-225	3.46E-19	3.60E-19	3.09E-19	2.83E-19	8.89E-19	2.89E-19	2.91E-19	3.34E-19	3.82E-19
Ac-226	3.32E-18	3.45E-18	2.98E-18	2.84E-18	7.17E-18	2.78E-18	2.83E-18	3.19E-18	4.11E-18
Ac-227	2.72E-21	2.85E-21	2.40E-21	2.19E-21	7.10E-21	2.24E-21	2.26E-21	2.62E-21	3.18E-21
Ac-228	2.88E-17	2.94E-17	2.66E-17	2.65E-17	4.01E-17	2.49E-17	2.56E-17	2.76E-17	3.34E-17
Thorium									
Th-226	1.80E-19	1.87E-19	1.62E-19	1.50E-19	4.46E-19	1.51E-19	1.52E-19	1.74E-19	1.99E-19
Th-227	2.77E-18	2.88E-18	2.48E-18	2.39E-18	5.47E-18	2.32E-18	2.37E-18	2.65E-18	3.06E-18
Th-228	4.33E-20	4.53E-20	3.84E-20	3.51E-20	1.11E-19	3.58E-20	3.61E-20	4.17E-20	4.99E-20
Th-229	1.76E-18	1.83E-18	1.57E-18	1.41E-18	4.79E-18	1.46E-18	1.47E-18	1.70E-18	1.94E-18
Th-230	6.80E-21	7.30E-21	5.65E-21	4.97E-21	1.89E-20	5.35E-21	5.32E-21	6.39E-21	9.70E-21
Th-231	2.06E-19	2.18E-19	1.72E-19	1.50E-19	6.02E-19	1.63E-19	1.61E-19	1.94E-19	2.56E-19
Th-232	3.06E-21	3.36E-21	2.35E-21	2.03E-21	8.47E-21	2.25E-21	2.23E-21	2.78E-21	5.54E-21
Th-234	1.34E-19	1.41E-19	1.17E-19	1.01E-19	4.18E-19	1.10E-19	1.09E-19	1.29E-19	1.50E-19
Protactinium									
Pa-227	3.53E-19	3.68E-19	3.11E-19	2.70E-19	1.07E-18	2.91E-19	2.88E-19	3.41E-19	3.90E-19
Pa-228	3.28E-17	3.35E-17	3.02E-17	3.00E-17	4.82E-17	2.83E-17	2.91E-17	3.15E-17	3.61E-17
Pa-230	1.86E-17	1.91E-17	1.71E-17	1.69E-17	2.77E-17	1.60E-17	1.65E-17	1.79E-17	2.05E-17
Pa-231	1.01E-18	1.05E-18	8.99E-19	8.74E-19	1.83E-18	8.43E-19	8.62E-19	9.62E-19	1.13E-18
Pa-232	2.77E-17	2.84E-17	2.55E-17	2.54E-17	3.92E-17	2.38E-17	2.46E-17	2.66E-17	3.06E-17
Pa-233	5.40E-18	5.58E-18	4.84E-18	4.67E-18	1.03E-17	4.53E-18	4.62E-18	5.16E-18	5.93E-18
Pa-234m	4.38E-19	4.48E-19	4.02E-19	3.96E-19	6.70E-19	3.76E-19	3.87E-19	4.20E-19	8.19E-18
Pa-234	5.61E-17	5.74E-17	5.17E-17	5.13E-17	8.07E-17	4.83E-17	4.98E-17	5.38E-17	6.22E-17
Uranium									
U-230	2.41E-20	2.55E-20	2.08E-20	1.92E-20	5.92E-20	1.95E-20	1.97E-20	2.29E-20	3.03E-20
U-231	1.28E-18	1.33E-18	1.13E-18	1.00E-18	3.75E-18	1.06E-18	1.05E-18	1.24E-18	1.43E-18
U-232	5.32E-21	5.85E-21	3.99E-21	3.59E-21	1.31E-20	3.84E-21	3.82E-21	4.77E-21	9.71E-21
U-233	7.74E-21	8.20E-21	6.51E-21	6.11E-21	1.70E-20	6.15E-21	6.21E-21	7.24E-21	1.05E-20
U-234	2.52E-21	2.88E-21	1.63E-21	1.46E-21	5.94E-21	1.62E-21	1.60E-21	2.14E-21	5.98E-21
U-235	3.89E-18	4.05E-18	3.50E-18	3.32E-18	8.77E-18	3.26E-18	3.32E-18	3.75E-18	4.28E-18
U-236	1.46E-21	1.76E-21	7.44E-22	6.80E-22	2.99E-21	7.75E-22	7.69E-22	1.14E-21	4.61E-21
U-237	2.89E-18	3.02E-18	2.57E-18	2.37E-18	7.21E-18	2.40E-18	2.42E-18	2.78E-18	3.20E-18
U-238	8.19E-22	1.06E-21	2.34E-22	2.18E-22	1.32E-21	2.91E-22	2.86E-22	5.52E-22	3.55E-21
U-239	9.22E-19	9.64E-19	8.12E-19	7.24E-19	2.43E-18	7.63E-19	7.63E-19	8.84E-19	2.32E-18
U-240	1.04E-20	1.24E-20	4.38E-21	3.59E-21	2.16E-20	5.07E-21	4.68E-21	7.62E-21	2.67E-20

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	3.47E-17	3.56E-17	3.18E-17	3.14E-17	5.26E-17	2.97E-17	3.06E-17	3.33E-17	3.83E-17
Np-233	1.78E-18	1.85E-18	1.59E-18	1.44E-18	4.89E-18	1.48E-18	1.49E-18	1.72E-18	1.95E-18
Np-234	4.25E-17	4.32E-17	3.96E-17	3.98E-17	5.65E-17	3.74E-17	3.84E-17	4.10E-17	4.65E-17
Np-235	1.93E-20	2.11E-20	1.43E-20	1.29E-20	4.95E-20	1.38E-20	1.37E-20	1.73E-20	3.39E-20
Np-236a[1]	2.53E-18	2.63E-18	2.26E-18	2.06E-18	6.82E-18	2.11E-18	2.12E-18	2.45E-18	2.80E-18
Np-236b[2]	1.02E-18	1.05E-18	9.12E-19	8.33E-19	2.61E-18	8.51E-19	8.56E-19	9.83E-19	1.12E-18
Np-237	4.35E-19	4.57E-19	3.76E-19	3.33E-19	1.24E-18	3.53E-19	3.51E-19	4.16E-19	5.00E-19
Np-238	1.64E-17	1.68E-17	1.52E-17	1.52E-17	2.20E-17	1.42E-17	1.47E-17	1.58E-17	1.88E-17
Np-239	4.05E-18	4.20E-18	3.63E-18	3.42E-18	9.22E-18	3.39E-18	3.44E-18	3.90E-18	4.46E-18
Np-240m	9.96E-18	1.02E-17	9.08E-18	9.01E-18	1.43E-17	8.51E-18	8.76E-18	9.50E-18	1.57E-17
Np-240	3.82E-17	3.91E-17	3.50E-17	3.46E-17	5.61E-17	3.27E-17	3.37E-17	3.65E-17	4.23E-17
Plutonium									
Pu-234	1.28E-18	1.32E-18	1.14E-18	1.02E-18	3.70E-18	1.06E-18	1.06E-18	1.24E-18	1.40E-18
Pu-235	1.82E-18	1.89E-18	1.63E-18	1.48E-18	4.87E-18	1.52E-18	1.53E-18	1.76E-18	2.00E-18
Pu-236	1.74E-21	2.15E-21	5.91E-22	5.94E-22	2.60E-21	7.00E-22	6.89E-22	1.20E-21	6.16E-21
Pu-237	8.94E-19	9.29E-19	7.94E-19	7.06E-19	2.59E-18	7.41E-19	7.39E-19	8.65E-19	9.88E-19
Pu-238	1.25E-21	1.60E-21	2.97E-22	3.29E-22	1.57E-21	4.02E-22	3.98E-22	8.07E-22	5.09E-21
Pu-239	1.75E-21	1.92E-21	1.25E-21	1.20E-21	3.27E-21	1.22E-21	1.22E-21	1.52E-21	3.31E-21
Pu-240	1.21E-21	1.55E-21	2.92E-22	3.17E-22	1.58E-21	3.94E-22	3.88E-22	7.84E-22	4.87E-21
Pu-241	3.27E-23	3.41E-23	2.88E-23	2.59E-23	9.12E-23	2.69E-23	2.69E-23	3.15E-23	3.76E-23
Pu-242	1.04E-21	1.32E-21	2.75E-22	2.92E-22	1.41E-21	3.56E-22	3.51E-22	6.85E-22	4.08E-21
Pu-243	4.37E-19	4.56E-19	3.85E-19	3.39E-19	1.25E-18	3.60E-19	3.59E-19	4.20E-19	4.89E-19
Pu-244	7.00E-22	9.29E-22	7.05E-23	1.06E-22	6.55E-22	1.50E-22	1.49E-22	4.04E-22	3.27E-21
Pu-245	1.20E-17	1.23E-17	1.09E-17	1.07E-17	1.89E-17	1.02E-17	1.05E-17	1.15E-17	1.36E-17
Pu-246	3.08E-18	3.20E-18	2.74E-18	2.57E-18	7.21E-18	2.56E-18	2.59E-18	2.96E-18	3.40E-18
Americium									
Am-237	9.69E-18	1.00E-17	8.73E-18	8.41E-18	1.86E-17	8.16E-18	8.33E-18	9.28E-18	1.06E-17
Am-238	2.57E-17	2.63E-17	2.37E-17	2.35E-17	3.73E-17	2.22E-17	2.29E-17	2.47E-17	2.84E-17
Am-239	5.26E-18	5.46E-18	4.71E-18	4.38E-18	1.27E-17	4.39E-18	4.44E-18	5.07E-18	5.78E-18
Am-240	2.99E-17	3.05E-17	2.76E-17	2.75E-17	4.21E-17	2.58E-17	2.67E-17	2.87E-17	3.30E-17
Am-241	2.53E-19	2.74E-19	2.01E-19	1.57E-19	8.43E-19	1.94E-19	1.86E-19	2.34E-19	3.10E-19
Am-242m	1.09E-20	1.23E-20	6.63E-21	6.13E-21	2.36E-20	6.75E-21	6.61E-21	9.00E-21	2.22E-20
Am-242	2.77E-19	2.88E-19	2.44E-19	2.19E-19	7.83E-19	2.28E-19	2.28E-19	2.67E-19	3.36E-19
Am-243	7.91E-19	8.36E-19	6.82E-19	5.68E-19	2.60E-18	6.43E-19	6.33E-19	7.60E-19	8.80E-19
Am-244m	3.59E-20	3.77E-20	3.04E-20	2.85E-20	7.76E-20	2.88E-20	2.90E-20	3.36E-20	2.62E-18
Am-244	2.34E-17	2.40E-17	2.15E-17	2.14E-17	3.35E-17	2.01E-17	2.07E-17	2.24E-17	2.60E-17
Am-245	7.80E-19	8.09E-19	6.99E-19	6.60E-19	1.76E-18	6.53E-19	6.63E-19	7.51E-19	1.13E-18
Am-246m	3.03E-17	3.10E-17	2.81E-17	2.81E-17	4.09E-17	2.63E-17	2.72E-17	2.92E-17	3.55E-17
Am-246	1.98E-17	2.03E-17	1.80E-17	1.77E-17	3.08E-17	1.68E-17	1.73E-17	1.89E-17	2.28E-17
Curium									
Cm-238	1.49E-18	1.55E-18	1.34E-18	1.20E-18	4.22E-18	1.24E-18	1.25E-18	1.45E-18	1.63E-18
Cm-240	1.46E-21	1.88E-21	1.56E-22	2.26E-22	1.41E-21	3.39E-22	3.19E-22	8.41E-22	5.87E-21
Cm-241	1.37E-17	1.41E-17	1.23E-17	1.20E-17	2.36E-17	1.15E-17	1.18E-17	1.30E-17	1.50E-17
Cm-242	1.47E-21	1.86E-21	2.80E-22	3.38E-22	1.60E-21	4.36E-22	4.18E-22	9.07E-22	5.48E-21
Cm-243	3.14E-18	3.26E-18	2.81E-18	2.66E-18	7.02E-18	2.63E-18	2.67E-18	3.02E-18	3.45E-18
Cm-244	1.19E-21	1.54E-21	1.05E-22	1.71E-22	1.06E-21	2.59E-22	2.44E-22	6.74E-22	4.89E-21
Cm-245	1.86E-18	1.94E-18	1.67E-18	1.51E-18	5.08E-18	1.55E-18	1.56E-18	1.80E-18	2.05E-18
Cm-246	1.08E-21	1.40E-21	1.11E-22	1.65E-22	1.03E-21	2.48E-22	2.33E-22	6.22E-22	4.38E-21
Cm-247	9.25E-18	9.52E-18	8.31E-18	8.14E-18	1.51E-17	7.78E-18	7.98E-18	8.80E-18	1.01E-17
Cm-248	8.22E-22	1.06E-21	8.01E-23	1.23E-22	7.65E-22	1.85E-22	1.74E-22	4.70E-22	3.35E-21
Cm-249	5.79E-19	5.93E-19	5.24E-19	5.17E-19	8.74E-19	4.91E-19	5.05E-19	5.51E-19	9.60E-19
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	5.35E-18	5.55E-18	4.80E-18	4.48E-18	1.26E-17	4.47E-18	4.53E-18	5.16E-18	5.87E-18
Bk-246	2.75E-17	2.82E-17	2.54E-17	2.51E-17	3.98E-17	2.37E-17	2.44E-17	2.64E-17	3.04E-17
Bk-247	2.35E-18	2.44E-18	2.10E-18	1.94E-18	5.69E-18	1.96E-18	1.98E-18	2.26E-18	2.57E-18
Bk-249	3.08E-23	3.48E-23	1.76E-23	1.41E-23	7.54E-23	1.89E-23	1.75E-23	2.48E-23	4.98E-23
Bk-250	2.65E-17	2.70E-17	2.46E-17	2.46E-17	3.54E-17	2.29E-17	2.37E-17	2.54E-17	2.97E-17

[1] $T_{½}$ = 1.15E5 y

[2] $T_{½}$ = 22.5 h

Table III.6. Dose Coefficients for Exposure to Soil Contaminated to a Depth of 15 cm

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	1.72E-21	2.17E-21	1.55E-22	2.47E-22	1.56E-21	4.06E-22	3.60E-22	9.70E-22	6.02E-21
Cf-246	1.53E-21	1.85E-21	4.30E-22	4.59E-22	2.07E-21	5.78E-22	5.43E-22	1.01E-21	4.49E-21
Cf-248	1.18E-21	1.49E-21	1.11E-22	1.72E-22	1.09E-21	2.83E-22	2.50E-22	6.67E-22	4.11E-21
Cf-249	9.66E-18	9.96E-18	8.67E-18	8.48E-18	1.62E-17	8.12E-18	8.33E-18	9.19E-18	1.06E-17
Cf-250	1.12E-21	1.41E-21	1.05E-22	1.63E-22	1.03E-21	2.68E-22	2.38E-22	6.34E-22	3.91E-21
Cf-251	2.86E-18	2.98E-18	2.56E-18	2.39E-18	6.89E-18	2.39E-18	2.42E-18	2.76E-18	3.16E-18
Cf-252	1.42E-21	1.71E-21	4.08E-22	4.32E-22	1.95E-21	5.43E-22	5.10E-22	9.40E-22	4.12E-21
Cf-253	4.62E-22	5.03E-22	3.37E-22	2.83E-22	1.28E-21	3.33E-22	3.21E-22	4.10E-22	6.27E-22
Cf-254	3.65E-24	4.60E-24	3.45E-25	5.33E-25	3.37E-24	8.76E-25	7.77E-25	2.07E-24	1.27E-23
Einsteinium									
Es-250	1.10E-17	1.12E-17	1.01E-17	9.97E-18	1.73E-17	9.45E-18	9.73E-18	1.06E-17	1.21E-17
Es-251	1.98E-18	2.06E-18	1.77E-18	1.62E-18	5.30E-18	1.65E-18	1.66E-18	1.92E-18	2.18E-18
Es-253	9.59E-21	1.01E-20	7.93E-21	7.72E-21	1.65E-20	7.56E-21	7.67E-21	8.81E-21	1.22E-20
Es-254m	1.40E-17	1.43E-17	1.27E-17	1.26E-17	2.00E-17	1.19E-17	1.23E-17	1.33E-17	1.57E-17
Es-254	7.63E-20	8.30E-20	5.49E-20	5.10E-20	1.58E-19	5.41E-20	5.34E-20	6.66E-20	1.18E-19
Fermium									
Fm-252	1.27E-21	1.57E-21	1.34E-22	1.92E-22	1.23E-21	3.29E-22	2.83E-22	7.24E-22	3.93E-21
Fm-253	1.74E-18	1.80E-18	1.55E-18	1.43E-18	4.46E-18	1.45E-18	1.46E-18	1.68E-18	1.90E-18
Fm-254	1.89E-21	2.23E-21	6.27E-22	6.31E-22	2.93E-21	8.01E-22	7.45E-22	1.29E-21	4.76E-21
Fm-255	3.77E-20	4.18E-20	2.55E-20	2.26E-20	9.37E-20	2.53E-20	2.48E-20	3.25E-20	6.69E-20
Fm-257	2.34E-18	2.43E-18	2.10E-18	1.94E-18	5.81E-18	1.95E-18	1.97E-18	2.26E-18	2.58E-18
Mendelevium									
Md-257	2.69E-18	2.78E-18	2.41E-18	2.27E-18	5.92E-18	2.25E-18	2.28E-18	2.58E-18	2.95E-18
Md-258	1.55E-20	1.76E-20	8.15E-21	7.22E-21	3.51E-20	8.84E-21	8.40E-21	1.22E-20	2.96E-20

TABLE III.7

Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

Explanation of Entries

For each radionuclide, values for the organ dose equivalent coefficients h_T, and the effective dose equivalent coefficient h_E, based upon the weighting factors of Table II.1, are given in SI units. The coefficients are for soil at a density of 1.6×10^3 kg m^{-3}.

h_T: The tissue dose equivalent coefficient for organ or tissue T (Sv per Bq s m^{-3}), i.e., the dose equivalent per unit time-integrated exposure to a radionuclide.

h_E: The effective dose equivalent coefficient (Sv per Bq s m^{-3}), i.e., the effective dose equivalent per unit time-integrated exposure to a radionuclide:

$$h_E = \sum_T w_T h_T \quad .$$

Note that skin is not included in the summation.

To convert to a source per unit mass basis (Sv per Bq s kg^{-1}), multiply table entries by 1.6×10^3 (kg m^{-3}).

To convert to conventional units (mrem per µCi y cm^{-3}), multiply table entries by 1.168×10^{23}.

To convert to conventional units for a source per unit mass basis (mrem per µCi y g^{-1}), multiply table entries by 1.868×10^{23}.

To convert coefficients for a soil density other than 1.6×10^3 kg m^{-3}, multiply coefficients (in any units) by $(1.6 \times 10^3/\rho)$, where ρ is the soil density in kg m^{-3}.

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hydrogen									
H-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beryllium									
Be-7	1.63E-18	1.67E-18	1.46E-18	1.43E-18	2.52E-18	1.36E-18	1.40E-18	1.54E-18	1.78E-18
Be-10	6.12E-21	6.45E-21	5.17E-21	4.63E-21	1.60E-20	4.90E-21	4.87E-21	5.76E-21	3.17E-20
Carbon									
C-11	3.40E-17	3.48E-17	3.04E-17	3.00E-17	5.15E-17	2.83E-17	2.93E-17	3.21E-17	3.80E-17
C-14	8.60E-23	9.61E-23	5.41E-23	4.28E-23	2.34E-22	5.64E-23	5.26E-23	7.20E-23	1.27E-22
Nitrogen									
N-13	3.41E-17	3.49E-17	3.04E-17	3.00E-17	5.16E-17	2.84E-17	2.93E-17	3.22E-17	3.91E-17
Oxygen									
O-15	3.41E-17	3.49E-17	3.05E-17	3.00E-17	5.17E-17	2.84E-17	2.94E-17	3.22E-17	4.29E-17
Fluorine									
F-18	3.41E-17	3.49E-17	3.04E-17	3.00E-17	5.16E-17	2.84E-17	2.93E-17	3.22E-17	3.73E-17
Neon									
Ne-19	3.42E-17	3.50E-17	3.05E-17	3.01E-17	5.19E-17	2.85E-17	2.94E-17	3.23E-17	4.72E-17
Sodium									
Na-22	7.69E-17	7.84E-17	7.00E-17	6.98E-17	1.07E-16	6.54E-17	6.76E-17	7.32E-17	8.41E-17
Na-24	1.59E-16	1.59E-16	1.47E-16	1.49E-16	1.97E-16	1.40E-16	1.43E-16	1.52E-16	1.73E-16
Magnesium									
Mg-28	4.84E-17	4.92E-17	4.43E-17	4.43E-17	6.49E-17	4.14E-17	4.29E-17	4.62E-17	5.30E-17
Aluminum									
Al-26	9.81E-17	9.88E-17	8.93E-17	8.97E-17	1.30E-16	8.44E-17	8.64E-17	9.32E-17	1.08E-16
Al-28	6.80E-17	6.81E-17	6.24E-17	6.31E-17	8.49E-17	5.93E-17	6.05E-17	6.47E-17	8.83E-17
Silicon									
Si-31	7.96E-20	8.20E-20	7.12E-20	6.88E-20	1.45E-19	6.67E-20	6.82E-20	7.58E-20	3.63E-18
Si-32	2.16E-22	2.37E-22	1.53E-22	1.25E-22	6.16E-22	1.54E-22	1.46E-22	1.90E-22	2.89E-22
Phosphorus									
P-30	3.44E-17	3.52E-17	3.07E-17	3.03E-17	5.22E-17	2.87E-17	2.96E-17	3.25E-17	5.69E-17
P-32	6.64E-20	6.90E-20	5.85E-20	5.53E-20	1.40E-19	5.48E-20	5.56E-20	6.31E-20	5.20E-18
P-33	3.54E-22	3.84E-22	2.62E-22	2.17E-22	1.01E-21	2.59E-22	2.49E-22	3.16E-22	4.55E-22
Sulphur									
S-35	9.42E-23	1.05E-22	6.08E-23	4.84E-23	2.59E-22	6.29E-23	5.89E-23	7.97E-23	1.36E-22
Chlorine									
Cl-36	1.36E-20	1.42E-20	1.18E-20	1.11E-20	2.91E-20	1.11E-20	1.12E-20	1.28E-20	1.80E-19
Cl-38	5.78E-17	5.77E-17	5.30E-17	5.37E-17	7.16E-17	5.05E-17	5.15E-17	5.50E-17	8.34E-17
Cl-39	5.21E-17	5.28E-17	4.78E-17	4.79E-17	6.95E-17	4.49E-17	4.63E-17	4.97E-17	6.43E-17
Argon									
Ar-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar-39	4.92E-21	5.19E-21	4.14E-21	3.70E-21	1.29E-20	3.93E-21	3.90E-21	4.62E-21	2.41E-20
Ar-41	4.68E-17	4.74E-17	4.30E-17	4.32E-17	6.08E-17	4.03E-17	4.17E-17	4.47E-17	5.29E-17
Potassium									
K-38	1.18E-16	1.19E-16	1.08E-16	1.09E-16	1.55E-16	1.02E-16	1.05E-16	1.13E-16	1.42E-16
K-40	5.84E-18	5.89E-18	5.36E-18	5.40E-18	7.48E-18	5.05E-18	5.19E-18	5.57E-18	9.33E-18
K-42	1.06E-17	1.07E-17	9.76E-18	9.83E-18	1.37E-17	9.21E-18	9.46E-18	1.01E-17	3.10E-17
K-43	3.22E-17	3.30E-17	2.89E-17	2.85E-17	4.94E-17	2.69E-17	2.78E-17	3.05E-17	3.58E-17
K-44	8.61E-17	8.66E-17	7.95E-17	8.04E-17	1.09E-16	7.54E-17	7.73E-17	8.24E-17	1.13E-16
K-45	6.97E-17	6.99E-17	6.39E-17	6.44E-17	9.06E-17	6.06E-17	6.19E-17	6.64E-17	8.52E-17
Calcium									
Ca-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca-45	3.74E-22	4.06E-22	2.79E-22	2.31E-22	1.07E-21	2.75E-22	2.64E-22	3.35E-22	4.79E-22
Ca-47	3.85E-17	3.91E-17	3.54E-17	3.55E-17	5.05E-17	3.31E-17	3.43E-17	3.68E-17	4.35E-17
Ca-49	1.26E-16	1.25E-16	1.17E-16	1.19E-16	1.52E-16	1.12E-16	1.14E-16	1.21E-16	1.41E-16
Scandium									
Sc-43	3.62E-17	3.71E-17	3.23E-17	3.18E-17	5.61E-17	3.01E-17	3.11E-17	3.42E-17	4.02E-17
Sc-44m	8.71E-18	9.00E-18	7.84E-18	7.66E-18	1.54E-17	7.31E-18	7.52E-18	8.32E-18	9.57E-18
Sc-44	7.42E-17	7.58E-17	6.75E-17	6.72E-17	1.04E-16	6.29E-17	6.52E-17	7.07E-17	8.51E-17
Sc-46	7.09E-17	7.25E-17	6.52E-17	6.52E-17	9.57E-17	6.06E-17	6.31E-17	6.79E-17	7.83E-17
Sc-47	2.79E-18	2.90E-18	2.51E-18	2.37E-18	6.56E-18	2.34E-18	2.38E-18	2.70E-18	3.07E-18
Sc-48	1.20E-16	1.22E-16	1.10E-16	1.10E-16	1.59E-16	1.03E-16	1.06E-16	1.14E-16	1.32E-16
Sc-49	1.35E-19	1.39E-19	1.21E-19	1.17E-19	2.44E-19	1.14E-19	1.16E-19	1.29E-19	7.54E-18

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Titanium									
Ti-44	2.00E-18	2.11E-18	1.73E-18	1.43E-18	6.62E-18	1.63E-18	1.60E-18	1.92E-18	2.20E-18
Ti-45	2.91E-17	2.98E-17	2.59E-17	2.56E-17	4.40E-17	2.42E-17	2.50E-17	2.75E-17	3.28E-17
Vanadium									
V-47	3.33E-17	3.41E-17	2.98E-17	2.93E-17	5.04E-17	2.78E-17	2.87E-17	3.15E-17	4.34E-17
V-48	1.03E-16	1.05E-16	9.46E-17	9.46E-17	1.40E-16	8.84E-17	9.16E-17	9.87E-17	1.13E-16
V-49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chromium									
Cr-48	1.25E-17	1.29E-17	1.12E-17	1.07E-17	2.45E-17	1.04E-17	1.06E-17	1.19E-17	1.37E-17
Cr-49	3.39E-17	3.48E-17	3.03E-17	2.97E-17	5.41E-17	2.82E-17	2.91E-17	3.21E-17	4.07E-17
Cr-51	9.82E-19	1.01E-18	8.77E-19	8.57E-19	1.72E-18	8.18E-19	8.42E-19	9.34E-19	1.08E-18
Manganese									
Mn-51	3.34E-17	3.42E-17	2.98E-17	2.94E-17	5.06E-17	2.78E-17	2.88E-17	3.16E-17	4.60E-17
Mn-52m	8.57E-17	8.70E-17	7.79E-17	7.78E-17	1.18E-16	7.30E-17	7.53E-17	8.14E-17	1.07E-16
Mn-52	1.23E-16	1.25E-16	1.13E-16	1.13E-16	1.66E-16	1.05E-16	1.09E-16	1.17E-16	1.35E-16
Mn-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn-54	2.89E-17	2.96E-17	2.64E-17	2.63E-17	4.01E-17	2.45E-17	2.56E-17	2.76E-17	3.20E-17
Mn-56	6.20E-17	6.27E-17	5.69E-17	5.71E-17	8.11E-17	5.35E-17	5.51E-17	5.92E-17	7.60E-17
Iron									
Fe-52	2.35E-17	2.41E-17	2.10E-17	2.06E-17	3.90E-17	1.96E-17	2.02E-17	2.23E-17	2.59E-17
Fe-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe-59	4.27E-17	4.35E-17	3.93E-17	3.94E-17	5.64E-17	3.67E-17	3.81E-17	4.09E-17	4.69E-17
Fe-60	7.29E-23	8.20E-23	4.37E-23	3.43E-23	1.93E-22	4.64E-23	4.29E-23	6.00E-23	1.11E-22
Cobalt									
Co-55	6.90E-17	7.04E-17	6.26E-17	6.23E-17	9.76E-17	5.84E-17	6.05E-17	6.56E-17	7.79E-17
Co-56	1.32E-16	1.33E-16	1.21E-16	1.22E-16	1.71E-16	1.14E-16	1.17E-16	1.26E-16	1.43E-16
Co-57	2.77E-18	2.87E-18	2.49E-18	2.28E-18	7.32E-18	2.32E-18	2.33E-18	2.68E-18	3.01E-18
Co-58m	2.26E-23	2.69E-23	4.07E-24	4.23E-24	2.85E-23	7.90E-24	6.46E-24	1.37E-23	4.57E-23
Co-58	3.35E-17	3.43E-17	3.05E-17	3.03E-17	4.73E-17	2.83E-17	2.95E-17	3.19E-17	3.70E-17
Co-60m	1.38E-19	1.41E-19	1.26E-19	1.24E-19	2.08E-19	1.18E-19	1.21E-19	1.32E-19	1.61E-19
Co-60	9.08E-17	9.22E-17	8.36E-17	8.39E-17	1.18E-16	7.82E-17	8.09E-17	8.68E-17	9.94E-17
Co-61	1.93E-18	2.01E-18	1.72E-18	1.59E-18	4.26E-18	1.61E-18	1.63E-18	1.85E-18	3.95E-18
Co-62m	9.89E-17	1.00E-16	9.10E-17	9.15E-17	1.28E-16	8.54E-17	8.82E-17	9.45E-17	1.20E-16
Nickel									
Ni-56	5.79E-17	5.93E-17	5.26E-17	5.22E-17	8.59E-17	4.90E-17	5.08E-17	5.52E-17	6.36E-17
Ni-57	6.96E-17	7.04E-17	6.36E-17	6.38E-17	9.25E-17	5.99E-17	6.16E-17	6.63E-17	7.57E-17
Ni-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni-65	2.01E-17	2.04E-17	1.85E-17	1.86E-17	2.62E-17	1.73E-17	1.79E-17	1.92E-17	2.71E-17
Ni-66	2.60E-22	2.83E-22	1.88E-22	1.55E-22	7.42E-22	1.87E-22	1.79E-22	2.30E-22	3.40E-22
Copper									
Cu-60	1.42E-16	1.44E-16	1.30E-16	1.30E-16	1.88E-16	1.22E-16	1.26E-16	1.35E-16	1.63E-16
Cu-61	2.77E-17	2.83E-17	2.48E-17	2.45E-17	4.17E-17	2.31E-17	2.39E-17	2.62E-17	3.15E-17
Cu-62	3.38E-17	3.47E-17	3.02E-17	2.98E-17	5.13E-17	2.82E-17	2.91E-17	3.20E-17	5.34E-17
Cu-64	6.34E-18	6.49E-18	5.67E-18	5.59E-18	9.54E-18	5.29E-18	5.46E-18	5.99E-18	6.95E-18
Cu-66	3.17E-18	3.24E-18	2.91E-18	2.90E-18	4.36E-18	2.70E-18	2.81E-18	3.03E-18	1.56E-17
Cu-67	2.96E-18	3.08E-18	2.65E-18	2.50E-18	6.79E-18	2.47E-18	2.51E-18	2.85E-18	3.25E-18
Zinc									
Zn-62	1.43E-17	1.46E-17	1.28E-17	1.26E-17	2.16E-17	1.19E-17	1.23E-17	1.35E-17	1.57E-17
Zn-63	3.71E-17	3.80E-17	3.32E-17	3.28E-17	5.54E-17	3.10E-17	3.20E-17	3.51E-17	5.01E-17
Zn-65	2.07E-17	2.11E-17	1.90E-17	1.91E-17	2.76E-17	1.77E-17	1.84E-17	1.98E-17	2.28E-17
Zn-69m	1.36E-17	1.40E-17	1.21E-17	1.19E-17	2.15E-17	1.13E-17	1.17E-17	1.29E-17	1.49E-17
Zn-69	1.28E-20	1.34E-20	1.10E-20	1.01E-20	3.08E-20	1.04E-20	1.04E-20	1.21E-20	4.94E-19
Zn-71m	5.20E-17	5.32E-17	4.66E-17	4.61E-17	7.84E-17	4.35E-17	4.50E-17	4.92E-17	6.00E-17
Zn-72	3.62E-18	3.76E-18	3.26E-18	3.04E-18	8.85E-18	3.03E-18	3.07E-18	3.50E-18	3.96E-18
Gallium									
Ga-65	3.85E-17	3.94E-17	3.45E-17	3.40E-17	5.98E-17	3.22E-17	3.32E-17	3.65E-17	4.98E-17
Ga-66	9.23E-17	9.29E-17	8.49E-17	8.57E-17	1.20E-16	8.05E-17	8.25E-17	8.83E-17	1.13E-16
Ga-67	4.14E-18	4.29E-18	3.71E-18	3.53E-18	8.69E-18	3.46E-18	3.53E-18	3.97E-18	4.54E-18
Ga-68	3.19E-17	3.26E-17	2.85E-17	2.81E-17	4.80E-17	2.66E-17	2.75E-17	3.01E-17	4.13E-17
Ga-70	3.21E-19	3.29E-19	2.93E-19	2.89E-19	4.89E-19	2.73E-19	2.82E-19	3.07E-19	4.80E-18
Ga-72	9.99E-17	1.01E-16	9.16E-17	9.22E-17	1.30E-16	8.64E-17	8.88E-17	9.53E-17	1.12E-16
Ga-73	9.59E-18	9.91E-18	8.58E-18	8.38E-18	1.69E-17	8.00E-18	8.23E-18	9.14E-18	1.22E-17

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Germanium									
Ge-66	2.18E-17	2.24E-17	1.95E-17	1.92E-17	3.48E-17	1.82E-17	1.88E-17	2.07E-17	2.40E-17
Ge-67	4.72E-17	4.83E-17	4.25E-17	4.19E-17	7.19E-17	3.97E-17	4.09E-17	4.48E-17	6.85E-17
Ge-68	5.68E-24	1.48E-23	1.35E-26	3.75E-25	2.28E-24	5.32E-25	1.65E-24	4.26E-24	4.59E-22
Ge-69	3.01E-17	3.07E-17	2.73E-17	2.71E-17	4.26E-17	2.54E-17	2.64E-17	2.86E-17	3.37E-17
Ge-71	5.75E-24	1.49E-23	1.36E-26	3.80E-25	2.31E-24	5.39E-25	1.67E-24	4.31E-24	4.65E-22
Ge-75	1.05E-18	1.09E-18	9.43E-19	9.16E-19	1.98E-18	8.80E-19	9.03E-19	1.01E-18	2.54E-18
Ge-77	3.63E-17	3.71E-17	3.28E-17	3.25E-17	5.59E-17	3.07E-17	3.16E-17	3.46E-17	4.49E-17
Ge-78	8.46E-18	8.76E-18	7.57E-18	7.37E-18	1.57E-17	7.06E-18	7.25E-18	8.08E-18	9.38E-18
Arsenic									
As-69	3.39E-17	3.47E-17	3.02E-17	2.98E-17	5.17E-17	2.82E-17	2.91E-17	3.20E-17	5.32E-17
As-70	1.46E-16	1.48E-16	1.33E-16	1.33E-16	1.98E-16	1.24E-16	1.28E-16	1.39E-16	1.68E-16
As-71	1.81E-17	1.86E-17	1.62E-17	1.59E-17	3.01E-17	1.51E-17	1.56E-17	1.72E-17	1.99E-17
As-72	6.18E-17	6.31E-17	5.58E-17	5.55E-17	8.87E-17	5.21E-17	5.39E-17	5.87E-17	7.97E-17
As-73	5.50E-20	6.02E-20	4.26E-20	3.19E-20	1.85E-19	4.19E-20	3.94E-20	5.04E-20	6.56E-20
As-74	2.55E-17	2.61E-17	2.29E-17	2.26E-17	3.78E-17	2.13E-17	2.21E-17	2.42E-17	2.89E-17
As-76	1.51E-17	1.54E-17	1.36E-17	1.36E-17	2.15E-17	1.27E-17	1.32E-17	1.43E-17	2.89E-17
As-77	2.75E-19	2.84E-19	2.46E-19	2.39E-19	4.98E-19	2.29E-19	2.35E-19	2.62E-19	3.78E-19
As-78	4.52E-17	4.59E-17	4.13E-17	4.13E-17	6.10E-17	3.87E-17	3.99E-17	4.31E-17	6.75E-17
Selenium									
Se-70	3.23E-17	3.31E-17	2.88E-17	2.83E-17	5.04E-17	2.69E-17	2.77E-17	3.05E-17	3.80E-17
Se-73m	8.09E-18	8.28E-18	7.23E-18	7.13E-18	1.23E-17	6.74E-18	6.96E-18	7.65E-18	1.01E-17
Se-73	3.46E-17	3.56E-17	3.09E-17	3.03E-17	5.55E-17	2.88E-17	2.97E-17	3.28E-17	3.97E-17
Se-75	1.11E-17	1.15E-17	9.94E-18	9.56E-18	2.23E-17	9.27E-18	9.48E-18	1.06E-17	1.22E-17
Se-77m	2.20E-18	2.29E-18	1.98E-18	1.87E-18	5.12E-18	1.84E-18	1.87E-18	2.13E-18	2.41E-18
Se-79	1.18E-22	1.31E-22	7.62E-23	6.05E-23	3.25E-22	7.87E-23	7.37E-23	9.96E-23	1.69E-22
Se-81m	2.81E-19	2.91E-19	2.51E-19	2.25E-19	8.05E-19	2.34E-19	2.34E-19	2.72E-19	3.11E-19
Se-81	3.51E-19	3.62E-19	3.15E-19	3.08E-19	5.94E-19	2.94E-19	3.03E-19	3.35E-19	4.30E-18
Se-83	8.58E-17	8.72E-17	7.81E-17	7.80E-17	1.19E-16	7.33E-17	7.56E-17	8.17E-17	9.66E-17
Bromine									
Br-74m	1.48E-16	1.50E-16	1.35E-16	1.36E-16	2.00E-16	1.28E-16	1.31E-16	1.41E-16	1.80E-16
Br-74	1.70E-16	1.71E-16	1.57E-16	1.58E-16	2.22E-16	1.49E-16	1.52E-16	1.63E-16	1.96E-16
Br-75	3.98E-17	4.08E-17	3.56E-17	3.50E-17	6.29E-17	3.32E-17	3.43E-17	3.77E-17	4.73E-17
Br-76	9.56E-17	9.66E-17	8.72E-17	8.75E-17	1.28E-16	8.23E-17	8.44E-17	9.10E-17	1.12E-16
Br-77	1.02E-17	1.05E-17	9.16E-18	9.00E-18	1.64E-17	8.54E-18	8.81E-18	9.70E-18	1.12E-17
Br-80m	8.04E-20	9.21E-20	4.11E-20	2.91E-20	1.95E-19	4.70E-20	4.16E-20	6.21E-20	1.20E-19
Br-80	2.70E-18	2.76E-18	2.42E-18	2.40E-18	3.97E-18	2.26E-18	2.34E-18	2.55E-18	3.83E-18
Br-82	9.22E-17	9.42E-17	8.40E-17	8.37E-17	1.28E-16	7.83E-17	8.12E-17	8.78E-17	1.01E-16
Br-83	2.64E-19	2.71E-19	2.36E-19	2.32E-19	4.08E-19	2.20E-19	2.27E-19	2.50E-19	7.98E-19
Br-84	6.79E-17	6.82E-17	6.27E-17	6.34E-17	8.62E-17	5.95E-17	6.09E-17	6.50E-17	8.91E-17
Krypton									
Kr-74	3.76E-17	3.85E-17	3.36E-17	3.29E-17	6.05E-17	3.13E-17	3.23E-17	3.56E-17	4.84E-17
Kr-76	1.32E-17	1.36E-17	1.18E-17	1.16E-17	2.28E-17	1.10E-17	1.13E-17	1.26E-17	1.45E-17
Kr-77	3.23E-17	3.31E-17	2.89E-17	2.82E-17	5.31E-17	2.69E-17	2.77E-17	3.06E-17	4.04E-17
Kr-79	8.22E-18	8.44E-18	7.37E-18	7.26E-18	1.30E-17	6.88E-18	7.10E-18	7.80E-18	9.02E-18
Kr-81m	3.53E-18	3.68E-18	3.17E-18	3.03E-18	7.64E-18	2.96E-18	3.02E-18	3.40E-18	3.89E-18
Kr-81	1.68E-19	1.74E-19	1.50E-19	1.46E-19	3.12E-19	1.40E-19	1.44E-19	1.60E-19	1.93E-19
Kr-83m	2.57E-22	4.21E-22	2.74E-23	3.51E-23	2.24E-22	4.79E-23	6.28E-23	1.62E-22	3.47E-21
Kr-85m	4.22E-18	4.37E-18	3.79E-18	3.59E-18	9.34E-18	3.53E-18	3.59E-18	4.06E-18	4.86E-18
Kr-85	8.10E-20	8.31E-20	7.20E-20	7.05E-20	1.30E-19	6.73E-20	6.93E-20	7.65E-20	2.03E-19
Kr-87	2.95E-17	2.97E-17	2.70E-17	2.71E-17	3.94E-17	2.56E-17	2.61E-17	2.81E-17	4.94E-17
Kr-88	7.42E-17	7.43E-17	6.82E-17	6.89E-17	9.39E-17	6.49E-17	6.62E-17	7.08E-17	8.20E-17
Rubidium									
Rb-79	4.46E-17	4.58E-17	4.00E-17	3.94E-17	6.92E-17	3.73E-17	3.85E-17	4.23E-17	5.65E-17
Rb-80	4.24E-17	4.34E-17	3.79E-17	3.74E-17	6.38E-17	3.54E-17	3.65E-17	4.01E-17	7.72E-17
Rb-81m	7.41E-20	7.79E-20	6.47E-20	5.57E-20	2.32E-19	6.06E-20	6.01E-20	7.15E-20	9.07E-20
Rb-81	1.98E-17	2.03E-17	1.77E-17	1.74E-17	3.23E-17	1.65E-17	1.70E-17	1.88E-17	2.21E-17
Rb-82m	1.01E-16	1.03E-16	9.22E-17	9.18E-17	1.41E-16	8.59E-17	8.91E-17	9.64E-17	1.11E-16
Rb-82	3.69E-17	3.78E-17	3.31E-17	3.26E-17	5.55E-17	3.08E-17	3.19E-17	3.49E-17	5.95E-17
Rb-83	1.66E-17	1.70E-17	1.49E-17	1.47E-17	2.49E-17	1.39E-17	1.43E-17	1.57E-17	1.82E-17
Rb-84	3.15E-17	3.22E-17	2.86E-17	2.84E-17	4.45E-17	2.66E-17	2.76E-17	3.00E-17	3.49E-17
Rb-86	3.42E-18	3.50E-18	3.15E-18	3.15E-18	4.62E-18	2.93E-18	3.05E-18	3.28E-18	9.00E-18
Rb-87	8.27E-22	8.90E-22	6.42E-22	5.42E-22	2.37E-21	6.25E-22	6.06E-22	7.54E-22	1.02E-21

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Rubidium, cont'd									
Rb-88	2.45E-17	2.46E-17	2.25E-17	2.27E-17	3.13E-17	2.13E-17	2.18E-17	2.34E-17	5.78E-17
Rb-89	7.66E-17	7.74E-17	7.05E-17	7.09E-17	9.90E-17	6.63E-17	6.83E-17	7.32E-17	9.48E-17
Strontium									
Sr-80	1.13E-21	1.90E-21	6.86E-24	9.87E-23	5.68E-22	8.60E-23	1.86E-22	6.55E-22	1.48E-20
Sr-81	4.55E-17	4.66E-17	4.08E-17	4.01E-17	7.14E-17	3.80E-17	3.92E-17	4.31E-17	6.12E-17
Sr-82	1.11E-21	1.87E-21	6.74E-24	9.71E-23	5.58E-22	8.46E-23	1.83E-22	6.44E-22	1.45E-20
Sr-83	2.70E-17	2.76E-17	2.44E-17	2.43E-17	3.91E-17	2.28E-17	2.36E-17	2.57E-17	3.01E-17
Sr-85m	6.29E-18	6.54E-18	5.65E-18	5.45E-18	1.27E-17	5.26E-18	5.39E-18	6.04E-18	6.92E-18
Sr-85	1.68E-17	1.72E-17	1.50E-17	1.48E-17	2.54E-17	1.40E-17	1.45E-17	1.59E-17	1.84E-17
Sr-87m	1.03E-17	1.05E-17	9.13E-18	8.96E-18	1.68E-17	8.53E-18	8.78E-18	9.71E-18	1.12E-17
Sr-89	5.12E-20	5.32E-20	4.50E-20	4.25E-20	1.08E-19	4.22E-20	4.29E-20	4.86E-20	3.70E-18
Sr-90	4.02E-21	4.25E-21	3.37E-21	3.00E-21	1.06E-20	3.21E-21	3.17E-21	3.77E-21	1.50E-20
Sr-91	2.44E-17	2.50E-17	2.24E-17	2.23E-17	3.37E-17	2.08E-17	2.16E-17	2.33E-17	3.24E-17
Sr-92	4.90E-17	4.96E-17	4.51E-17	4.53E-17	6.35E-17	4.23E-17	4.36E-17	4.68E-17	5.37E-17
Yttrium									
Y-86m	6.38E-18	6.62E-18	5.74E-18	5.54E-18	1.27E-17	5.35E-18	5.48E-18	6.13E-18	7.04E-18
Y-86	1.28E-16	1.30E-16	1.17E-16	1.17E-16	1.73E-16	1.10E-16	1.13E-16	1.22E-16	1.41E-16
Y-87	1.49E-17	1.52E-17	1.33E-17	1.31E-17	2.28E-17	1.24E-17	1.28E-17	1.40E-17	1.63E-17
Y-88	9.98E-17	1.00E-16	9.15E-17	9.22E-17	1.28E-16	8.64E-17	8.87E-17	9.51E-17	1.08E-16
Y-90m	1.98E-17	2.04E-17	1.77E-17	1.73E-17	3.35E-17	1.65E-17	1.70E-17	1.88E-17	2.17E-17
Y-90	1.34E-19	1.39E-19	1.19E-19	1.14E-19	2.63E-19	1.12E-19	1.14E-19	1.28E-19	9.91E-18
Y-91m	1.78E-17	1.83E-17	1.60E-17	1.58E-17	2.65E-17	1.49E-17	1.54E-17	1.69E-17	1.96E-17
Y-91	1.82E-19	1.86E-19	1.66E-19	1.63E-19	2.82E-19	1.55E-19	1.59E-19	1.74E-19	4.16E-18
Y-92	9.27E-18	9.46E-18	8.48E-18	8.47E-18	1.27E-17	7.91E-18	8.20E-18	8.85E-18	3.01E-17
Y-93	3.39E-18	3.44E-18	3.09E-18	3.09E-18	4.82E-18	2.91E-18	2.99E-18	3.24E-18	1.81E-17
Y-94	4.01E-17	4.09E-17	3.68E-17	3.68E-17	5.39E-17	3.44E-17	3.56E-17	3.83E-17	6.82E-17
Y-95	3.47E-17	3.48E-17	3.21E-17	3.25E-17	4.36E-17	3.05E-17	3.12E-17	3.32E-17	5.91E-17
Zirconium									
Zr-86	7.98E-18	8.27E-18	7.14E-18	6.94E-18	1.50E-17	6.66E-18	6.84E-18	7.63E-18	8.81E-18
Zr-88	1.27E-17	1.30E-17	1.13E-17	1.11E-17	2.07E-17	1.05E-17	1.08E-17	1.20E-17	1.39E-17
Zr-89	4.01E-17	4.10E-17	3.66E-17	3.64E-17	5.60E-17	3.40E-17	3.54E-17	3.82E-17	4.44E-17
Zr-93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zr-95	2.54E-17	2.60E-17	2.31E-17	2.29E-17	3.59E-17	2.14E-17	2.23E-17	2.42E-17	2.80E-17
Zr-97	6.40E-18	6.51E-18	5.83E-18	5.82E-18	8.88E-18	5.46E-18	5.63E-18	6.09E-18	1.26E-17
Niobium									
Nb-88	1.42E-16	1.45E-16	1.29E-16	1.28E-16	2.02E-16	1.20E-16	1.24E-16	1.35E-16	1.71E-16
Nb-89b[1]	4.96E-17	5.02E-17	4.49E-17	4.49E-17	6.89E-17	4.23E-17	4.35E-17	4.71E-17	6.88E-17
Nb-89a[2]	6.46E-17	6.62E-17	5.79E-17	5.71E-17	9.66E-17	5.40E-17	5.58E-17	6.11E-17	7.91E-17
Nb-90	1.56E-16	1.57E-16	1.43E-16	1.44E-16	2.04E-16	1.35E-16	1.39E-16	1.49E-16	1.70E-16
Nb-93m	1.03E-21	1.41E-21	2.51E-23	1.12E-22	6.70E-22	1.37E-22	1.58E-22	5.57E-22	5.26E-21
Nb-94	5.43E-17	5.57E-17	4.95E-17	4.93E-17	7.60E-17	4.60E-17	4.79E-17	5.18E-17	6.00E-17
Nb-95m	1.78E-18	1.85E-18	1.59E-18	1.54E-18	3.52E-18	1.49E-18	1.52E-18	1.71E-18	1.97E-18
Nb-95	2.64E-17	2.70E-17	2.40E-17	2.39E-17	3.71E-17	2.23E-17	2.32E-17	2.51E-17	2.91E-17
Nb-96	8.57E-17	8.77E-17	7.81E-17	7.78E-17	1.20E-16	7.27E-17	7.55E-17	8.17E-17	9.46E-17
Nb-97m	2.50E-17	2.57E-17	2.27E-17	2.26E-17	3.53E-17	2.11E-17	2.20E-17	2.38E-17	2.77E-17
Nb-97	2.24E-17	2.29E-17	2.02E-17	2.01E-17	3.22E-17	1.88E-17	1.95E-17	2.13E-17	2.66E-17
Nb-98	8.58E-17	8.74E-17	7.83E-17	7.82E-17	1.17E-16	7.31E-17	7.57E-17	8.18E-17	1.03E-16
Molybdenum									
Mo-90	2.59E-17	2.66E-17	2.33E-17	2.29E-17	4.30E-17	2.18E-17	2.24E-17	2.47E-17	2.88E-17
Mo-93m	8.06E-17	8.17E-17	7.36E-17	7.38E-17	1.09E-16	6.91E-17	7.12E-17	7.68E-17	8.78E-17
Mo-93	5.84E-21	8.00E-21	1.42E-22	6.37E-22	3.80E-21	7.78E-22	8.98E-22	3.16E-21	2.99E-20
Mo-99	4.99E-18	5.12E-18	4.52E-18	4.47E-18	7.51E-18	4.20E-18	4.36E-18	4.75E-18	6.85E-18
Mo-101	4.89E-17	4.97E-17	4.47E-17	4.48E-17	6.63E-17	4.20E-17	4.33E-17	4.67E-17	5.75E-17
Technetium									
Tc-93m	2.66E-17	2.67E-17	2.43E-17	2.45E-17	3.56E-17	2.32E-17	2.36E-17	2.54E-17	2.85E-17
Tc-93	5.35E-17	5.40E-17	4.91E-17	4.95E-17	6.85E-17	4.62E-17	4.76E-17	5.10E-17	5.81E-17
Tc-94m	6.49E-17	6.62E-17	5.90E-17	5.88E-17	9.08E-17	5.52E-17	5.70E-17	6.18E-17	7.93E-17
Tc-94	9.20E-17	9.42E-17	8.38E-17	8.35E-17	1.28E-16	7.79E-17	8.10E-17	8.77E-17	1.02E-16
Tc-95m	2.20E-17	2.26E-17	1.99E-17	1.97E-17	3.36E-17	1.85E-17	1.92E-17	2.10E-17	2.43E-17

[1] $T_{½}$ = 122 m
[2] $T_{½}$ = 66 m

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Technetium, cont'd									
Tc-95	2.71E-17	2.78E-17	2.47E-17	2.45E-17	3.79E-17	2.29E-17	2.38E-17	2.58E-17	2.99E-17
Tc-96m	1.58E-18	1.61E-18	1.44E-18	1.43E-18	2.16E-18	1.34E-18	1.39E-18	1.50E-18	1.75E-18
Tc-96	8.64E-17	8.86E-17	7.89E-17	7.86E-17	1.20E-16	7.33E-17	7.63E-17	8.25E-17	9.55E-17
Tc-97m	1.41E-20	1.66E-20	5.67E-21	5.65E-21	2.39E-20	6.47E-21	6.27E-21	1.02E-20	3.64E-20
Tc-97	8.02E-21	1.06E-20	2.78E-22	9.22E-22	5.59E-21	1.28E-21	1.30E-21	4.33E-21	3.44E-20
Tc-98	4.84E-17	4.96E-17	4.38E-17	4.35E-17	6.89E-17	4.08E-17	4.23E-17	4.60E-17	5.33E-17
Tc-99m	3.05E-18	3.17E-18	2.75E-18	2.55E-18	7.62E-18	2.55E-18	2.58E-18	2.95E-18	3.33E-18
Tc-99	7.37E-22	7.93E-22	5.74E-22	4.85E-22	2.11E-21	5.58E-22	5.41E-22	6.72E-22	9.09E-22
Tc-101	1.05E-17	1.08E-17	9.37E-18	9.16E-18	1.83E-17	8.74E-18	8.99E-18	9.97E-18	1.35E-17
Tc-104	7.20E-17	7.28E-17	6.57E-17	6.59E-17	9.78E-17	6.20E-17	6.36E-17	6.86E-17	1.00E-16
Ruthenium									
Ru-94	1.74E-17	1.79E-17	1.57E-17	1.56E-17	2.64E-17	1.46E-17	1.52E-17	1.66E-17	1.92E-17
Ru-97	6.62E-18	6.88E-18	5.93E-18	5.73E-18	1.31E-17	5.53E-18	5.67E-18	6.35E-18	7.31E-18
Ru-103	1.56E-17	1.60E-17	1.39E-17	1.37E-17	2.37E-17	1.30E-17	1.34E-17	1.47E-17	1.70E-17
Ru-105	2.65E-17	2.72E-17	2.40E-17	2.37E-17	3.90E-17	2.23E-17	2.31E-17	2.52E-17	3.04E-17
Ru-106	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodium									
Rh-99m	2.27E-17	2.33E-17	2.06E-17	2.04E-17	3.39E-17	1.92E-17	1.98E-17	2.16E-17	2.50E-17
Rh-99	1.90E-17	1.95E-17	1.71E-17	1.68E-17	3.03E-17	1.59E-17	1.64E-17	1.81E-17	2.09E-17
Rh-100	1.02E-16	1.02E-16	9.29E-17	9.35E-17	1.33E-16	8.78E-17	9.00E-17	9.67E-17	1.10E-16
Rh-101m	9.15E-18	9.44E-18	8.16E-18	7.97E-18	1.61E-17	7.61E-18	7.83E-18	8.70E-18	1.01E-17
Rh-101	6.83E-18	7.09E-18	6.11E-18	5.81E-18	1.49E-17	5.70E-18	5.81E-18	6.56E-18	7.52E-18
Rh-102m	1.61E-17	1.64E-17	1.44E-17	1.42E-17	2.40E-17	1.34E-17	1.39E-17	1.52E-17	1.83E-17
Rh-102	7.29E-17	7.47E-17	6.61E-17	6.56E-17	1.04E-16	6.15E-17	6.38E-17	6.94E-17	8.02E-17
Rh-103m	2.27E-21	2.77E-21	2.69E-22	3.61E-22	2.31E-21	6.23E-22	5.25E-22	1.30E-21	6.22E-21
Rh-105	2.42E-18	2.50E-18	2.16E-18	2.11E-18	4.27E-18	2.02E-18	2.07E-18	2.30E-18	2.66E-18
Rh-106m	1.02E-16	1.04E-16	9.27E-17	9.24E-17	1.42E-16	8.66E-17	8.96E-17	9.70E-17	1.12E-16
Rh-106	7.29E-18	7.46E-18	6.56E-18	6.49E-18	1.08E-17	6.12E-18	6.32E-18	6.91E-18	2.71E-17
Rh-107	9.81E-18	1.01E-17	8.77E-18	8.57E-18	1.70E-17	8.18E-18	8.42E-18	9.33E-18	1.25E-17
Palladium									
Pd-100	1.83E-18	1.92E-18	1.58E-18	1.36E-18	5.65E-18	1.49E-18	1.47E-18	1.75E-18	2.05E-18
Pd-101	1.05E-17	1.07E-17	9.42E-18	9.32E-18	1.58E-17	8.79E-18	9.08E-18	9.94E-18	1.16E-17
Pd-103	2.19E-20	2.62E-20	4.59E-21	5.59E-21	2.21E-20	7.41E-21	6.67E-21	1.35E-20	5.65E-20
Pd-107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pd-109	1.09E-19	1.16E-19	8.62E-20	7.85E-20	2.65E-19	8.30E-20	8.22E-20	9.94E-20	9.65E-19
Silver									
Ag-102	1.19E-16	1.21E-16	1.08E-16	1.08E-16	1.64E-16	1.02E-16	1.05E-16	1.13E-16	1.39E-16
Ag-103	2.52E-17	2.57E-17	2.27E-17	2.24E-17	3.82E-17	2.12E-17	2.19E-17	2.39E-17	2.92E-17
Ag-104m	4.12E-17	4.18E-17	3.73E-17	3.71E-17	5.80E-17	3.50E-17	3.60E-17	3.91E-17	5.06E-17
Ag-104	9.34E-17	9.53E-17	8.50E-17	8.47E-17	1.30E-16	7.93E-17	8.21E-17	8.89E-17	1.03E-16
Ag-105	1.64E-17	1.69E-17	1.47E-17	1.44E-17	2.65E-17	1.37E-17	1.41E-17	1.56E-17	1.80E-17
Ag-106m	9.77E-17	9.97E-17	8.88E-17	8.85E-17	1.37E-16	8.29E-17	8.59E-17	9.30E-17	1.07E-16
Ag-106	2.36E-17	2.41E-17	2.11E-17	2.08E-17	3.57E-17	1.96E-17	2.03E-17	2.23E-17	3.02E-17
Ag-108m	5.44E-17	5.58E-17	4.90E-17	4.85E-17	8.01E-17	4.56E-17	4.73E-17	5.16E-17	5.98E-17
Ag-108	6.46E-19	6.63E-19	5.79E-19	5.71E-19	9.86E-19	5.40E-19	5.58E-19	6.12E-19	4.79E-18
Ag-109m	7.10E-20	7.62E-20	5.25E-20	4.62E-20	1.93E-19	5.15E-20	5.02E-20	6.34E-20	9.48E-20
Ag-110m	9.64E-17	9.84E-17	8.80E-17	8.78E-17	1.32E-16	8.20E-17	8.51E-17	9.19E-17	1.06E-16
Ag-110	1.26E-18	1.30E-18	1.14E-18	1.12E-18	1.91E-18	1.06E-18	1.10E-18	1.20E-18	1.58E-17
Ag-111	8.40E-19	8.67E-19	7.49E-19	7.32E-19	1.47E-18	7.00E-19	7.19E-19	7.99E-19	1.72E-18
Ag-112	2.39E-17	2.43E-17	2.18E-17	2.18E-17	3.24E-17	2.05E-17	2.11E-17	2.28E-17	4.48E-17
Ag-115	2.55E-17	2.57E-17	2.33E-17	2.33E-17	3.54E-17	2.20E-17	2.25E-17	2.43E-17	3.96E-17
Cadmium									
Cd-104	7.40E-18	7.60E-18	6.64E-18	6.50E-18	1.18E-17	6.18E-18	6.39E-18	7.02E-18	8.18E-18
Cd-107	2.97E-19	3.13E-19	2.34E-19	2.25E-19	5.46E-19	2.25E-19	2.27E-19	2.67E-19	3.79E-19
Cd-109	9.74E-20	1.08E-19	5.58E-20	5.04E-20	2.21E-19	5.94E-20	5.65E-20	7.87E-20	1.57E-19
Cd-113m	3.70E-21	3.91E-21	3.10E-21	2.76E-21	9.76E-21	2.95E-21	2.92E-21	3.47E-21	1.81E-20
Cd-113	6.66E-22	7.15E-22	5.19E-22	4.39E-22	1.89E-21	5.04E-22	4.90E-22	6.07E-22	8.20E-22
Cd-115m	8.31E-19	8.49E-19	7.60E-19	7.58E-19	1.16E-18	7.09E-19	7.35E-19	7.94E-19	4.87E-18
Cd-115	7.73E-18	7.92E-18	6.90E-18	6.81E-18	1.18E-17	6.44E-18	6.65E-18	7.31E-18	9.09E-18
Cd-117m	7.56E-17	7.62E-17	6.93E-17	6.98E-17	9.76E-17	6.54E-17	6.72E-17	7.21E-17	8.22E-17
Cd-117	3.86E-17	3.92E-17	3.53E-17	3.53E-17	5.30E-17	3.31E-17	3.42E-17	3.69E-17	4.50E-17

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Indium									
In-109	2.17E-17	2.23E-17	1.97E-17	1.95E-17	3.35E-17	1.84E-17	1.90E-17	2.07E-17	2.39E-17
In-110b[1]	1.05E-16	1.08E-16	9.58E-17	9.54E-17	1.47E-16	8.91E-17	9.26E-17	1.00E-16	1.16E-16
In-110a[2]	5.38E-17	5.48E-17	4.85E-17	4.82E-17	7.68E-17	4.54E-17	4.69E-17	5.10E-17	6.51E-17
In-111	1.10E-17	1.14E-17	9.81E-18	9.43E-18	2.26E-17	9.15E-18	9.35E-18	1.05E-17	1.21E-17
In-112	8.79E-18	9.00E-18	7.85E-18	7.75E-18	1.32E-17	7.33E-18	7.57E-18	8.31E-18	1.06E-17
In-113m	8.11E-18	8.34E-18	7.22E-18	7.08E-18	1.33E-17	6.74E-18	6.94E-18	7.68E-18	8.88E-18
In-114m	2.73E-18	2.81E-18	2.44E-18	2.40E-18	4.52E-18	2.28E-18	2.35E-18	2.59E-18	3.02E-18
In-114	9.95E-20	1.01E-19	9.12E-20	9.15E-20	1.31E-19	8.55E-20	8.83E-20	9.49E-20	1.09E-19
In-115m	4.83E-18	4.98E-18	4.29E-18	4.20E-18	8.32E-18	4.01E-18	4.12E-18	4.58E-18	5.32E-18
In-115	2.30E-21	2.44E-21	1.90E-21	1.67E-21	6.23E-21	1.81E-21	1.79E-21	2.15E-21	3.59E-21
In-116m	8.97E-17	9.10E-17	8.24E-17	8.27E-17	1.18E-16	7.73E-17	7.98E-17	8.57E-17	9.84E-17
In-117m	2.58E-18	2.67E-18	2.30E-18	2.22E-18	4.94E-18	2.15E-18	2.20E-18	2.46E-18	5.32E-18
In-117	2.21E-17	2.27E-17	1.98E-17	1.94E-17	3.59E-17	1.85E-17	1.90E-17	2.10E-17	2.43E-17
In-119m	4.15E-19	4.29E-19	3.68E-19	3.60E-19	6.92E-19	3.45E-19	3.54E-19	3.93E-19	1.23E-17
In-119	2.64E-17	2.71E-17	2.40E-17	2.39E-17	3.71E-17	2.23E-17	2.32E-17	2.52E-17	3.32E-17
Tin									
Sn-110	8.68E-18	8.99E-18	7.73E-18	7.53E-18	1.59E-17	7.22E-18	7.41E-18	8.27E-18	9.56E-18
Sn-111	1.72E-17	1.76E-17	1.55E-17	1.54E-17	2.47E-17	1.46E-17	1.50E-17	1.63E-17	2.02E-17
Sn-113	1.81E-19	1.94E-19	1.34E-19	1.30E-19	3.21E-19	1.32E-19	1.31E-19	1.59E-19	2.37E-19
Sn-117m	3.65E-18	3.80E-18	3.25E-18	3.06E-18	8.55E-18	3.04E-18	3.08E-18	3.51E-18	4.03E-18
Sn-119m	2.61E-20	3.10E-20	5.21E-21	5.15E-21	3.46E-20	9.47E-21	7.81E-21	1.61E-20	5.17E-20
Sn-121m	1.56E-20	1.82E-20	5.02E-21	4.07E-21	2.72E-20	7.04E-21	5.99E-21	1.05E-20	2.62E-20
Sn-121	1.14E-21	1.22E-21	9.13E-22	7.86E-22	3.19E-21	8.80E-22	8.60E-22	1.05E-21	1.37E-21
Sn-123m	3.57E-18	3.71E-18	3.20E-18	3.02E-18	8.33E-18	2.98E-18	3.03E-18	3.44E-18	5.73E-18
Sn-123	2.83E-19	2.90E-19	2.59E-19	2.57E-19	4.11E-19	2.41E-19	2.50E-19	2.71E-19	3.14E-18
Sn-125	1.13E-17	1.15E-17	1.04E-17	1.04E-17	1.52E-17	9.68E-18	1.00E-17	1.08E-17	2.07E-17
Sn-126	8.24E-19	8.66E-19	7.10E-19	6.09E-19	2.56E-18	6.69E-19	6.60E-19	7.89E-19	9.21E-19
Sn-127	6.82E-17	6.93E-17	6.25E-17	6.26E-17	9.21E-17	5.85E-17	6.05E-17	6.51E-17	7.90E-17
Sn-128	2.01E-17	2.06E-17	1.79E-17	1.76E-17	3.14E-17	1.67E-17	1.72E-17	1.90E-17	2.21E-17
Antimony									
Sb-115	3.00E-17	3.07E-17	2.68E-17	2.65E-17	4.53E-17	2.50E-17	2.58E-17	2.84E-17	3.43E-17
Sb-116m	1.09E-16	1.11E-16	9.97E-17	9.94E-17	1.51E-16	9.30E-17	9.64E-17	1.04E-16	1.20E-16
Sb-116	7.74E-17	7.85E-17	7.07E-17	7.09E-17	1.03E-16	6.64E-17	6.85E-17	7.37E-17	8.83E-17
Sb-117	4.48E-18	4.64E-18	3.99E-18	3.80E-18	9.65E-18	3.73E-18	3.79E-18	4.29E-18	4.94E-18
Sb-118m	8.96E-17	9.15E-17	8.23E-17	8.22E-17	1.23E-16	7.67E-17	7.96E-17	8.57E-17	9.87E-17
Sb-119	5.55E-20	6.59E-20	1.14E-20	1.10E-20	7.47E-20	2.04E-20	1.68E-20	3.43E-20	1.08E-19
Sb-120b[3]	8.45E-17	8.64E-17	7.76E-17	7.74E-17	1.19E-16	7.23E-17	7.50E-17	8.09E-17	9.32E-17
Sb-120a[4]	1.48E-17	1.52E-17	1.32E-17	1.31E-17	2.23E-17	1.23E-17	1.27E-17	1.40E-17	1.85E-17
Sb-122	1.50E-17	1.53E-17	1.34E-17	1.33E-17	2.20E-17	1.25E-17	1.30E-17	1.42E-17	2.00E-17
Sb-124n[5]	1.74E-22	2.07E-22	3.19E-23	3.28E-23	2.21E-22	6.12E-23	5.01E-23	1.06E-22	3.50E-22
Sb-124m[6]	1.19E-17	1.22E-17	1.07E-17	1.06E-17	1.75E-17	9.95E-18	1.03E-17	1.13E-17	1.33E-17
Sb-124	6.58E-17	6.66E-17	6.00E-17	6.01E-17	8.77E-17	5.65E-17	5.80E-17	6.26E-17	7.38E-17
Sb-125	1.38E-17	1.42E-17	1.24E-17	1.22E-17	2.12E-17	1.15E-17	1.19E-17	1.31E-17	1.52E-17
Sb-126m	5.24E-17	5.37E-17	4.73E-17	4.68E-17	7.69E-17	4.40E-17	4.56E-17	4.98E-17	6.20E-17
Sb-126	9.64E-17	9.88E-17	8.72E-17	8.65E-17	1.40E-16	8.11E-17	8.42E-17	9.16E-17	1.07E-16
Sb-127	2.32E-17	2.38E-17	2.09E-17	2.07E-17	3.42E-17	1.95E-17	2.02E-17	2.20E-17	2.61E-17
Sb-128b[7]	1.06E-16	1.08E-16	9.57E-17	9.50E-17	1.52E-16	8.90E-17	9.24E-17	1.00E-16	1.18E-16
Sb-128a[8]	6.76E-17	6.94E-17	6.14E-17	6.09E-17	9.83E-17	5.70E-17	5.92E-17	6.44E-17	8.40E-17
Sb-129	5.08E-17	5.17E-17	4.64E-17	4.63E-17	6.93E-17	4.33E-17	4.49E-17	4.84E-17	5.79E-17
Sb-130	1.12E-16	1.15E-16	1.02E-16	1.02E-16	1.61E-16	9.51E-17	9.86E-17	1.07E-16	1.29E-16
Sb-131	6.70E-17	6.80E-17	6.14E-17	6.15E-17	8.96E-17	5.75E-17	5.94E-17	6.39E-17	7.71E-17
Tellurium									
Te-116	1.10E-18	1.14E-18	9.27E-19	8.57E-19	2.51E-18	8.78E-19	8.80E-19	1.03E-18	1.25E-18
Te-121m	5.99E-18	6.22E-18	5.38E-18	5.21E-18	1.16E-17	5.02E-18	5.15E-18	5.74E-18	6.62E-18

[1] $T_{½}$ = 4.9 h
[2] $T_{½}$ = 69.1 m
[3] $T_{½}$ = 5.76 d
[4] $T_{½}$ = 15.89 m
[5] $T_{½}$ = 20.2 m
[6] $T_{½}$ = 93 s
[7] $T_{½}$ = 9.01 h
[8] $T_{½}$ = 10.4 m

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Tellurium, cont'd									
Te-121	1.88E-17	1.93E-17	1.68E-17	1.66E-17	2.79E-17	1.57E-17	1.62E-17	1.78E-17	2.06E-17
Te-123m	3.49E-18	3.63E-18	3.11E-18	2.93E-18	8.17E-18	2.90E-18	2.94E-18	3.36E-18	3.84E-18
Te-123	5.49E-20	6.49E-20	1.36E-20	1.19E-20	8.20E-20	2.20E-20	1.83E-20	3.51E-20	9.87E-20
Te-125m	1.19E-19	1.39E-19	3.97E-20	3.26E-20	2.07E-19	5.47E-20	4.69E-20	8.11E-20	1.95E-19
Te-127m	4.09E-20	4.71E-20	1.64E-20	1.39E-20	7.35E-20	2.06E-20	1.83E-20	2.92E-20	6.86E-20
Te-127	1.62E-19	1.66E-19	1.44E-19	1.41E-19	2.69E-19	1.34E-19	1.38E-19	1.53E-19	2.51E-19
Te-129m	1.05E-18	1.08E-18	9.36E-19	9.27E-19	1.52E-18	8.74E-19	9.05E-19	9.91E-19	2.46E-18
Te-129	1.87E-18	1.92E-18	1.67E-18	1.65E-18	2.89E-18	1.56E-18	1.61E-18	1.77E-18	4.81E-18
Te-131m	4.91E-17	5.02E-17	4.49E-17	4.47E-17	6.92E-17	4.18E-17	4.33E-17	4.69E-17	5.45E-17
Te-131	1.34E-17	1.38E-17	1.22E-17	1.19E-17	2.19E-17	1.13E-17	1.17E-17	1.28E-17	2.04E-17
Te-132	6.07E-18	6.32E-18	5.39E-18	5.19E-18	1.23E-17	5.04E-18	5.15E-18	5.80E-18	6.72E-18
Te-133m	8.07E-17	8.24E-17	7.37E-17	7.35E-17	1.12E-16	6.88E-17	7.13E-17	7.70E-17	9.42E-17
Te-133	3.20E-17	3.27E-17	2.91E-17	2.89E-17	4.67E-17	2.72E-17	2.81E-17	3.05E-17	4.26E-17
Te-134	2.87E-17	2.94E-17	2.58E-17	2.55E-17	4.48E-17	2.40E-17	2.49E-17	2.73E-17	3.17E-17
Iodine									
I-120m	1.89E-16	1.92E-16	1.72E-16	1.72E-16	2.58E-16	1.62E-16	1.66E-16	1.80E-16	2.22E-16
I-120	9.85E-17	9.96E-17	8.96E-17	8.97E-17	1.34E-16	8.45E-17	8.67E-17	9.37E-17	1.27E-16
I-121	1.25E-17	1.29E-17	1.12E-17	1.10E-17	2.16E-17	1.05E-17	1.08E-17	1.19E-17	1.40E-17
I-122	3.18E-17	3.26E-17	2.85E-17	2.81E-17	4.77E-17	2.66E-17	2.74E-17	3.01E-17	4.85E-17
I-123	3.98E-18	4.14E-18	3.53E-18	3.34E-18	8.87E-18	3.30E-18	3.35E-18	3.81E-18	4.40E-18
I-124	3.82E-17	3.88E-17	3.46E-17	3.45E-17	5.30E-17	3.25E-17	3.34E-17	3.63E-17	4.32E-17
I-125	1.33E-19	1.57E-19	3.99E-20	3.23E-20	2.23E-19	5.82E-20	4.91E-20	8.86E-20	2.24E-19
I-126	1.49E-17	1.53E-17	1.34E-17	1.32E-17	2.23E-17	1.25E-17	1.29E-17	1.41E-17	1.67E-17
I-128	2.85E-18	2.93E-18	2.54E-18	2.50E-18	4.47E-18	2.37E-18	2.45E-18	2.70E-18	9.79E-18
I-129	9.74E-20	1.13E-19	3.81E-20	2.84E-20	1.94E-19	4.88E-20	4.21E-20	6.93E-20	1.48E-19
I-130	7.29E-17	7.46E-17	6.58E-17	6.53E-17	1.05E-16	6.13E-17	6.35E-17	6.92E-17	8.06E-17
I-131	1.22E-17	1.26E-17	1.09E-17	1.07E-17	2.01E-17	1.02E-17	1.05E-17	1.16E-17	1.34E-17
I-132m	1.05E-17	1.08E-17	9.52E-18	9.42E-18	1.56E-17	8.86E-18	9.18E-18	1.00E-17	1.20E-17
I-132	7.92E-17	8.09E-17	7.20E-17	7.16E-17	1.11E-16	6.70E-17	6.96E-17	7.54E-17	8.98E-17
I-133	2.06E-17	2.11E-17	1.85E-17	1.83E-17	3.02E-17	1.73E-17	1.79E-17	1.95E-17	2.40E-17
I-134	9.21E-17	9.41E-17	8.42E-17	8.40E-17	1.26E-16	7.85E-17	8.14E-17	8.79E-17	1.06E-16
I-135	5.75E-17	5.82E-17	5.28E-17	5.30E-17	7.51E-17	4.95E-17	5.11E-17	5.48E-17	6.39E-17
Xenon									
Xe-120	1.29E-17	1.33E-17	1.16E-17	1.14E-17	2.00E-17	1.08E-17	1.12E-17	1.23E-17	1.43E-17
Xe-121	6.47E-17	6.53E-17	5.89E-17	5.90E-17	8.88E-17	5.56E-17	5.70E-17	6.16E-17	7.63E-17
Xe-122	1.46E-18	1.51E-18	1.25E-18	1.22E-18	2.61E-18	1.18E-18	1.21E-18	1.36E-18	1.64E-18
Xe-123	2.05E-17	2.09E-17	1.85E-17	1.83E-17	3.14E-17	1.74E-17	1.78E-17	1.95E-17	2.33E-17
Xe-125	7.22E-18	7.49E-18	6.43E-18	6.23E-18	1.37E-17	6.01E-18	6.16E-18	6.89E-18	7.99E-18
Xe-127	7.37E-18	7.65E-18	6.55E-18	6.30E-18	1.48E-17	6.12E-18	6.26E-18	7.04E-18	8.14E-18
Xe-129m	4.12E-19	4.49E-19	2.86E-19	2.61E-19	8.47E-19	2.89E-19	2.80E-19	3.54E-19	5.24E-19
Xe-131m	1.43E-19	1.57E-19	9.47E-20	8.54E-20	3.02E-19	9.72E-20	9.34E-20	1.21E-19	1.85E-19
Xe-133m	7.44E-19	7.81E-19	6.33E-19	6.07E-19	1.47E-18	5.99E-19	6.07E-19	6.96E-19	8.48E-19
Xe-133	5.71E-19	6.05E-19	4.71E-19	3.98E-19	1.76E-18	4.50E-19	4.41E-19	5.36E-19	6.50E-19
Xe-135m	1.42E-17	1.46E-17	1.27E-17	1.25E-17	2.14E-17	1.19E-17	1.23E-17	1.34E-17	1.57E-17
Xe-135	7.44E-18	7.71E-18	6.66E-18	6.47E-18	1.41E-17	6.21E-18	6.38E-18	7.11E-18	8.60E-18
Xe-138	4.14E-17	4.16E-17	3.78E-17	3.80E-17	5.51E-17	3.58E-17	3.66E-17	3.94E-17	5.05E-17
Cesium									
Cs-125	2.23E-17	2.28E-17	1.99E-17	1.97E-17	3.36E-17	1.86E-17	1.92E-17	2.11E-17	2.73E-17
Cs-126	3.63E-17	3.72E-17	3.24E-17	3.19E-17	5.57E-17	3.02E-17	3.12E-17	3.43E-17	6.09E-17
Cs-127	1.29E-17	1.33E-17	1.15E-17	1.13E-17	2.07E-17	1.08E-17	1.11E-17	1.22E-17	1.42E-17
Cs-128	3.00E-17	3.07E-17	2.68E-17	2.64E-17	4.55E-17	2.50E-17	2.58E-17	2.83E-17	4.31E-17
Cs-129	8.12E-18	8.36E-18	7.17E-18	7.03E-18	1.33E-17	6.71E-18	6.90E-18	7.66E-18	8.94E-18
Cs-130	1.70E-17	1.74E-17	1.52E-17	1.50E-17	2.55E-17	1.42E-17	1.46E-17	1.60E-17	2.23E-17
Cs-131	8.37E-20	9.78E-20	2.94E-20	2.23E-20	1.54E-19	3.96E-20	3.37E-20	5.77E-20	1.31E-19
Cs-132	2.34E-17	2.40E-17	2.11E-17	2.09E-17	3.36E-17	1.97E-17	2.04E-17	2.22E-17	2.58E-17
Cs-134m	4.12E-19	4.32E-19	3.50E-19	3.19E-19	1.05E-18	3.31E-19	3.30E-19	3.89E-19	4.65E-19
Cs-134	5.33E-17	5.46E-17	4.83E-17	4.80E-17	7.59E-17	4.50E-17	4.67E-17	5.07E-17	5.87E-17
Cs-135m	5.48E-17	5.62E-17	5.00E-17	4.98E-17	7.64E-17	4.64E-17	4.83E-17	5.23E-17	6.08E-17
Cs-135	2.33E-22	2.55E-22	1.66E-22	1.35E-22	6.65E-22	1.66E-22	1.58E-22	2.05E-22	3.11E-22
Cs-136	7.45E-17	7.63E-17	6.81E-17	6.78E-17	1.05E-16	6.34E-17	6.58E-17	7.12E-17	8.22E-17

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Cesium, cont'd									
Cs-137	4.27E-21	4.50E-21	3.61E-21	3.25E-21	1.09E-20	3.43E-21	3.41E-21	4.02E-21	9.34E-20
Cs-138	8.72E-17	8.80E-17	7.99E-17	8.04E-17	1.13E-16	7.54E-17	7.75E-17	8.31E-17	1.09E-16
Barium									
Ba-126	4.51E-18	4.66E-18	3.98E-18	3.89E-18	7.58E-18	3.73E-18	3.83E-18	4.26E-18	4.99E-18
Ba-128	1.66E-18	1.73E-18	1.44E-18	1.39E-18	3.11E-18	1.35E-18	1.38E-18	1.56E-18	1.87E-18
Ba-131m	1.35E-18	1.40E-18	1.18E-18	1.05E-18	3.78E-18	1.10E-18	1.10E-18	1.29E-18	1.49E-18
Ba-131	1.37E-17	1.40E-17	1.22E-17	1.19E-17	2.28E-17	1.14E-17	1.17E-17	1.29E-17	1.50E-17
Ba-133m	1.54E-18	1.61E-18	1.35E-18	1.30E-18	2.89E-18	1.26E-18	1.29E-18	1.46E-18	1.72E-18
Ba-133	1.11E-17	1.15E-17	9.86E-18	9.57E-18	1.99E-17	9.22E-18	9.46E-18	1.06E-17	1.23E-17
Ba-135m	1.34E-18	1.40E-18	1.17E-18	1.13E-18	2.54E-18	1.10E-18	1.12E-18	1.27E-18	1.50E-18
Ba-137m	2.03E-17	2.08E-17	1.83E-17	1.82E-17	2.91E-17	1.70E-17	1.77E-17	1.93E-17	2.26E-17
Ba-139	1.25E-18	1.30E-18	1.13E-18	1.07E-18	2.67E-18	1.05E-18	1.07E-18	1.21E-18	1.02E-17
Ba-140	5.83E-18	5.98E-18	5.20E-18	5.12E-18	9.15E-18	4.86E-18	5.01E-18	5.52E-18	6.87E-18
Ba-141	2.84E-17	2.91E-17	2.58E-17	2.55E-17	4.33E-17	2.41E-17	2.48E-17	2.71E-17	4.00E-17
Ba-142	3.59E-17	3.67E-17	3.29E-17	3.27E-17	5.09E-17	3.06E-17	3.17E-17	3.43E-17	4.13E-17
Lanthanum									
La-131	2.11E-17	2.16E-17	1.88E-17	1.85E-17	3.37E-17	1.76E-17	1.81E-17	2.00E-17	2.44E-17
La-132	7.10E-17	7.20E-17	6.44E-17	6.43E-17	9.83E-17	6.06E-17	6.23E-17	6.75E-17	8.35E-17
La-134	2.33E-17	2.38E-17	2.08E-17	2.05E-17	3.49E-17	1.94E-17	2.00E-17	2.20E-17	3.43E-17
La-135	4.53E-19	4.79E-19	3.53E-19	3.37E-19	7.46E-19	3.44E-19	3.43E-19	4.03E-19	5.36E-19
La-137	1.04E-19	1.21E-19	4.34E-20	3.16E-20	2.16E-19	5.42E-20	4.69E-20	7.54E-20	1.52E-19
La-138	4.46E-17	4.52E-17	4.09E-17	4.11E-17	5.82E-17	3.84E-17	3.96E-17	4.26E-17	4.87E-17
La-140	8.46E-17	8.54E-17	7.73E-17	7.77E-17	1.11E-16	7.29E-17	7.49E-17	8.06E-17	9.45E-17
La-141	1.73E-18	1.75E-18	1.58E-18	1.59E-18	2.31E-18	1.49E-18	1.53E-18	1.65E-18	1.18E-17
La-142	1.05E-16	1.05E-16	9.63E-17	9.73E-17	1.32E-16	9.15E-17	9.35E-17	9.99E-17	1.21E-16
La-143	3.75E-18	3.79E-18	3.42E-18	3.43E-18	5.02E-18	3.23E-18	3.32E-18	3.57E-18	2.14E-17
Cerium									
Ce-134	1.22E-19	1.40E-19	5.46E-20	3.92E-20	2.67E-19	6.59E-20	5.75E-20	8.99E-20	1.73E-19
Ce-135	5.89E-17	6.04E-17	5.29E-17	5.22E-17	9.00E-17	4.93E-17	5.09E-17	5.59E-17	6.47E-17
Ce-137m	1.10E-18	1.15E-18	9.48E-19	9.11E-19	2.07E-18	8.94E-19	9.09E-19	1.03E-18	1.24E-18
Ce-137	4.00E-19	4.26E-19	3.03E-19	2.83E-19	7.00E-19	2.98E-19	2.94E-19	3.53E-19	4.78E-19
Ce-139	3.56E-18	3.72E-18	3.14E-18	2.96E-18	8.19E-18	2.94E-18	2.98E-18	3.41E-18	3.95E-18
Ce-141	1.77E-18	1.84E-18	1.58E-18	1.47E-18	4.34E-18	1.47E-18	1.49E-18	1.70E-18	1.94E-18
Ce-143	8.36E-18	8.62E-18	7.46E-18	7.30E-18	1.39E-17	6.96E-18	7.17E-18	7.93E-18	1.06E-17
Ce-144	4.01E-19	4.19E-19	3.52E-19	3.20E-19	1.05E-18	3.30E-19	3.30E-19	3.84E-19	4.43E-19
Praseodymium									
Pr-136	7.31E-17	7.44E-17	6.61E-17	6.58E-17	1.03E-16	6.20E-17	6.39E-17	6.94E-17	8.88E-17
Pr-137	1.63E-17	1.67E-17	1.46E-17	1.44E-17	2.43E-17	1.36E-17	1.41E-17	1.54E-17	1.93E-17
Pr-138m	8.46E-17	8.66E-17	7.71E-17	7.67E-17	1.20E-16	7.17E-17	7.45E-17	8.07E-17	9.45E-17
Pr-138	2.73E-17	2.79E-17	2.44E-17	2.41E-17	4.12E-17	2.28E-17	2.35E-17	2.58E-17	4.59E-17
Pr-139	3.41E-18	3.50E-18	3.00E-18	2.96E-18	5.13E-18	2.82E-18	2.90E-18	3.20E-18	3.89E-18
Pr-142m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr-142	2.29E-18	2.31E-18	2.10E-18	2.12E-18	2.97E-18	1.99E-18	2.04E-18	2.19E-18	1.02E-17
Pr-143	1.24E-20	1.30E-20	1.07E-20	9.83E-21	3.01E-20	1.01E-20	1.01E-20	1.18E-20	5.10E-19
Pr-144m	9.24E-20	1.02E-19	5.99E-20	5.06E-20	1.94E-19	6.23E-20	5.88E-20	7.69E-20	1.19E-19
Pr-144	1.42E-18	1.43E-18	1.29E-18	1.29E-18	1.96E-18	1.22E-18	1.25E-18	1.35E-18	1.65E-17
Pr-145	5.13E-19	5.27E-19	4.66E-19	4.61E-19	7.62E-19	4.34E-19	4.50E-19	4.89E-19	5.66E-18
Pr-147	2.84E-17	2.91E-17	2.57E-17	2.55E-17	4.22E-17	2.40E-17	2.48E-17	2.70E-17	3.77E-17
Neodymium									
Nd-136	7.83E-18	8.07E-18	6.94E-18	6.73E-18	1.35E-17	6.49E-18	6.65E-18	7.40E-18	8.71E-18
Nd-138	5.83E-19	6.19E-19	4.62E-19	4.29E-19	1.16E-18	4.48E-19	4.44E-19	5.27E-19	6.79E-19
Nd-139m	5.31E-17	5.43E-17	4.84E-17	4.82E-17	7.51E-17	4.51E-17	4.68E-17	5.07E-17	5.89E-17
Nd-139	1.31E-17	1.34E-17	1.17E-17	1.15E-17	1.95E-17	1.09E-17	1.13E-17	1.24E-17	1.59E-17
Nd-141m	2.61E-17	2.67E-17	2.37E-17	2.36E-17	3.67E-17	2.20E-17	2.29E-17	2.48E-17	2.91E-17
Nd-141	1.77E-18	1.83E-18	1.55E-18	1.52E-18	2.68E-18	1.46E-18	1.49E-18	1.66E-18	1.99E-18
Nd-147	3.78E-18	3.90E-18	3.35E-18	3.23E-18	6.67E-18	3.13E-18	3.21E-18	3.58E-18	4.34E-18
Nd-149	1.15E-17	1.18E-17	1.03E-17	9.98E-18	2.04E-17	9.57E-18	9.83E-18	1.09E-17	1.46E-17
Nd-151	3.06E-17	3.12E-17	2.78E-17	2.76E-17	4.56E-17	2.60E-17	2.69E-17	2.92E-17	3.80E-17
Promethium									
Pm-141	2.52E-17	2.57E-17	2.26E-17	2.24E-17	3.67E-17	2.12E-17	2.18E-17	2.38E-17	3.51E-17
Pm-142	2.94E-17	3.01E-17	2.63E-17	2.60E-17	4.40E-17	2.46E-17	2.54E-17	2.78E-17	5.21E-17
Pm-143	9.99E-18	1.03E-17	9.02E-18	8.93E-18	1.43E-17	8.39E-18	8.71E-18	9.48E-18	1.11E-17

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Promethium, cont'd									
Pm-144	5.22E-17	5.35E-17	4.70E-17	4.66E-17	7.60E-17	4.38E-17	4.54E-17	4.95E-17	5.74E-17
Pm-145	1.93E-19	2.17E-19	1.14E-19	8.34E-20	5.16E-19	1.23E-19	1.11E-19	1.57E-19	2.49E-19
Pm-146	2.49E-17	2.55E-17	2.24E-17	2.22E-17	3.67E-17	2.09E-17	2.16E-17	2.36E-17	2.75E-17
Pm-147	2.96E-22	3.20E-22	2.25E-22	1.91E-22	8.31E-22	2.21E-22	2.14E-22	2.68E-22	3.75E-22
Pm-148m	6.77E-17	6.94E-17	6.12E-17	6.06E-17	9.87E-17	5.69E-17	5.90E-17	6.43E-17	7.45E-17
Pm-148	2.07E-17	2.10E-17	1.89E-17	1.89E-17	2.78E-17	1.77E-17	1.83E-17	1.97E-17	2.90E-17
Pm-149	3.51E-19	3.62E-19	3.14E-19	3.07E-19	6.19E-19	2.93E-19	3.01E-19	3.34E-19	1.30E-18
Pm-150	5.08E-17	5.16E-17	4.64E-17	4.64E-17	6.99E-17	4.35E-17	4.49E-17	4.85E-17	6.24E-17
Pm-151	9.75E-18	1.01E-17	8.73E-18	8.53E-18	1.66E-17	8.15E-18	8.39E-18	9.28E-18	1.12E-17
Samarium									
Sm-141m	6.76E-17	6.90E-17	6.13E-17	6.09E-17	9.76E-17	5.73E-17	5.92E-17	6.43E-17	7.83E-17
Sm-141	4.81E-17	4.90E-17	4.34E-17	4.31E-17	6.97E-17	4.06E-17	4.19E-17	4.56E-17	6.13E-17
Sm-142	2.35E-18	2.42E-18	2.05E-18	1.99E-18	3.72E-18	1.93E-18	1.97E-18	2.20E-18	2.69E-18
Sm-145	4.38E-19	4.90E-19	2.74E-19	2.00E-19	1.24E-18	2.90E-19	2.65E-19	3.65E-19	5.54E-19
Sm-146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-147	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm-151	9.38E-24	1.14E-23	8.79E-25	1.37E-24	8.76E-24	2.48E-24	2.03E-24	5.27E-24	2.46E-23
Sm-153	9.00E-19	9.49E-19	7.55E-19	6.53E-19	2.58E-18	7.18E-19	7.05E-19	8.47E-19	1.11E-18
Sm-155	2.22E-18	2.30E-18	1.97E-18	1.79E-18	5.87E-18	1.84E-18	1.85E-18	2.13E-18	5.55E-18
Sm-156	2.95E-18	3.08E-18	2.63E-18	2.49E-18	6.64E-18	2.46E-18	2.50E-18	2.84E-18	3.30E-18
Europium									
Eu-145	5.14E-17	5.22E-17	4.69E-17	4.70E-17	6.89E-17	4.40E-17	4.54E-17	4.90E-17	5.62E-17
Eu-146	8.67E-17	8.85E-17	7.88E-17	7.86E-17	1.20E-16	7.36E-17	7.62E-17	8.25E-17	9.53E-17
Eu-147	1.54E-17	1.58E-17	1.39E-17	1.37E-17	2.36E-17	1.30E-17	1.34E-17	1.47E-17	1.70E-17
Eu-148	7.41E-17	7.57E-17	6.69E-17	6.65E-17	1.06E-16	6.25E-17	6.46E-17	7.03E-17	8.12E-17
Eu-149	1.17E-18	1.22E-18	9.82E-19	9.27E-19	2.24E-18	9.34E-19	9.41E-19	1.08E-18	1.32E-18
Eu-150b[1]	4.92E-17	5.04E-17	4.42E-17	4.37E-17	7.46E-17	4.13E-17	4.26E-17	4.67E-17	5.40E-17
Eu-150a[2]	1.48E-18	1.52E-18	1.33E-18	1.31E-18	2.32E-18	1.24E-18	1.28E-18	1.40E-18	2.29E-18
Eu-152m	9.85E-18	1.01E-17	8.99E-18	8.94E-18	1.40E-17	8.36E-18	8.69E-18	9.40E-18	1.48E-17
Eu-152	3.93E-17	4.01E-17	3.59E-17	3.58E-17	5.54E-17	3.35E-17	3.47E-17	3.75E-17	4.33E-17
Eu-154	4.30E-17	4.39E-17	3.94E-17	3.93E-17	5.98E-17	3.68E-17	3.81E-17	4.11E-17	4.81E-17
Eu-155	1.02E-18	1.06E-18	8.85E-19	7.68E-19	3.06E-18	8.31E-19	8.22E-19	9.75E-19	1.12E-18
Eu-156	4.85E-17	4.91E-17	4.45E-17	4.48E-17	6.34E-17	4.19E-17	4.31E-17	4.63E-17	5.58E-17
Eu-157	7.44E-18	7.67E-18	6.58E-18	6.40E-18	1.25E-17	6.16E-18	6.32E-18	7.02E-18	9.28E-18
Eu-158	3.73E-17	3.80E-17	3.42E-17	3.42E-17	5.05E-17	3.19E-17	3.31E-17	3.56E-17	5.07E-17
Gadolinium									
Gd-145	8.30E-17	8.35E-17	7.57E-17	7.62E-17	1.08E-16	7.17E-17	7.34E-17	7.89E-17	9.59E-17
Gd-146	4.51E-18	4.72E-18	3.90E-18	3.52E-18	1.18E-17	3.68E-18	3.66E-18	4.29E-18	5.00E-18
Gd-147	4.41E-17	4.52E-17	4.00E-17	3.96E-17	6.58E-17	3.73E-17	3.86E-17	4.20E-17	4.85E-17
Gd-148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-149	1.21E-17	1.25E-17	1.08E-17	1.06E-17	2.09E-17	1.01E-17	1.04E-17	1.15E-17	1.34E-17
Gd-151	1.00E-18	1.06E-18	8.34E-19	7.63E-19	2.28E-18	7.96E-19	7.91E-19	9.31E-19	1.14E-18
Gd-152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gd-153	1.40E-18	1.48E-18	1.15E-18	9.83E-19	4.11E-18	1.10E-18	1.08E-18	1.31E-18	1.58E-18
Gd-159	1.35E-18	1.40E-18	1.19E-18	1.15E-18	2.40E-18	1.12E-18	1.14E-18	1.28E-18	1.93E-18
Terbium									
Tb-147	5.45E-17	5.57E-17	4.95E-17	4.93E-17	7.71E-17	4.62E-17	4.79E-17	5.19E-17	6.68E-17
Tb-149	5.65E-17	5.73E-17	5.14E-17	5.13E-17	7.85E-17	4.83E-17	4.97E-17	5.38E-17	6.31E-17
Tb-150	5.84E-17	5.94E-17	5.29E-17	5.26E-17	8.19E-17	4.95E-17	5.11E-17	5.54E-17	7.05E-17
Tb-151	2.78E-17	2.86E-17	2.50E-17	2.45E-17	4.44E-17	2.33E-17	2.40E-17	2.64E-17	3.06E-17
Tb-153	5.61E-18	5.83E-18	4.98E-18	4.77E-18	1.09E-17	4.66E-18	4.76E-18	5.34E-18	6.23E-18
Tb-154	8.66E-17	8.71E-17	7.95E-17	8.01E-17	1.12E-16	7.53E-17	7.71E-17	8.26E-17	9.34E-17
Tb-155	2.63E-18	2.76E-18	2.28E-18	2.08E-18	6.38E-18	2.15E-18	2.15E-18	2.50E-18	2.93E-18
Tb-156m[3]	2.16E-19	2.39E-19	1.59E-19	1.17E-19	7.08E-19	1.59E-19	1.48E-19	1.93E-19	2.58E-19
Tb-156n[4]	3.77E-20	4.07E-20	2.94E-20	2.35E-20	1.17E-19	2.87E-20	2.74E-20	3.45E-20	4.38E-20
Tb-156	6.23E-17	6.35E-17	5.67E-17	5.65E-17	8.80E-17	5.31E-17	5.48E-17	5.93E-17	6.82E-17
Tb-157	1.82E-20	2.03E-20	1.19E-20	8.57E-21	5.45E-20	1.24E-20	1.13E-20	1.55E-20	2.26E-20
Tb-158	2.65E-17	2.71E-17	2.42E-17	2.41E-17	3.74E-17	2.25E-17	2.34E-17	2.53E-17	2.93E-17

[1] $T_{½}$ = 34.2 y
[2] $T_{½}$ = 12.62 h
[3] $T_{½}$ = 24.4 y
[4] $T_{½}$ = 5.0 h

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Terbium, cont'd									
Tb-160	3.87E-17	3.96E-17	3.55E-17	3.53E-17	5.43E-17	3.30E-17	3.43E-17	3.70E-17	4.28E-17
Tb-161	3.24E-19	3.51E-19	2.48E-19	1.98E-19	9.91E-19	2.44E-19	2.32E-19	2.94E-19	3.87E-19
Dysprosium									
Dy-155	1.83E-17	1.88E-17	1.66E-17	1.64E-17	2.86E-17	1.55E-17	1.60E-17	1.75E-17	2.01E-17
Dy-157	1.02E-17	1.06E-17	9.07E-18	8.81E-18	1.83E-17	8.48E-18	8.70E-18	9.70E-18	1.12E-17
Dy-159	3.41E-19	3.79E-19	2.33E-19	1.69E-19	1.05E-18	2.40E-19	2.20E-19	2.95E-19	4.17E-19
Dy-165	7.30E-19	7.53E-19	6.50E-19	6.27E-19	1.29E-18	6.07E-19	6.23E-19	6.92E-19	2.57E-18
Dy-166	5.23E-19	5.57E-19	4.30E-19	3.65E-19	1.47E-18	4.13E-19	4.02E-19	4.87E-19	5.94E-19
Holmium									
Ho-155	1.17E-17	1.20E-17	1.04E-17	1.02E-17	1.90E-17	9.75E-18	1.00E-17	1.11E-17	1.47E-17
Ho-157	1.41E-17	1.46E-17	1.26E-17	1.23E-17	2.38E-17	1.18E-17	1.21E-17	1.34E-17	1.57E-17
Ho-159	8.98E-18	9.32E-18	7.98E-18	7.60E-18	1.81E-17	7.47E-18	7.61E-18	8.56E-18	9.92E-18
Ho-161	5.36E-19	5.85E-19	3.98E-19	3.14E-19	1.62E-18	3.96E-19	3.74E-19	4.80E-19	6.44E-19
Ho-162m	1.84E-17	1.88E-17	1.67E-17	1.66E-17	2.72E-17	1.56E-17	1.61E-17	1.75E-17	2.02E-17
Ho-162	4.59E-18	4.71E-18	4.11E-18	4.02E-18	7.15E-18	3.86E-18	3.95E-18	4.35E-18	5.13E-18
Ho-164m	3.70E-19	4.09E-19	2.67E-19	1.97E-19	1.18E-18	2.69E-19	2.49E-19	3.28E-19	4.45E-19
Ho-164	2.70E-19	2.95E-19	2.02E-19	1.55E-19	8.51E-19	2.01E-19	1.89E-19	2.43E-19	5.24E-19
Ho-166m	5.78E-17	5.94E-17	5.24E-17	5.18E-17	8.70E-17	4.88E-17	5.06E-17	5.51E-17	6.38E-17
Ho-166	8.80E-19	8.97E-19	7.95E-19	7.76E-19	1.43E-18	7.49E-19	7.64E-19	8.38E-19	6.08E-18
Ho-167	1.12E-17	1.15E-17	9.94E-18	9.70E-18	1.95E-17	9.28E-18	9.54E-18	1.06E-17	1.24E-17
Erbium									
Er-161	3.05E-17	3.12E-17	2.78E-17	2.76E-17	4.34E-17	2.59E-17	2.68E-17	2.91E-17	3.36E-17
Er-165	3.10E-19	3.43E-19	2.24E-19	1.65E-19	1.00E-18	2.26E-19	2.10E-19	2.75E-19	3.72E-19
Er-169	8.13E-22	8.71E-22	6.41E-22	5.47E-22	2.30E-21	6.21E-22	6.05E-22	7.45E-22	9.91E-22
Er-171	1.10E-17	1.14E-17	9.80E-18	9.48E-18	2.05E-17	9.15E-18	9.38E-18	1.05E-17	1.30E-17
Er-172	1.68E-17	1.72E-17	1.50E-17	1.48E-17	2.60E-17	1.40E-17	1.44E-17	1.59E-17	1.84E-17
Thulium									
Tm-162	6.39E-17	6.46E-17	5.85E-17	5.87E-17	8.53E-17	5.53E-17	5.67E-17	6.10E-17	7.32E-17
Tm-166	6.63E-17	6.71E-17	6.05E-17	6.07E-17	8.91E-17	5.70E-17	5.86E-17	6.31E-17	7.22E-17
Tm-167	3.14E-18	3.29E-18	2.75E-18	2.58E-18	6.92E-18	2.59E-18	2.61E-18	2.99E-18	3.49E-18
Tm-170	8.42E-20	8.92E-20	7.15E-20	6.00E-20	2.62E-19	6.78E-20	6.64E-20	8.00E-20	6.38E-19
Tm-171	6.47E-21	7.03E-21	5.12E-21	3.91E-21	2.18E-20	4.99E-21	4.74E-21	5.98E-21	7.47E-21
Tm-172	1.72E-17	1.74E-17	1.58E-17	1.59E-17	2.27E-17	1.49E-17	1.53E-17	1.65E-17	2.22E-17
Tm-173	1.24E-17	1.28E-17	1.11E-17	1.09E-17	2.03E-17	1.03E-17	1.06E-17	1.18E-17	1.40E-17
Tm-175	3.58E-17	3.67E-17	3.25E-17	3.22E-17	5.15E-17	3.03E-17	3.14E-17	3.41E-17	4.16E-17
Ytterbium									
Yb-162	2.61E-18	2.74E-18	2.29E-18	2.07E-18	6.75E-18	2.15E-18	2.15E-18	2.50E-18	2.89E-18
Yb-166	8.77E-19	9.51E-19	6.92E-19	5.36E-19	2.89E-18	6.75E-19	6.42E-19	8.09E-19	1.01E-18
Yb-167	4.99E-18	5.22E-18	4.36E-18	3.95E-18	1.26E-17	4.11E-18	4.10E-18	4.76E-18	5.52E-18
Yb-169	6.20E-18	6.50E-18	5.42E-18	4.98E-18	1.50E-17	5.10E-18	5.12E-18	5.91E-18	6.88E-18
Yb-175	1.19E-18	1.22E-18	1.06E-18	1.03E-18	2.10E-18	9.87E-19	1.01E-18	1.13E-18	1.30E-18
Yb-177	6.19E-18	6.33E-18	5.67E-18	5.61E-18	9.38E-18	5.28E-18	5.46E-18	5.93E-18	8.68E-18
Yb-178	1.11E-18	1.14E-18	9.85E-19	9.65E-19	1.85E-18	9.20E-19	9.47E-19	1.05E-18	1.24E-18
Lutetium									
Lu-169	3.51E-17	3.57E-17	3.20E-17	3.19E-17	4.93E-17	3.00E-17	3.09E-17	3.35E-17	3.84E-17
Lu-170	9.19E-17	9.24E-17	8.46E-17	8.53E-17	1.18E-16	8.01E-17	8.21E-17	8.78E-17	9.95E-17
Lu-171	2.18E-17	2.24E-17	1.97E-17	1.95E-17	3.25E-17	1.84E-17	1.90E-17	2.08E-17	2.41E-17
Lu-172	6.44E-17	6.58E-17	5.89E-17	5.87E-17	9.01E-17	5.49E-17	5.69E-17	6.15E-17	7.10E-17
Lu-173	2.37E-18	2.49E-18	2.04E-18	1.86E-18	5.55E-18	1.93E-18	1.93E-18	2.23E-18	2.64E-18
Lu-174m	8.37E-19	8.90E-19	7.01E-19	6.04E-19	2.21E-18	6.70E-19	6.57E-19	7.83E-19	9.51E-19
Lu-174	3.23E-18	3.32E-18	2.91E-18	2.83E-18	5.24E-18	2.74E-18	2.80E-18	3.07E-18	3.57E-18
Lu-176m	2.29E-19	2.41E-19	1.97E-19	1.67E-19	7.07E-19	1.86E-19	1.83E-19	2.19E-19	1.94E-18
Lu-176	1.41E-17	1.47E-17	1.26E-17	1.22E-17	2.74E-17	1.18E-17	1.21E-17	1.35E-17	1.55E-17
Lu-177m	2.81E-17	2.91E-17	2.50E-17	2.41E-17	5.46E-17	2.34E-17	2.39E-17	2.68E-17	3.08E-17
Lu-177	8.83E-19	9.19E-19	7.89E-19	7.45E-19	1.99E-18	7.37E-19	7.49E-19	8.49E-19	9.72E-19
Lu-178m	3.29E-17	3.39E-17	2.93E-17	2.84E-17	5.97E-17	2.73E-17	2.81E-17	3.13E-17	3.77E-17
Lu-178	4.97E-18	5.04E-18	4.55E-18	4.55E-18	6.80E-18	4.27E-18	4.40E-18	4.74E-18	1.20E-17
Lu-179	9.09E-19	9.44E-19	8.16E-19	7.86E-19	1.83E-18	7.61E-19	7.79E-19	8.73E-19	2.99E-18

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Hafnium									
Hf-170	1.57E-17	1.62E-17	1.40E-17	1.36E-17	2.73E-17	1.31E-17	1.34E-17	1.49E-17	1.73E-17
Hf-172	1.42E-18	1.51E-18	1.17E-18	9.67E-19	4.42E-18	1.12E-18	1.09E-18	1.33E-18	1.61E-18
Hf-173	1.04E-17	1.08E-17	9.30E-18	8.83E-18	2.17E-17	8.68E-18	8.85E-18	9.97E-18	1.15E-17
Hf-175	1.05E-17	1.09E-17	9.33E-18	9.04E-18	1.89E-17	8.72E-18	8.94E-18	9.97E-18	1.15E-17
Hf-177m	6.60E-17	6.82E-17	5.90E-17	5.72E-17	1.22E-16	5.50E-17	5.65E-17	6.29E-17	7.25E-17
Hf-178m	7.35E-17	7.56E-17	6.56E-17	6.41E-17	1.23E-16	6.12E-17	6.30E-17	6.97E-17	8.05E-17
Hf-179m	2.64E-17	2.72E-17	2.35E-17	2.28E-17	4.76E-17	2.19E-17	2.25E-17	2.51E-17	2.89E-17
Hf-180m	3.03E-17	3.12E-17	2.70E-17	2.63E-17	5.32E-17	2.52E-17	2.59E-17	2.88E-17	3.32E-17
Hf-181	1.72E-17	1.77E-17	1.54E-17	1.50E-17	2.88E-17	1.43E-17	1.47E-17	1.63E-17	1.88E-17
Hf-182m	2.91E-17	2.99E-17	2.62E-17	2.56E-17	4.75E-17	2.44E-17	2.52E-17	2.77E-17	3.20E-17
Hf-182	6.99E-18	7.25E-18	6.25E-18	6.05E-18	1.34E-17	5.83E-18	5.98E-18	6.68E-18	7.68E-18
Hf-183	2.49E-17	2.55E-17	2.25E-17	2.23E-17	3.66E-17	2.10E-17	2.17E-17	2.37E-17	2.91E-17
Hf-184	6.70E-18	6.93E-18	5.96E-18	5.71E-18	1.34E-17	5.57E-18	5.69E-18	6.39E-18	7.88E-18
Tantalum									
Ta-172	5.24E-17	5.35E-17	4.77E-17	4.74E-17	7.56E-17	4.46E-17	4.61E-17	5.00E-17	6.20E-17
Ta-173	1.80E-17	1.85E-17	1.62E-17	1.59E-17	2.84E-17	1.51E-17	1.56E-17	1.71E-17	2.28E-17
Ta-174	1.93E-17	1.98E-17	1.74E-17	1.70E-17	3.16E-17	1.62E-17	1.67E-17	1.84E-17	2.42E-17
Ta-175	3.09E-17	3.14E-17	2.82E-17	2.80E-17	4.49E-17	2.65E-17	2.72E-17	2.95E-17	3.37E-17
Ta-176	7.78E-17	7.85E-17	7.14E-17	7.18E-17	1.02E-16	6.74E-17	6.92E-17	7.42E-17	8.46E-17
Ta-177	1.01E-18	1.06E-18	8.57E-19	7.43E-19	2.72E-18	8.14E-19	8.01E-19	9.49E-19	1.13E-18
Ta-178b[1]	2.93E-17	3.02E-17	2.60E-17	2.52E-17	5.41E-17	2.43E-17	2.49E-17	2.78E-17	3.21E-17
Ta-178a[2]	2.53E-18	2.60E-18	2.26E-18	2.16E-18	4.58E-18	2.13E-18	2.16E-18	2.40E-18	2.79E-18
Ta-179	3.32E-19	3.60E-19	2.66E-19	2.04E-19	1.13E-18	2.58E-19	2.46E-19	3.09E-19	3.80E-19
Ta-180m	5.47E-19	5.88E-19	4.48E-19	3.53E-19	1.82E-18	4.31E-19	4.14E-19	5.13E-19	6.30E-19
Ta-180	1.57E-17	1.63E-17	1.40E-17	1.35E-17	3.02E-17	1.31E-17	1.34E-17	1.50E-17	1.73E-17
Ta-182m	5.77E-18	6.02E-18	5.13E-18	4.79E-18	1.36E-17	4.80E-18	4.86E-18	5.55E-18	6.36E-18
Ta-182	4.44E-17	4.53E-17	4.08E-17	4.07E-17	6.19E-17	3.81E-17	3.94E-17	4.25E-17	4.90E-17
Ta-183	7.32E-18	7.61E-18	6.50E-18	6.17E-18	1.55E-17	6.08E-18	6.19E-18	6.99E-18	8.08E-18
Ta-184	5.28E-17	5.42E-17	4.78E-17	4.72E-17	8.16E-17	4.45E-17	4.61E-17	5.03E-17	5.94E-17
Ta-185	4.83E-18	5.01E-18	4.31E-18	4.08E-18	1.02E-17	4.02E-18	4.10E-18	4.62E-18	9.80E-18
Ta-186	5.07E-17	5.20E-17	4.57E-17	4.50E-17	8.01E-17	4.25E-17	4.40E-17	4.82E-17	6.47E-17
Tungsten									
W-176	2.66E-18	2.80E-18	2.30E-18	1.94E-18	8.34E-18	2.17E-18	2.13E-18	2.55E-18	2.94E-18
W-177	2.74E-17	2.82E-17	2.48E-17	2.43E-17	4.45E-17	2.31E-17	2.39E-17	2.62E-17	3.03E-17
W-178	1.43E-19	1.55E-19	1.17E-19	9.03E-20	4.88E-19	1.12E-19	1.08E-19	1.34E-19	1.63E-19
W-179	5.61E-19	6.10E-19	4.38E-19	3.40E-19	1.84E-18	4.27E-19	4.08E-19	5.15E-19	6.56E-19
W-181	4.37E-19	4.72E-19	3.56E-19	2.77E-19	1.48E-18	3.43E-19	3.29E-19	4.09E-19	4.98E-19
W-185	2.47E-21	2.61E-21	2.06E-21	1.80E-21	6.97E-21	1.96E-21	1.93E-21	2.32E-21	2.85E-21
W-187	1.55E-17	1.59E-17	1.40E-17	1.37E-17	2.36E-17	1.30E-17	1.34E-17	1.47E-17	1.76E-17
W-188	5.42E-20	5.63E-20	4.83E-20	4.65E-20	1.06E-19	4.51E-20	4.62E-20	5.18E-20	5.97E-20
Rhenium									
Re-177	1.97E-17	2.01E-17	1.78E-17	1.76E-17	3.00E-17	1.67E-17	1.71E-17	1.87E-17	2.43E-17
Re-178	4.19E-17	4.25E-17	3.82E-17	3.81E-17	6.03E-17	3.60E-17	3.69E-17	4.00E-17	5.18E-17
Re-180	3.93E-17	4.04E-17	3.59E-17	3.56E-17	5.66E-17	3.34E-17	3.47E-17	3.76E-17	4.41E-17
Re-181	2.41E-17	2.47E-17	2.17E-17	2.13E-17	3.81E-17	2.03E-17	2.09E-17	2.29E-17	2.65E-17
Re-182b[3]	6.12E-17	6.26E-17	5.58E-17	5.52E-17	9.30E-17	5.22E-17	5.38E-17	5.85E-17	6.73E-17
Re-182a[4]	3.97E-17	4.04E-17	3.64E-17	3.62E-17	5.56E-17	3.40E-17	3.52E-17	3.79E-17	4.37E-17
Re-184m	1.15E-17	1.18E-17	1.04E-17	1.01E-17	1.93E-17	9.65E-18	9.95E-18	1.09E-17	1.26E-17
Re-184	2.93E-17	3.01E-17	2.68E-17	2.65E-17	4.25E-17	2.49E-17	2.58E-17	2.80E-17	3.25E-17
Re-186m	1.59E-19	1.71E-19	1.28E-19	1.01E-19	5.23E-19	1.24E-19	1.19E-19	1.48E-19	1.84E-19
Re-186	4.34E-19	4.52E-19	3.85E-19	3.49E-19	1.15E-18	3.60E-19	3.61E-19	4.18E-19	1.24E-18
Re-187	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re-188m	1.09E-18	1.15E-18	9.27E-19	7.69E-19	3.50E-18	8.78E-19	8.59E-19	1.04E-18	1.21E-18
Re-188	1.80E-18	1.85E-18	1.63E-18	1.58E-18	3.23E-18	1.52E-18	1.56E-18	1.72E-18	8.66E-18
Re-189	1.87E-18	1.94E-18	1.67E-18	1.59E-18	3.86E-18	1.56E-18	1.59E-18	1.79E-18	2.59E-18
Osmium									
Os-180	9.07E-19	9.59E-19	7.71E-19	6.65E-19	2.49E-18	7.31E-19	7.21E-19	8.56E-19	1.03E-18

[1] $T_{1/2}$ = 2.2 h
[2] $T_{1/2}$ = 9.31 m
[3] $T_{1/2}$ = 64.0 h
[4] $T_{1/2}$ = 12.7 h

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

Nuclide	Dose Coefficient h_T (Sv per Bq s m^{-3})								
	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Osmium, cont'd									
Os-181	4.03E-17	4.12E-17	3.67E-17	3.64E-17	5.97E-17	3.43E-17	3.54E-17	3.85E-17	4.44E-17
Os-182	1.26E-17	1.30E-17	1.13E-17	1.09E-17	2.21E-17	1.05E-17	1.08E-17	1.20E-17	1.39E-17
Os-185	2.35E-17	2.41E-17	2.12E-17	2.09E-17	3.48E-17	1.97E-17	2.04E-17	2.23E-17	2.59E-17
Os-189m	1.05E-23	2.38E-23	1.58E-25	8.20E-25	4.96E-24	1.02E-24	2.64E-24	7.28E-24	5.34E-22
Os-190m	5.16E-17	5.30E-17	4.62E-17	4.55E-17	8.16E-17	4.31E-17	4.45E-17	4.89E-17	5.66E-17
Os-191m	9.07E-20	9.70E-20	7.61E-20	6.08E-20	3.08E-19	7.25E-20	7.05E-20	8.62E-20	1.03E-19
Os-191	1.34E-18	1.40E-18	1.18E-18	1.03E-18	3.92E-18	1.10E-18	1.09E-18	1.29E-18	1.48E-18
Os-193	2.07E-18	2.14E-18	1.85E-18	1.78E-18	3.82E-18	1.72E-18	1.77E-18	1.97E-18	3.14E-18
Os-194	7.38E-21	8.27E-21	4.76E-21	3.43E-21	2.17E-20	5.00E-21	4.55E-21	6.23E-21	9.77E-21
Iridium									
Ir-182	4.41E-17	4.52E-17	3.98E-17	3.93E-17	6.77E-17	3.71E-17	3.84E-17	4.19E-17	6.06E-17
Ir-184	6.46E-17	6.58E-17	5.88E-17	5.84E-17	9.42E-17	5.50E-17	5.67E-17	6.16E-17	7.27E-17
Ir-185	1.99E-17	2.01E-17	1.81E-17	1.81E-17	2.86E-17	1.72E-17	1.75E-17	1.90E-17	2.16E-17
Ir-186a[1]	5.53E-17	5.63E-17	5.02E-17	4.99E-17	8.13E-17	4.71E-17	4.85E-17	5.27E-17	6.04E-17
Ir-186b[2]	3.17E-17	3.24E-17	2.87E-17	2.84E-17	4.73E-17	2.68E-17	2.77E-17	3.01E-17	3.62E-17
Ir-187	1.08E-17	1.11E-17	9.73E-18	9.52E-18	1.74E-17	9.07E-18	9.36E-18	1.03E-17	1.19E-17
Ir-188	5.67E-17	5.71E-17	5.18E-17	5.19E-17	7.63E-17	4.89E-17	5.01E-17	5.40E-17	6.12E-17
Ir-189	1.38E-18	1.45E-18	1.20E-18	1.06E-18	3.69E-18	1.13E-18	1.12E-18	1.31E-18	1.53E-18
Ir-190n[3]	4.95E-17	5.09E-17	4.43E-17	4.35E-17	7.93E-17	4.13E-17	4.26E-17	4.70E-17	5.43E-17
Ir-190m[4]	1.34E-23	2.97E-23	5.64E-26	9.87E-25	5.83E-24	1.09E-24	3.13E-24	9.07E-24	5.86E-22
Ir-190	4.57E-17	4.69E-17	4.10E-17	4.02E-17	7.34E-17	3.82E-17	3.94E-17	4.34E-17	5.01E-17
Ir-191m	1.28E-18	1.34E-18	1.12E-18	9.84E-19	3.70E-18	1.05E-18	1.04E-18	1.23E-18	1.40E-18
Ir-192m	4.16E-18	4.33E-18	3.74E-18	3.53E-18	9.72E-18	3.49E-18	3.54E-18	4.02E-18	4.56E-18
Ir-192	2.60E-17	2.68E-17	2.32E-17	2.28E-17	4.34E-17	2.17E-17	2.23E-17	2.47E-17	2.85E-17
Ir-194m	7.70E-17	7.90E-17	6.90E-17	6.81E-17	1.19E-16	6.44E-17	6.65E-17	7.30E-17	8.44E-17
Ir-194	3.07E-18	3.16E-18	2.77E-18	2.73E-18	4.88E-18	2.59E-18	2.67E-18	2.93E-18	1.09E-17
Ir-195m	1.21E-17	1.25E-17	1.08E-17	1.05E-17	2.14E-17	1.01E-17	1.04E-17	1.15E-17	1.35E-17
Ir-195	9.16E-19	9.64E-19	7.96E-19	6.84E-19	2.78E-18	7.49E-19	7.41E-19	8.79E-19	1.67E-18
Platinum									
Pt-186	2.42E-17	2.48E-17	2.18E-17	2.16E-17	3.58E-17	2.03E-17	2.11E-17	2.30E-17	2.66E-17
Pt-188	4.73E-18	4.92E-18	4.19E-18	3.93E-18	1.04E-17	3.92E-18	3.98E-18	4.51E-18	5.20E-18
Pt-189	8.93E-18	9.20E-18	8.00E-18	7.73E-18	1.57E-17	7.48E-18	7.67E-18	8.50E-18	9.84E-18
Pt-191	7.65E-18	7.91E-18	6.77E-18	6.43E-18	1.49E-17	6.33E-18	6.46E-18	7.26E-18	8.40E-18
Pt-193m	1.44E-19	1.52E-19	1.22E-19	1.00E-19	4.81E-19	1.16E-19	1.13E-19	1.37E-19	1.61E-19
Pt-193	4.65E-23	9.70E-23	1.62E-25	3.52E-24	2.06E-23	3.60E-24	1.00E-23	3.03E-23	1.66E-21
Pt-195m	1.05E-18	1.11E-18	9.10E-19	7.64E-19	3.38E-18	8.58E-19	8.44E-19	1.01E-18	1.17E-18
Pt-197m	1.87E-18	1.95E-18	1.65E-18	1.55E-18	3.99E-18	1.55E-18	1.57E-18	1.78E-18	2.07E-18
Pt-197	4.50E-19	4.71E-19	3.97E-19	3.55E-19	1.24E-18	3.72E-19	3.72E-19	4.33E-19	5.33E-19
Pt-199	6.61E-18	6.78E-18	5.93E-18	5.84E-18	1.04E-17	5.53E-18	5.71E-18	6.27E-18	1.01E-17
Pt-200	1.25E-18	1.30E-18	1.10E-18	1.01E-18	3.06E-18	1.03E-18	1.04E-18	1.20E-18	1.40E-18
Gold									
Au-193	3.39E-18	3.54E-18	3.00E-18	2.76E-18	8.01E-18	2.81E-18	2.83E-18	3.24E-18	3.74E-18
Au-194	3.66E-17	3.72E-17	3.34E-17	3.32E-17	5.24E-17	3.14E-17	3.22E-17	3.49E-17	3.99E-17
Au-195m	5.67E-18	5.89E-18	5.07E-18	4.90E-18	1.11E-17	4.73E-18	4.85E-18	5.43E-18	6.24E-18
Au-195	1.16E-18	1.23E-18	9.97E-19	8.27E-19	3.80E-18	9.41E-19	9.24E-19	1.11E-18	1.29E-18
Au-198m	1.46E-17	1.52E-17	1.31E-17	1.24E-17	3.27E-17	1.22E-17	1.24E-17	1.41E-17	1.61E-17
Au-198	1.31E-17	1.35E-17	1.17E-17	1.15E-17	2.11E-17	1.09E-17	1.13E-17	1.24E-17	1.49E-17
Au-199	2.16E-18	2.25E-18	1.94E-18	1.82E-18	5.13E-18	1.81E-18	1.83E-18	2.09E-18	2.37E-18
Au-200m	6.84E-17	7.03E-17	6.16E-17	6.08E-17	1.06E-16	5.74E-17	5.94E-17	6.51E-17	7.52E-17
Au-200	9.63E-18	9.81E-18	8.79E-18	8.77E-18	1.35E-17	8.22E-18	8.49E-18	9.18E-18	1.72E-17
Au-201	1.74E-18	1.79E-18	1.56E-18	1.53E-18	2.73E-18	1.45E-18	1.50E-18	1.65E-18	3.42E-18
Mercury									
Hg-193m	3.40E-17	3.48E-17	3.09E-17	3.05E-17	5.21E-17	2.88E-17	2.97E-17	3.24E-17	3.73E-17
Hg-193	4.37E-18	4.55E-18	3.87E-18	3.58E-18	1.03E-17	3.62E-18	3.66E-18	4.18E-18	4.86E-18
Hg-194	9.47E-23	1.82E-22	4.09E-25	7.60E-24	4.40E-23	7.13E-24	1.83E-23	5.89E-23	2.32E-21
Hg-195m	5.90E-18	6.09E-18	5.28E-18	5.11E-18	1.08E-17	4.93E-18	5.05E-18	5.62E-18	6.49E-18
Hg-195	5.58E-18	5.74E-18	5.03E-18	4.88E-18	9.63E-18	4.69E-18	4.83E-18	5.32E-18	6.17E-18

[1] $T_{½}$ = 15.8 h
[2] $T_{½}$ = 1.75 h
[3] $T_{½}$ = 3.1 h
[4] $T_{½}$ = 1.2 h

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Mercury, cont'd									
Hg-197m	1.96E-18	2.04E-18	1.75E-18	1.60E-18	5.04E-18	1.63E-18	1.64E-18	1.89E-18	2.15E-18
Hg-197	9.57E-19	1.01E-18	8.25E-19	6.84E-19	3.16E-18	7.78E-19	7.65E-19	9.20E-19	1.06E-18
Hg-199m	4.50E-18	4.67E-18	4.01E-18	3.77E-18	1.01E-17	3.74E-18	3.80E-18	4.31E-18	4.94E-18
Hg-203	7.08E-18	7.33E-18	6.33E-18	6.14E-18	1.33E-17	5.90E-18	6.06E-18	6.76E-18	7.77E-18
Thallium									
Tl-194m	7.63E-17	7.83E-17	6.87E-17	6.78E-17	1.16E-16	6.40E-17	6.62E-17	7.24E-17	8.64E-17
Tl-194	2.48E-17	2.54E-17	2.22E-17	2.18E-17	3.91E-17	2.07E-17	2.14E-17	2.35E-17	2.72E-17
Tl-195	4.45E-17	4.51E-17	4.07E-17	4.07E-17	6.11E-17	3.83E-17	3.94E-17	4.25E-17	4.87E-17
Tl-197	1.24E-17	1.27E-17	1.12E-17	1.10E-17	2.02E-17	1.05E-17	1.08E-17	1.18E-17	1.37E-17
Tl-198m	3.84E-17	3.94E-17	3.45E-17	3.39E-17	6.03E-17	3.21E-17	3.32E-17	3.65E-17	4.22E-17
Tl-198	7.15E-17	7.22E-17	6.52E-17	6.53E-17	9.71E-17	6.15E-17	6.31E-17	6.81E-17	7.75E-17
Tl-199	6.61E-18	6.83E-18	5.90E-18	5.65E-18	1.28E-17	5.51E-18	5.64E-18	6.30E-18	7.27E-18
Tl-200	4.43E-17	4.52E-17	4.03E-17	4.00E-17	6.43E-17	3.77E-17	3.89E-17	4.22E-17	4.86E-17
Tl-201	1.53E-18	1.61E-18	1.34E-18	1.17E-18	4.57E-18	1.26E-18	1.25E-18	1.48E-18	1.69E-18
Tl-202	1.42E-17	1.46E-17	1.26E-17	1.23E-17	2.38E-17	1.18E-17	1.21E-17	1.34E-17	1.55E-17
Tl-204	2.27E-20	2.39E-20	1.95E-20	1.66E-20	6.95E-20	1.84E-20	1.82E-20	2.17E-20	1.96E-19
Tl-206	4.34E-20	4.51E-20	3.81E-20	3.57E-20	9.41E-20	3.57E-20	3.62E-20	4.12E-20	3.05E-18
Tl-207	1.11E-19	1.14E-19	1.00E-19	9.83E-20	1.82E-19	9.35E-20	9.66E-20	1.06E-19	2.53E-18
Tl-208	1.28E-16	1.29E-16	1.18E-16	1.19E-16	1.63E-16	1.13E-16	1.15E-16	1.23E-16	1.41E-16
Tl-209	7.27E-17	7.34E-17	6.63E-17	6.64E-17	9.91E-17	6.25E-17	6.41E-17	6.92E-17	8.35E-17
Lead									
Pb-195m	5.22E-17	5.35E-17	4.71E-17	4.65E-17	8.00E-17	4.39E-17	4.54E-17	4.96E-17	5.83E-17
Pb-198	1.25E-17	1.29E-17	1.12E-17	1.08E-17	2.30E-17	1.04E-17	1.07E-17	1.19E-17	1.38E-17
Pb-199	5.10E-17	5.18E-17	4.64E-17	4.63E-17	7.21E-17	4.36E-17	4.49E-17	4.86E-17	5.56E-17
Pb-200	4.68E-18	4.87E-18	4.17E-18	3.86E-18	1.11E-17	3.89E-18	3.94E-18	4.50E-18	5.14E-18
Pb-201	2.40E-17	2.47E-17	2.17E-17	2.13E-17	3.83E-17	2.02E-17	2.09E-17	2.29E-17	2.64E-17
Pb-202m	6.97E-17	7.14E-17	6.34E-17	6.29E-17	9.99E-17	5.89E-17	6.12E-17	6.64E-17	7.69E-17
Pb-202	4.97E-23	1.06E-22	1.71E-25	3.72E-24	2.18E-23	3.97E-24	1.11E-23	3.30E-23	2.07E-21
Pb-203	8.41E-18	8.72E-18	7.50E-18	7.18E-18	1.68E-17	7.00E-18	7.16E-18	8.03E-18	9.24E-18
Pb-205	5.76E-23	1.21E-22	2.14E-25	4.38E-24	2.57E-23	4.58E-24	1.26E-23	3.78E-23	2.24E-21
Pb-209	4.41E-21	4.65E-21	3.72E-21	3.33E-21	1.15E-20	3.53E-21	3.50E-21	4.14E-21	3.91E-20
Pb-210	1.51E-20	1.70E-20	1.03E-20	7.48E-21	4.68E-20	1.06E-20	9.70E-21	1.31E-20	2.26E-20
Pb-211	1.73E-18	1.77E-18	1.56E-18	1.54E-18	2.57E-18	1.45E-18	1.51E-18	1.64E-18	3.91E-18
Pb-212	3.93E-18	4.09E-18	3.52E-18	3.35E-18	8.30E-18	3.28E-18	3.35E-18	3.77E-18	4.32E-18
Pb-214	7.54E-18	7.78E-18	6.74E-18	6.56E-18	1.34E-17	6.29E-18	6.46E-18	7.18E-18	8.38E-18
Bismuth									
Bi-200	7.95E-17	8.15E-17	7.20E-17	7.13E-17	1.19E-16	6.71E-17	6.95E-17	7.57E-17	8.87E-17
Bi-201	4.50E-17	4.61E-17	4.11E-17	4.08E-17	6.45E-17	3.82E-17	3.96E-17	4.30E-17	5.02E-17
Bi-202	9.27E-17	9.47E-17	8.44E-17	8.39E-17	1.32E-16	7.87E-17	8.15E-17	8.84E-17	1.02E-16
Bi-203	8.54E-17	8.64E-17	7.81E-17	7.83E-17	1.14E-16	7.35E-17	7.56E-17	8.14E-17	9.31E-17
Bi-205	6.04E-17	6.11E-17	5.52E-17	5.54E-17	8.09E-17	5.20E-17	5.35E-17	5.76E-17	6.57E-17
Bi-206	1.13E-16	1.15E-16	1.03E-16	1.03E-16	1.59E-16	9.63E-17	9.96E-17	1.08E-16	1.24E-16
Bi-207	5.27E-17	5.38E-17	4.80E-17	4.77E-17	7.44E-17	4.47E-17	4.64E-17	5.02E-17	5.87E-17
Bi-210m	7.72E-18	7.99E-18	6.91E-18	6.72E-18	1.42E-17	6.45E-18	6.62E-18	7.37E-18	8.48E-18
Bi-210	2.03E-20	2.12E-20	1.77E-20	1.64E-20	4.71E-20	1.66E-20	1.67E-20	1.93E-20	1.20E-18
Bi-211	1.45E-18	1.49E-18	1.29E-18	1.26E-18	2.50E-18	1.20E-18	1.24E-18	1.37E-18	1.58E-18
Bi-212	6.58E-18	6.70E-18	6.00E-18	5.99E-18	8.99E-18	5.61E-18	5.80E-18	6.27E-18	1.13E-17
Bi-213	4.33E-18	4.45E-18	3.87E-18	3.80E-18	6.90E-18	3.61E-18	3.72E-18	4.10E-18	6.47E-18
Bi-214	5.52E-17	5.57E-17	5.05E-17	5.07E-17	7.24E-17	4.75E-17	4.89E-17	5.25E-17	6.51E-17
Polonium									
Po-203	5.66E-17	5.77E-17	5.18E-17	5.17E-17	7.93E-17	4.84E-17	5.01E-17	5.41E-17	6.30E-17
Po-205	5.44E-17	5.55E-17	4.98E-17	4.97E-17	7.60E-17	4.65E-17	4.82E-17	5.20E-17	6.00E-17
Po-207	4.51E-17	4.62E-17	4.13E-17	4.11E-17	6.42E-17	3.84E-17	3.99E-17	4.31E-17	4.99E-17
Po-210	2.94E-22	3.01E-22	2.68E-22	2.67E-22	4.10E-22	2.49E-22	2.59E-22	2.80E-22	3.25E-22
Po-211	2.68E-19	2.75E-19	2.44E-19	2.42E-19	3.80E-19	2.27E-19	2.35E-19	2.55E-19	2.96E-19
Po-212	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-213	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Po-214	2.88E-21	2.95E-21	2.63E-21	2.61E-21	4.02E-21	2.44E-21	2.54E-21	2.75E-21	3.18E-21
Po-215	5.75E-21	5.90E-21	5.12E-21	5.04E-21	9.10E-21	4.78E-21	4.93E-21	5.44E-21	6.28E-21
Po-216	5.85E-22	6.00E-22	5.34E-22	5.32E-22	8.16E-22	4.96E-22	5.16E-22	5.58E-22	6.48E-22
Po-218	3.16E-22	3.24E-22	2.89E-22	2.88E-22	4.39E-22	2.68E-22	2.79E-22	3.02E-22	3.50E-22

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Astatine									
At-207	4.54E-17	4.62E-17	4.13E-17	4.12E-17	6.44E-17	3.87E-17	3.99E-17	4.33E-17	4.96E-17
At-211	6.43E-19	6.73E-19	5.66E-19	4.89E-19	1.96E-18	5.30E-19	5.26E-19	6.21E-19	7.07E-19
At-215	6.22E-21	6.39E-21	5.54E-21	5.44E-21	1.01E-20	5.17E-21	5.33E-21	5.89E-21	6.80E-21
At-216	2.50E-20	2.62E-20	2.20E-20	1.90E-20	7.79E-20	2.06E-20	2.04E-20	2.42E-20	2.74E-20
At-217	1.00E-20	1.03E-20	8.98E-21	8.83E-21	1.57E-20	8.37E-21	8.64E-21	9.49E-21	1.10E-20
At-218	3.43E-20	3.77E-20	2.63E-20	1.97E-20	1.14E-19	2.59E-20	2.44E-20	3.13E-20	4.45E-20
Radon									
Rn-218	2.57E-20	2.63E-20	2.31E-20	2.28E-20	3.74E-20	2.15E-20	2.23E-20	2.43E-20	2.82E-20
Rn-219	1.73E-18	1.79E-18	1.55E-18	1.51E-18	3.05E-18	1.44E-18	1.48E-18	1.65E-18	1.90E-18
Rn-220	1.30E-20	1.33E-20	1.16E-20	1.15E-20	1.93E-20	1.08E-20	1.12E-20	1.23E-20	1.42E-20
Rn-222	1.33E-20	1.36E-20	1.19E-20	1.17E-20	2.02E-20	1.11E-20	1.14E-20	1.26E-20	1.45E-20
Francium									
Fr-219	1.10E-19	1.13E-19	9.81E-20	9.60E-20	1.84E-19	9.16E-20	9.43E-20	1.04E-19	1.20E-19
Fr-220	2.53E-19	2.63E-19	2.26E-19	2.10E-19	6.24E-19	2.11E-19	2.13E-19	2.44E-19	2.79E-19
Fr-221	8.55E-19	8.89E-19	7.67E-19	7.36E-19	1.79E-18	7.15E-19	7.31E-19	8.22E-19	9.41E-19
Fr-222	8.01E-20	8.32E-20	7.08E-20	6.72E-20	1.64E-19	6.63E-20	6.74E-20	7.62E-20	6.19E-18
Fr-223	1.12E-18	1.17E-18	9.76E-19	9.00E-19	2.56E-18	9.18E-19	9.24E-19	1.06E-18	2.05E-18
Radium									
Ra-222	2.85E-19	2.95E-19	2.55E-19	2.49E-19	5.02E-19	2.38E-19	2.44E-19	2.71E-19	3.13E-19
Ra-223	3.37E-18	3.49E-18	3.01E-18	2.84E-18	7.33E-18	2.81E-18	2.86E-18	3.23E-18	3.70E-18
Ra-224	2.86E-19	2.97E-19	2.56E-19	2.48E-19	5.67E-19	2.39E-19	2.45E-19	2.74E-19	3.14E-19
Ra-225	7.32E-20	8.30E-20	4.20E-20	2.98E-20	1.96E-19	4.59E-20	4.11E-20	5.90E-20	9.88E-20
Ra-226	1.76E-19	1.83E-19	1.58E-19	1.50E-19	3.93E-19	1.47E-19	1.50E-19	1.70E-19	1.94E-19
Ra-227	4.78E-18	4.92E-18	4.26E-18	4.16E-18	8.28E-18	3.98E-18	4.09E-18	4.54E-18	6.38E-18
Ra-228	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Actinium									
Ac-223	1.21E-19	1.25E-19	1.08E-19	1.03E-19	2.42E-19	1.00E-19	1.03E-19	1.15E-19	1.35E-19
Ac-224	4.71E-18	4.90E-18	4.21E-18	3.93E-18	1.13E-17	3.93E-18	3.98E-18	4.54E-18	5.17E-18
Ac-225	3.54E-19	3.67E-19	3.15E-19	2.89E-19	9.05E-19	2.94E-19	2.96E-19	3.41E-19	3.90E-19
Ac-226	3.44E-18	3.57E-18	3.08E-18	2.94E-18	7.44E-18	2.87E-18	2.93E-18	3.31E-18	4.24E-18
Ac-227	2.76E-21	2.88E-21	2.43E-21	2.22E-21	7.20E-21	2.27E-21	2.29E-21	2.65E-21	3.22E-21
Ac-228	3.36E-17	3.43E-17	3.07E-17	3.06E-17	4.70E-17	2.86E-17	2.96E-17	3.20E-17	3.87E-17
Thorium									
Th-226	1.84E-19	1.91E-19	1.65E-19	1.53E-19	4.55E-19	1.54E-19	1.55E-19	1.78E-19	2.03E-19
Th-227	2.92E-18	3.03E-18	2.60E-18	2.50E-18	5.77E-18	2.43E-18	2.48E-18	2.79E-18	3.22E-18
Th-228	4.42E-20	4.62E-20	3.91E-20	3.58E-20	1.13E-19	3.65E-20	3.68E-20	4.25E-20	5.08E-20
Th-229	1.78E-18	1.85E-18	1.58E-18	1.43E-18	4.84E-18	1.48E-18	1.48E-18	1.72E-18	1.97E-18
Th-230	6.88E-21	7.38E-21	5.72E-21	5.03E-21	1.91E-20	5.41E-21	5.39E-21	6.47E-21	9.79E-21
Th-231	2.07E-19	2.19E-19	1.72E-19	1.51E-19	6.02E-19	1.63E-19	1.62E-19	1.95E-19	2.56E-19
Th-232	3.07E-21	3.38E-21	2.36E-21	2.04E-21	8.51E-21	2.26E-21	2.24E-21	2.79E-21	5.55E-21
Th-234	1.34E-19	1.41E-19	1.17E-19	1.01E-19	4.17E-19	1.10E-19	1.09E-19	1.29E-19	1.50E-19
Protactinium									
Pa-227	3.53E-19	3.68E-19	3.11E-19	2.70E-19	1.07E-18	2.91E-19	2.88E-19	3.41E-19	3.90E-19
Pa-228	3.80E-17	3.88E-17	3.47E-17	3.44E-17	5.56E-17	3.23E-17	3.34E-17	3.63E-17	4.18E-17
Pa-230	2.13E-17	2.19E-17	1.94E-17	1.92E-17	3.17E-17	1.81E-17	1.88E-17	2.04E-17	2.35E-17
Pa-231	1.08E-18	1.11E-18	9.52E-19	9.26E-19	1.96E-18	8.90E-19	9.13E-19	1.02E-18	1.20E-18
Pa-232	3.19E-17	3.27E-17	2.91E-17	2.89E-17	4.54E-17	2.70E-17	2.81E-17	3.04E-17	3.52E-17
Pa-233	5.73E-18	5.91E-18	5.11E-18	4.93E-18	1.10E-17	4.77E-18	4.88E-18	5.46E-18	6.28E-18
Pa-234m	5.02E-19	5.15E-19	4.57E-19	4.52E-19	7.64E-19	4.26E-19	4.41E-19	4.80E-19	8.27E-18
Pa-234	6.48E-17	6.63E-17	5.91E-17	5.87E-17	9.34E-17	5.50E-17	5.71E-17	6.18E-17	7.18E-17
Uranium									
U-230	2.47E-20	2.60E-20	2.13E-20	1.96E-20	6.05E-20	2.00E-20	2.02E-20	2.34E-20	3.09E-20
U-231	1.28E-18	1.34E-18	1.13E-18	1.01E-18	3.75E-18	1.06E-18	1.06E-18	1.24E-18	1.43E-18
U-232	5.38E-21	5.92E-21	4.05E-21	3.64E-21	1.32E-20	3.89E-21	3.87E-21	4.83E-21	9.78E-21
U-233	8.00E-21	8.47E-21	6.73E-21	6.32E-21	1.75E-20	6.34E-21	6.42E-21	7.48E-21	1.08E-20
U-234	2.53E-21	2.89E-21	1.64E-21	1.47E-21	5.96E-21	1.62E-21	1.61E-21	2.15E-21	5.99E-21
U-235	4.00E-18	4.16E-18	3.59E-18	3.40E-18	9.04E-18	3.35E-18	3.41E-18	3.86E-18	4.40E-18
U-236	1.46E-21	1.76E-21	7.46E-22	6.81E-22	2.99E-21	7.77E-22	7.71E-22	1.15E-21	4.61E-21
U-237	2.96E-18	3.08E-18	2.63E-18	2.42E-18	7.36E-18	2.45E-18	2.47E-18	2.84E-18	3.27E-18
U-238	8.19E-22	1.06E-21	2.34E-22	2.18E-22	1.32E-21	2.91E-22	2.86E-22	5.52E-22	3.55E-21
U-239	9.68E-19	1.01E-18	8.51E-19	7.63E-19	2.50E-18	7.98E-19	8.01E-19	9.27E-19	2.37E-18
U-240	1.04E-20	1.24E-20	4.38E-21	3.59E-21	2.16E-20	5.07E-21	4.68E-21	7.62E-21	2.67E-20

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Neptunium									
Np-232	3.93E-17	4.04E-17	3.58E-17	3.54E-17	5.97E-17	3.33E-17	3.45E-17	3.76E-17	4.35E-17
Np-233	1.81E-18	1.87E-18	1.61E-18	1.45E-18	4.93E-18	1.50E-18	1.51E-18	1.74E-18	1.98E-18
Np-234	5.19E-17	5.24E-17	4.76E-17	4.78E-17	6.87E-17	4.48E-17	4.61E-17	4.95E-17	5.66E-17
Np-235	1.93E-20	2.11E-20	1.43E-20	1.29E-20	4.95E-20	1.38E-20	1.37E-20	1.73E-20	3.39E-20
Np-236a[1]	2.55E-18	2.65E-18	2.28E-18	2.07E-18	6.88E-18	2.12E-18	2.13E-18	2.47E-18	2.82E-18
Np-236b[2]	1.05E-18	1.09E-18	9.40E-19	8.61E-19	2.66E-18	8.75E-19	8.82E-19	1.01E-18	1.16E-18
Np-237	4.37E-19	4.59E-19	3.78E-19	3.34E-19	1.25E-18	3.55E-19	3.53E-19	4.17E-19	5.03E-19
Np-238	1.92E-17	1.97E-17	1.77E-17	1.77E-17	2.61E-17	1.64E-17	1.71E-17	1.84E-17	2.20E-17
Np-239	4.19E-18	4.35E-18	3.75E-18	3.53E-18	9.52E-18	3.50E-18	3.55E-18	4.03E-18	4.61E-18
Np-240m	1.14E-17	1.16E-17	1.03E-17	1.02E-17	1.64E-17	9.58E-18	9.91E-18	1.08E-17	1.72E-17
Np-240	4.34E-17	4.45E-17	3.95E-17	3.91E-17	6.41E-17	3.67E-17	3.81E-17	4.14E-17	4.82E-17
Plutonium									
Pu-234	1.28E-18	1.33E-18	1.14E-18	1.02E-18	3.70E-18	1.06E-18	1.06E-18	1.24E-18	1.40E-18
Pu-235	1.86E-18	1.93E-18	1.67E-18	1.52E-18	4.94E-18	1.55E-18	1.56E-18	1.80E-18	2.05E-18
Pu-236	1.75E-21	2.16E-21	6.01E-22	6.04E-22	2.62E-21	7.09E-22	6.99E-22	1.22E-21	6.18E-21
Pu-237	8.95E-19	9.30E-19	7.95E-19	7.07E-19	2.60E-18	7.42E-19	7.40E-19	8.66E-19	9.89E-19
Pu-238	1.26E-21	1.60E-21	2.99E-22	3.32E-22	1.57E-21	4.04E-22	4.00E-22	8.10E-22	5.09E-21
Pu-239	1.82E-21	1.99E-21	1.31E-21	1.25E-21	3.40E-21	1.27E-21	1.28E-21	1.58E-21	3.38E-21
Pu-240	1.21E-21	1.55E-21	2.93E-22	3.18E-22	1.58E-21	3.95E-22	3.89E-22	7.85E-22	4.87E-21
Pu-241	3.28E-23	3.42E-23	2.89E-23	2.60E-23	9.16E-23	2.70E-23	2.70E-23	3.16E-23	3.78E-23
Pu-242	1.04E-21	1.32E-21	2.75E-22	2.93E-22	1.41E-21	3.57E-22	3.52E-22	6.85E-22	4.08E-21
Pu-243	4.43E-19	4.62E-19	3.90E-19	3.44E-19	1.27E-18	3.65E-19	3.64E-19	4.26E-19	4.96E-19
Pu-244	7.00E-22	9.29E-22	7.05E-23	1.06E-22	6.55E-22	1.50E-22	1.49E-22	4.04E-22	3.27E-21
Pu-245	1.34E-17	1.38E-17	1.21E-17	1.19E-17	2.11E-17	1.13E-17	1.17E-17	1.28E-17	1.52E-17
Pu-246	3.16E-18	3.29E-18	2.81E-18	2.63E-18	7.40E-18	2.62E-18	2.66E-18	3.03E-18	3.49E-18
Americium									
Am-237	1.04E-17	1.07E-17	9.29E-18	8.97E-18	1.98E-17	8.66E-18	8.88E-18	9.91E-18	1.14E-17
Am-238	2.98E-17	3.05E-17	2.73E-17	2.71E-17	4.32E-17	2.54E-17	2.63E-17	2.85E-17	3.30E-17
Am-239	5.39E-18	5.59E-18	4.82E-18	4.49E-18	1.30E-17	4.49E-18	4.55E-18	5.19E-18	5.92E-18
Am-240	3.47E-17	3.55E-17	3.18E-17	3.17E-17	4.91E-17	2.95E-17	3.07E-17	3.32E-17	3.84E-17
Am-241	2.53E-19	2.74E-19	2.01E-19	1.57E-19	8.43E-19	1.94E-19	1.86E-19	2.34E-19	3.10E-19
Am-242m	1.10E-20	1.23E-20	6.67E-21	6.16E-21	2.38E-20	6.79E-21	6.65E-21	9.04E-21	2.22E-20
Am-242	2.77E-19	2.89E-19	2.45E-19	2.19E-19	7.86E-19	2.29E-19	2.28E-19	2.67E-19	3.37E-19
Am-243	7.91E-19	8.36E-19	6.82E-19	5.68E-19	2.60E-18	6.43E-19	6.33E-19	7.60E-19	8.80E-19
Am-244m	3.75E-20	3.93E-20	3.17E-20	2.98E-20	8.05E-20	3.00E-20	3.03E-20	3.50E-20	2.62E-18
Am-244	2.68E-17	2.75E-17	2.44E-17	2.42E-17	3.85E-17	2.27E-17	2.36E-17	2.55E-17	2.98E-17
Am-245	8.07E-19	8.37E-19	7.22E-19	6.81E-19	1.82E-18	6.73E-19	6.84E-19	7.75E-19	1.15E-18
Am-246m	3.56E-17	3.64E-17	3.27E-17	3.27E-17	4.85E-17	3.04E-17	3.16E-17	3.41E-17	4.14E-17
Am-246	2.21E-17	2.27E-17	2.00E-17	1.97E-17	3.45E-17	1.86E-17	1.92E-17	2.10E-17	2.53E-17
Curium									
Cm-238	1.50E-18	1.55E-18	1.34E-18	1.20E-18	4.24E-18	1.25E-18	1.25E-18	1.45E-18	1.64E-18
Cm-240	1.46E-21	1.88E-21	1.56E-22	2.26E-22	1.41E-21	3.39E-22	3.19E-22	8.41E-22	5.87E-21
Cm-241	1.49E-17	1.53E-17	1.33E-17	1.29E-17	2.56E-17	1.24E-17	1.27E-17	1.41E-17	1.63E-17
Cm-242	1.48E-21	1.87E-21	2.87E-22	3.45E-22	1.61E-21	4.42E-22	4.24E-22	9.15E-22	5.49E-21
Cm-243	3.25E-18	3.37E-18	2.91E-18	2.75E-18	7.26E-18	2.71E-18	2.75E-18	3.12E-18	3.58E-18
Cm-244	1.19E-21	1.54E-21	1.05E-22	1.71E-22	1.06E-21	2.59E-22	2.44E-22	6.74E-22	4.89E-21
Cm-245	1.88E-18	1.95E-18	1.68E-18	1.52E-18	5.12E-18	1.56E-18	1.57E-18	1.82E-18	2.06E-18
Cm-246	1.08E-21	1.40E-21	1.11E-22	1.65E-22	1.03E-21	2.48E-22	2.33E-22	6.22E-22	4.38E-21
Cm-247	1.01E-17	1.03E-17	8.96E-18	8.78E-18	1.65E-17	8.36E-18	8.61E-18	9.53E-18	1.10E-17
Cm-248	8.22E-22	1.06E-21	8.01E-23	1.23E-22	7.65E-22	1.85E-22	1.74E-22	4.70E-22	3.35E-21
Cm-249	6.46E-19	6.63E-19	5.80E-19	5.72E-19	9.81E-19	5.41E-19	5.59E-19	6.13E-19	1.03E-18
Cm-250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Berkelium									
Bk-245	5.51E-18	5.71E-18	4.93E-18	4.61E-18	1.30E-17	4.59E-18	4.65E-18	5.30E-18	6.04E-18
Bk-246	3.16E-17	3.24E-17	2.89E-17	2.87E-17	4.59E-17	2.68E-17	2.79E-17	3.02E-17	3.50E-17
Bk-247	2.42E-18	2.51E-18	2.16E-18	2.00E-18	5.84E-18	2.01E-18	2.03E-18	2.33E-18	2.65E-18
Bk-249	3.09E-23	3.49E-23	1.77E-23	1.42E-23	7.56E-23	1.90E-23	1.76E-23	2.49E-23	5.00E-23
Bk-250	3.10E-17	3.18E-17	2.86E-17	2.85E-17	4.20E-17	2.65E-17	2.76E-17	2.97E-17	3.49E-17

[1] $T_{1/2}$ = 1.15E5 y

[2] $T_{1/2}$ = 22.5 h

Table III.7. Dose Coefficients for Exposure to Soil Contaminated to an Infinite Depth

	Dose Coefficient h_T (Sv per Bq s m^{-3})								
Nuclide	Gonad	Breast	Lung	R Marrow	BSurface	Thyroid	Remainder	Effective	Skin
Californium									
Cf-244	1.72E-21	2.17E-21	1.55E-22	2.47E-22	1.56E-21	4.06E-22	3.60E-22	9.70E-22	6.02E-21
Cf-246	1.53E-21	1.85E-21	4.31E-22	4.61E-22	2.08E-21	5.80E-22	5.45E-22	1.01E-21	4.49E-21
Cf-248	1.18E-21	1.49E-21	1.11E-22	1.72E-22	1.09E-21	2.83E-22	2.50E-22	6.67E-22	4.11E-21
Cf-249	1.05E-17	1.08E-17	9.32E-18	9.12E-18	1.76E-17	8.70E-18	8.95E-18	9.91E-18	1.14E-17
Cf-250	1.12E-21	1.41E-21	1.05E-22	1.63E-22	1.03E-21	2.68E-22	2.38E-22	6.34E-22	3.91E-21
Cf-251	2.93E-18	3.04E-18	2.62E-18	2.44E-18	7.05E-18	2.44E-18	2.47E-18	2.82E-18	3.23E-18
Cf-252	1.42E-21	1.71E-21	4.09E-22	4.34E-22	1.96E-21	5.45E-22	5.12E-22	9.41E-22	4.12E-21
Cf-253	4.63E-22	5.04E-22	3.38E-22	2.84E-22	1.28E-21	3.34E-22	3.22E-22	4.11E-22	6.28E-22
Cf-254	3.65E-24	4.60E-24	3.45E-25	5.33E-25	3.37E-24	8.76E-25	7.77E-25	2.07E-24	1.27E-23
Einsteinium									
Es-250	1.26E-17	1.29E-17	1.15E-17	1.13E-17	1.96E-17	1.07E-17	1.11E-17	1.20E-17	1.39E-17
Es-251	2.00E-18	2.07E-18	1.79E-18	1.63E-18	5.35E-18	1.67E-18	1.67E-18	1.93E-18	2.20E-18
Es-253	1.03E-20	1.07E-20	8.48E-21	8.25E-21	1.77E-20	8.05E-21	8.21E-21	9.42E-21	1.30E-20
Es-254m	1.58E-17	1.62E-17	1.43E-17	1.41E-17	2.28E-17	1.33E-17	1.38E-17	1.50E-17	1.77E-17
Es-254	7.89E-20	8.58E-20	5.71E-20	5.31E-20	1.63E-19	5.60E-20	5.56E-20	6.91E-20	1.21E-19
Fermium									
Fm-252	1.27E-21	1.57E-21	1.34E-22	1.92E-22	1.23E-21	3.29E-22	2.83E-22	7.24E-22	3.93E-21
Fm-253	1.76E-18	1.82E-18	1.57E-18	1.45E-18	4.52E-18	1.47E-18	1.48E-18	1.70E-18	1.93E-18
Fm-254	1.89E-21	2.23E-21	6.27E-22	6.31E-22	2.93E-21	8.01E-22	7.45E-22	1.29E-21	4.76E-21
Fm-255	3.79E-20	4.20E-20	2.57E-20	2.27E-20	9.42E-20	2.55E-20	2.50E-20	3.27E-20	6.72E-20
Fm-257	2.39E-18	2.48E-18	2.13E-18	1.98E-18	5.92E-18	1.99E-18	2.01E-18	2.30E-18	2.63E-18
Mendelevium									
Md-257	2.81E-18	2.90E-18	2.51E-18	2.37E-18	6.14E-18	2.34E-18	2.38E-18	2.69E-18	3.08E-18
Md-258	1.55E-20	1.76E-20	8.15E-21	7.22E-21	3.51E-20	8.84E-21	8.40E-21	1.22E-20	2.96E-20

IV. APPLICATION CONSIDERATIONS

In this chapter we discuss some potentially important considerations in applying the dose coefficients to obtain realistic estimates of doses to members of the public. Applicability of the coefficients to a particular situation is influenced by those exposure conditions that differ from the assumptions in the derivation of the coefficients and other factors which might alter the radiation field at the location of the exposed individual. For example, the radiation field within a residence may be substantially different in energy and angular distribution, as well as intensity, from the field outside the residence. Furthermore, radionuclides may not be distributed in the environment in the manner assumed in deriving the dose coefficients; e.g., the actual distribution in the environment may be nonuniform. Modifying factors have historically been used with dose coefficients to estimate the dose for radiation fields which depart from idealized fields. Finally, the exposed individual may not conform sufficiently to the model of the human body assumed in determining the dose coefficients.

Environmental factors can influence the time-integrated activity that characterizes exposure, and an individual's life style may influence the extent of contact with a radionuclide in the environment. For example, the time-integrated activity of a radionuclide in an urban environment may be substantially different from that in a rural environment where environmental measurements are generally conducted. While these aspects are beyond the scope of this report, it is important to note that in prospective assessments the joint influence of these various factors is frequently expressed as a single modifying factor.

Radionuclide decay chains

In applying the dose coefficients of Tables III.1 through III.7 it is important to note that the values for each radionuclide do not include any contribution to dose from radioactive decay products formed in the spontaneous nuclear transformation of the nuclide. Rather, the tabulations contain separate entries for all such progeny.

In general, dose coefficients for a radionuclide and its progeny can be combined only after proper consideration of the equations describing production and decay of daughter radionuclides over time, and differences in environmental behavior of the parent and daughters. The information necessary to describe the production and decay of daughters is given in Appendix A.

Various simplifying assumptions have often been made when considering radioactive progeny following an "instantaneous" deposition of the parent nuclide, i.e., a deposition that occurs in a time period which is short compared to the half-life of the radionuclide and to the integration time of interest (DOE, 1988; Jacob et al., 1988a). However, such assumptions should no longer be necessary, since widespread access to personal computers and workstations makes solution of the appropriate equations almost a trivial task. Even for non-trivial time dependencies (see Jacob et al., 1988b) up to and including arbitrary deposition and/or removal rates, convolution methods can readily be applied to the dose coefficients tabulated in this report to estimate dose equivalents.

Spontaneous fission

Spontaneous fission is an important decay mode for a few radionuclides in Tables III.1 to III.7, e.g., ^{248}Cm, ^{250}Cm, ^{252}Cf, and ^{254}Cf. The frequency of spontaneous fission for these and other radionuclides is given in Appendix A. Empirical relationships describing the continuous energy spectra of photons, electrons, and neutrons from spontaneous fission, as needed in dosimetric evaluations, have been reported by Dillman and Jones (1975). However, detailed information has not been assembled on the radiation field (both neutron and gamma) resulting from distributed sources of neutrons in the environment. Radionuclides with a significant spontaneous fission yield are generally not released to the environment, or, if present in the environment, are at extremely low concentrations. The coefficients reported here for ^{248}Cm, ^{250}Cm, ^{252}Cf, and ^{254}Cf do not include any contribution to dose from spontaneous fission and might considerably underestimate external dose from these radionuclides.

Models of the human body

All organ doses in this report are calculated for an anthropomorphic model of the body derived by Cristy (Cristy and Eckerman, 1987) from ICRP Reference Man data (ICRP, 1975). The model represents an adult of stature 179 cm and mass of 73 kg. For all calculations, except water immersion, the phantom is upright at the air-ground interface. The phantom is a hermaphrodite of design similar to that used in the dosimetric evaluation of ICRP Publication 30 (ICRP, 1979) and is currently being used in the preparation of the various parts of ICRP Publication 56 (ICRP, 1990). Gender-specific models of adults have also been used in deriving external dose coefficients; e.g., ICRP Publication 51 (ICRP, 1987). However, most calculations of organ dose from the intake of radionuclides are based on the hermaphrodite phantom (ICRP, 1979, 1990).

Organ doses for individuals of specific size and gender may be somewhat different from the values tabulated here. Gender- and age-specific aspects of external dose have been investigated by Drexler et al. (1989) and Petoussi et al. (1991); see also the discussion of organ dose coefficients for monoenergetic environmental photon sources in Section II. The dose to organs of the body from external radiation increases with decreasing body size. This effect is more pronounced at low photon energy, and for organs located near the middle of the body, which are shielded by overlying tissues. Petoussi et al. (1991) indicate that organ doses for an infant may be about 40% higher than those in the adult male for both the ground plane source and submersion exposure at photon energies greater that 100 keV. Below 100 keV the difference may approach a factor of 3 for deeper organs such as the ovaries and colon.

Pathway-specific modifying factors and exposures

This section discusses modifying factors that can be used with the dose coefficients presented in this report to account for the effects of indoor residence, ground roughness, exposure during boating activities, and exposure to contaminated shorelines. These modifying factors, or dose-reduction factors, are multiplicative factors less than or equal to unity. They may be applied when using the tabulated dose coefficients for particular exposure modes to obtain more realistic estimates of dose equivalents to members of the public. Much of the discussion below is taken from that of Kocher (DOE, 1988).

Consider the problem of reconstructing the dose to an individual exposed in a number of different situations to a radionuclide present in the environment; e.g., while outdoors or within a residence. The dose equivalent H_T in tissue T due to exposures during the period t_1 to t_2 composed of n different exposure conditions can be expressed as

$$H_T = h_T \sum_{i=1}^{n} S_i \int_{t_1}^{t_2} R_i(t)\ C(t)\ dt \qquad \textbf{(22)}$$

where S_i denotes the strength of the radiation field (e.g., kerma in air) for exposure condition i relative to the idealized exposure conditions assumed in deriving the dose coefficient h_T; the function $R_i(t)$ defines whether exposure condition i is in effect at time t (it is a Heavyside function, having a value of 1 at times when condition i is applicable, or else it is zero); and $C(t)$ is the time-dependent concentration of the radionuclide in the environmental medium responsible for the radiation field. The summation extends over all exposure conditions i. In prospective assessments, information is usually not available to characterize $R_i(t)$. Then, exposure condition i is assumed, on average, to represent a fraction, $\bar{R}_i$, of the exposure period, and Eq. (22) reduces to

$$H_T = h_T \left[\int_{t_1}^{t_2} C(t)\ dt \right] \sum_{i=1}^{n} S_i\ \bar{R}_i \quad . \qquad \textbf{(23)}$$

The factors S_i and $\bar{R}_i$ take account of two fundamentally different considerations: (1) the change in dose contribution resulting from modification of the radiation field for a particular exposure situation; e.g., shielding by a building; and (2) the fraction of the exposure period associated with the particular exposure situation. Note that the product of S_i and $\bar{R}_i$ or, in many cases, the summation of their products, are often represented by a single modifying factor. Such ad hoc factors can be used only for the specific conditions for which they were derived, and should be use with extreme caution when the strength of the radiation field is highly time-dependent; e.g., following an acute release of short-lived radionuclides to the environment.

Ground roughness

The dose coefficients of Table III.3 for exposure to a contaminated ground surface assume that the source region is a smooth plane. A more realistic dose assessment for this exposure mode would take into account the effects of ground roughness in reducing external dose equivalents; i.e., the shielding provided by terrain irregularities and surface vegetation for sources on the ground surface. A dose-reduction factor for ground roughness can be applied in addition to the dose-reduction factor for indoor residence discussed above. In that case, no additional consideration of exposure times is needed in estimating the effects of ground roughness on external dose equivalents.

Dose-reduction factors for a photon spectrum representative of deposited radionuclides following releases from nuclear reactors are given by Burson and Profio (1977). The recommended values range from essentially unity for paved areas to about 0.5 for a deeply plowed field; a representative average value is about 0.7. This average dose-reduction factor would overestimate external dose equivalents from ground-surface exposure if the radionuclides emit mostly low-energy photons (Kocher, 1980). Jacob et al. (1986) used an effective depth of 3 mm into the soil to account for surface roughness. In subsequent work, Saito et al. (1990) and Petoussi et al. (1991), expressed the depth in terms of a density thickness of 0.5 g cm^{-2}

(equivalent to 3 mm for a soil density of 1.6×10^3 kg m^{-3}). Interpolation in the monoenergetic source data of Tables II.6 to II.11 indicates that the shielding factor for a source plane at a depth of 3 mm is about 0.7 for photons of energy greater than 100 keV. If an appropriate depth can be determined for a particular ground surface source, interpolation in the monoenergetic photon source dose coefficients of Tables II.6 to II.11 can be used to determine dose coefficients which can then be folded over the radionuclide decay data as specified by Eq. (21).

Electron dose-reduction factors for ground-surface exposure that take into account surface roughness have not been treated in the literature. However, some reduction in dose due to terrain irregularities and surface vegetation undoubtedly occurs. The electron dose is likely to be reduced more than the photon dose due to ground roughness. Furthermore, the electron dose will be strongly influenced by the moisture content of the soil and the amount of snow cover. Therefore, in estimating electron dose coefficients for ground-surface exposure, it would be conservative to use the appropriate photon dose-reduction factors for ground roughness, since the resulting electron dose probably would not be underestimated.

Non-uniform volume source distributions

For photon exposure, the assumption of uniformly-contaminated slab sources is appropriate for frequently plowed soils or for use with linear compartment models that describe downward migration of radionuclides in soil (see Sjoreen et al., 1984). It may be appropriate to treat volume sources as being non-uniformly distributed when a reasonable approximation to the distribution is known. For example, Beck and de Planque (1968) and Kocher and Sjoreen (1985) have considered sources exponentially distributed in the soil, which may be appropriate for natural infiltration of radionuclides into the soil during a chronic deposition on the surface. The dose coefficients for a known distribution of monoenergetic photon emitters can easily be derived by integrating the coefficients of Tables II.6 through II.11 over the distribution. Then, Eq. (21) can be used to determine the coefficients for the radionuclides of interest.

External exposure to electrons from radionuclides distributed with depth in soil generally can be neglected, because a few centimeters (often, only a few millimeters) of soil provides complete shielding of electrons from radioactive decay for a receptor location 1 m above ground (NAS, 1964). Therefore, calculations of electron dose equivalents from sources deposited on the ground need to consider only those sources that remain on or very near the surface. The tabulations of electron dose coefficients for volume sources in this report are based on the conservative assumption of an infinitely thick source.

Contaminated shorelines

The dose coefficients for exposure to contaminated soil in Tables III.3 through III.7 assume that the source region is infinite in extent and, thus, are appropriate for large areas that are contaminated by deposition of radionuclides from the atmosphere or by irrigation with contaminated water. Exposure to contaminated soil may also occur during fishing or hiking along shorelines of finite width that are contaminated by deposition of radionuclides from water.

For photon exposure, the NRC (1977) has recommended the following dose-reduction factors for different types of shorelines:

- 0.1 for discharge canal bank;
- 0.2 for river shoreline;
- 0.3 for lake shore;
- 0.5 for ocean shore;
- 1.0 for tidal basin.

These values would be applied in addition to the dose-reduction factor for ground roughness discussed earlier. They do not include consideration of exposure times.

Dose-reduction factors for exposure to electrons from contaminated shorelines have not been considered in the literature. Due to the relatively short range of electrons in air, the dose coefficient from exposure to shorelines of finite width should be about the same as the dose coefficient for exposure to an infinite ground surface; i.e., the dose-reduction factor should be nearly unity. However, the high moisture content of the shoreline would also reduce the electron dose for these exposures. As discussed earlier, an electron dose-reduction factor for ground roughness, based on an appropriate value for photons, could be taken into account in estimating electron dose coefficients for exposure to contaminated shorelines.

Although site-specific data for exposure times to contaminated shorelines can be used when available, the NRC (1977) has recommended exposure times in lieu of site-specific information. The values for an adult are 12 hours per year for maximally exposed individuals and 8 hours per year for average individuals in population groups. If other age groups are taken into account, the recommended exposure times are higher. For teenagers, the recommended values are 67 hours per year for maximally exposed individuals and 47 hours per year for average individuals in population groups.

Exposure during boating activities

The dose coefficients for immersion in contaminated water in Table III.2 assume immersion in an infinite pool and, thus, are appropriate for exposure while swimming. External exposure to contaminated water can also occur during boating activities.

For photon exposure, a dose-reduction factor of 0.5 during boating activities is a reasonable value that is unlikely to underestimate external dose equivalents. This dose-reduction factor takes into account that the source region is effectively semi-infinite in extent for an exposed individual located at the boundary of the air-water interface and assumes that the shielding of photons provided by the typically thin hull of a boat is negligible. The latter assumption will result in overestimates of external dose equivalents during boating activities for radionuclides that emit mostly low-energy photons.

For electron exposure, it is reasonable to assume a dose-reduction factor of zero during boating activities; i.e., that the electron dose equivalent is zero. The hull of a boat should provide complete shielding from electron sources in the water.

The exposure time for boating activities should be estimated on a site-specific basis. For individuals who reside on a boat for all or part of a year, an exposure time of 50% or more would be reasonable. For individuals who engage only in recreational boating activities, an exposure time as high as 5% (44 hours per year) would be reasonable.

Effects of indoor residence

The dose coefficients for air submersion and exposure to contaminated soil tabulated in Section III relate the organ dose to the time-integrated air or soil concentration, assuming the individual is located in the open without the benefit of shielding from structures. To realistically assess the dose for these exposure modes, consideration must be given to the reduction of the radiation field due to shielding by building structures.

Following the Chernobyl accident, considerable efforts have been devoted to improving the models for assessing external dose from airborne and deposited radionuclides, including evaluation of the reduction in the radiation field by various structures. The results of an extensive study of the shielding factors for selected European single-family and multi-story structures were reported by LeGrand et al. (1991) and Jacob and Meckbach (1991). For an airborne plume, the shielding factor (ratio of kerma in the "shielded" position to that in the open) ranged from about 0.01 to 0.7 for single family homes. In some cases, it may be more appropriate to assume that exposed individuals are residing in basements of homes or in schools, apartment houses, or office buildings. These structures generally provide significantly greater shielding than living areas in single-family homes. For submersion in contaminated air, representative shielding factors range from 0.6 for the basement of a wood frame house to 0.2 or less for a large office or industrial building. For contaminated soil exposure, representative shielding factors range from 0.1 for the basement of a home to 0.005 for the basement of large, multi-story structures (Burson and Profio, 1977). LeGrand et al. (1991) estimated the shielding factor for exposure in multi-story structures to an airborne plume. At a photon energy of 0.68 MeV, it ranged from 0.01 to 0.1 on the ground floor, and from 0.09 to 0.4 on the upper floors which have decreased shielding.

In an urban setting, for an overhead plume, locations outside of a structure are shielded by neighboring structures at a value of about 0.8, which is rather independent of photon energy. Within a structure, the dependence of the shielding factor on energy is more pronounced at strongly shielded locations like basements and lower floors of multi-floor structures. Neighboring structures can also have a large influence (factor of two) on the shielding inside of a structure (LeGrand et al., 1991).

For photon exposures following routine releases from nuclear reactors, the U. S. Nuclear Regulatory Commission has recommended (NRC, 1977) the following modifying factors for air submersion and exposure to contaminated soil that account for both the shielding provided by structures and the fraction of time individuals spend indoors:

- 0.7 for maximally exposed individuals;
- 0.5 for average individuals in population groups.

Both modifying factors are based on a shielding factor of 0.5. It should be noted that the values are most appropriate for photon energies above a few hundred keV. For photons of lower energy, use of these factors may considerably overestimate the dose equivalent (Kocher, 1980). Note that the difference in the two modifying factors implies a different fraction of time spent indoors; i.e., about 60% for maximally exposed individuals and effectively 100% for average individuals in population groups. In both cases, the individuals are presumed to spend 100% of their time at the exposed location. These dose-reduction factors were based on an analysis by Burson and Profio (1977). The National Council on Radiation Protection and Measurements has recommended similar values (NCRP, 1975), based on a compilation by Oakley (1972).

For electron exposures, external dose equivalents from electrons during indoor residence can be estimated on the basis of concentrations of radionuclides in indoor air and on the floor of the building (see Kocher, 1980). Electrons emitted by radionuclides outside the building cannot penetrate the structure.

The following discussion of modifying factors for electrons during indoor residence applies primarily to routine (i.e., chronic) releases of radionuclides to the atmosphere, in which case steady-state concentrations of airborne radionuclides inside and outside buildings may be assumed. For acute releases, however, the relationship between indoor and outdoor airborne concentrations of radionuclides will vary with time during and after a release, and will also depend on the timing and extent of building ventilation. For such releases, it may be prudent to assume no reduction in external dose equivalents from electrons during indoor residence.

For noble-gas radionuclides, air submersion is the only external exposure mode of concern. The effects of indoor residence on electron dose equivalents to skin should be negligible during chronic releases (i.e., the dose-reduction factor should be essentially unity), unless the range of the emitted electrons in air is somewhat greater than the interior dimensions of building rooms, because the indoor and outdoor air concentrations for noble gases will be about the same. For ^{85}Kr, for example, the electron energies from beta decay are less than 0.687 MeV and the corresponding electron ranges in air are less than 2.6 m (NAS, 1964), which is a representative radius of rooms in single-family homes. Therefore, a dose-reduction factor of unity for indoor exposure to electrons from ^{85}Kr decay is reasonable. However, if the electron range in air is somewhat greater than the dimensions of building rooms (i.e., if the emitted electron energy is about 1 MeV or greater), then the use of a modifying factor of unity will overestimate the electron dose equivalent to skin from exposure to noble gases during indoor residence. The extent of overestimation depends on the electron range in air relative to the dimensions of the building rooms.

For depositing radionuclides (particulates) dispersing in the atmosphere, the indoor air concentration can be considerably less than the outdoor air concentration during chronic releases (Kocher, 1980). If the fractional transfer rates from air to surfaces in the indoor and outdoor environments are comparable, the dose-reduction factors for external exposure to electrons during indoor residence can be substantial for both airborne and deposited activity. The dose-reduction factor for electrons for air submersion or a contaminated soil surface can be assumed to be equal to the ratio of indoor and outdoor concentrations of airborne or deposited radionuclides, respectively, provided the electron range in air is comparable to or less than the dimensions of the building rooms. For greater electron ranges in air, this assumption again overestimates electron skin dose equivalents during indoor residence, but by unknown amounts.

As stated earlier, indoor residence times recommended by the NRC (1977) for maximally exposed and average individuals are 60% and nearly 100%, respectively. In prospective assessments, it is generally assumed that both the indoor and outdoor exposures occur at the same locations. For a detailed consideration of how people spend their time, see Chapter 5 of the EPA Exposure Factors Handbook (1989). That handbook suggests that an average young person may spend about 15% of his or her time at school while for an adult it may be reasonable to assume a residence time of 25% in office-type buildings. In both cases, the indoor residence is probably at a location different from the home. Currently the EPA Office of Radiation and Indoor Air estimates that on average 75% of the time is spent in the home (EPA, 1993).

Conclusions

Application of the dose coefficients tabulated in this report typically involves use of modifying factors to reflect exposures of different durations to various radiation fields. It was the intent of the preceeding discussion to note the nature of the considerations reflected in these factors, but it was not the intent to establish specific numerical values for such factors. We note that it is extremely useful to keep separate the two aspects of the radiation exposure that are reflected in the modifying factors. To reiterate, these are the change in dose contribution resulting from modification of the radiation field for a particular exposure situation, and the fraction of the exposure period associated with the particular exposure situation; see Eqs. (22) and (23). When both these aspects are combined, it is extremely difficult to judge the reasonableness of the resulting single factor. We also note that the modifying factors developed for prospective assessments of chronic low-level exposures will generally not be applicable to exposure following an acute release of radioactivity to the environment. In such cases, the time of day of the release and subsequent time dependence of the radiation field can be important considerations in determining the dose. The adequacy of any modifying factors applied to the dose coefficients tabulated in this report must be determined by the user at the time of the dose assessment.

APPENDIX A
NUCLEAR DECAY DATA

The dose coefficients of Tables III.1 through III.7 are listed by radionuclide. In some instances a radionuclide is not uniquely identified by its atomic number (or chemical symbol) and mass number. Nuclei of the same atomic and mass numbers, but with distinguishable nuclear properties, are referred to as isomers. Identification of an isomer requires reference to its physical half-life. The nuclide designations of Tables III.1 through III.7 involve some nonstandard notation to reference isomers to data in Table A.1 of this appendix.

To differentiate isomers, when neither isomer has been designated as a metastable state, an "a" and "b" have been added to the chemical symbol-mass number notation; e.g., the Nb-89a entry in Table A.1 is the 66 m half-life isomer of ^{89}Nb. In Tables III.1 to III.7 the half-life of the isomer is given in a footnote. The "a" and "b" notations were assigned to the ^{89}Nb isomers in an arbitrary manner. To identify multiple metastable states, the "m" notation of one isomer is shown as "n"; e.g., Sb-124m in Table A.1 refers to the metastable state with a half-life of 93 s while Sb-124n refers to the 20.2 m half-life state. Additional examples can be seen in entries of Tables III.1 to III.7 and Table A.1 for indium (In), europium (Eu), terbium (Tb), rhenium (Re), iridium (Ir), and neptunium (Np).

Table A.1 summarizes information on the nuclear decay characteristics of each radionuclide considered in this report. All data were obtained from the ICRP/ORNL dosimetric data base (ICRP, 1983; Eckerman et al., 1993). Information on the methods used to derive these data from the basic nuclear structure information can be found in the report of Dillman (1980).

Table A.1 contains the following information, intended to aid in the proper use of the dose coefficients contained in Tables III.1 through III.7. The physical half-life of the radionuclides is given in the second column of the table. The time units are abbreviated as: y for year, d for day, h for hour, m for minutes, s for second, ms for millisecond, and µs for microsecond. The modes of nuclear transformation applicable to the radionuclide are given in the column headed "Decay Mode." The modes are abbreviated as: B- for beta minus decay, B+ for beta plus decay, EC for electron capture, A for alpha decay, IT for isometric transition, and SF for spontaneous fission. The nuclear transformations of a radionuclide (the parent) may form a nucleus which is also radioactive (radioactive decay product). The entries in the columns headed by "Radioactive Decay Products and Fractional Yield" identify radioactive nuclei formed by nuclear transformations of the parent radionuclide and give the fraction (referred to as the branching fraction) of the parent's transformations forming each decay product. No attempt is made to identify the radioactive nuclei formed by spontaneous fission. The notation "SF" simply indicates that the accompanying branching fraction refers to spontaneous fission. The three columns on the extreme right give the *total kinetic energy per nuclear transformation* of emitted alpha particles, electrons, and photons[1]. The entry for alpha particles represents only the kinetic energy of the alpha particles and does not include the recoil energy of the newly formed nucleus. The entry for electrons includes the kinetic energy of all beta particles (negatron or positron), internal conversion electrons, and Auger electrons emitted in the nuclear transformations. Similarly, the photon entry encompasses gamma rays, x rays, and annihilation photons. If nuclear transformations of the radionuclide do not result in emission of a particular radiation then a dash, "-", is shown in the appropriate column. If, however, radiations of a particular type are emitted, but the total energy per nuclear transformation is less than 1 keV, then the symbol "<" appears in the column.

The dose coefficients of Tables III.1 to III.7 are based on the radiations emitted by the indicated radionuclide and do not include consideration of the radiations emitted by radioactive decay products. For each radionuclide, the radioactive decay products, if formed, are identified in Table A.1. Consider the radionuclide ^{144}Ce. The ^{144}Ce entry in Table A.1 indicates that ^{144}Ce has a half-life of 284.3 days and forms ^{144}Pr in 98.22% of its transformations and ^{144m}Pr in 1.78% of its transformations. The entry for ^{144m}Pr, half-life of 7.2 m, indicates it decays (in 99.99% of the transformations) by internal transition to ^{144}Pr; the remaining transformations form the stable nucleus ^{144}Nd. Nuclear transformations of ^{144}Pr, half-life of 17.28 minutes, do

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[1]The total kinetic energy of radiation type R, $E_{T,R}$, is computed as

$$E_{T,R} = \sum_{i=1}^{n} y_{i,R}\, E_{i,R} \quad ,$$

where $y_{i,R}$ is the mean number of radiations of type R emitted per nuclear transformation with unique or mean energy $E_{i,R}$. The quantity should not be confused with the mean energy of radiation type R, which is

$$\bar{E}_R = \frac{E_{T,R}}{\sum_{i=1}^{n} y_{i,R}} \quad .$$

not form a radioactive decay product. Thus, by repeated entry into Table A.1 one can follow the serial transformations (decay chain) associated with a radionuclide. For nuclides with multiple modes of transformation, the branch formed by each mode must be followed. In some instances the branches may converge. It should be noted that the branching fractions may not always add to exactly one, since only branches leading to radioactive decay products are tabulated, and because of uncertainties in the fractions. The stated values are considered to be appropriate for use in dosimetric calculations.

The serial transformation by radioactive decay of each member of a radioactive series is described by the Bateman equations (ICRP, 1959; Jacquez, 1972; Skrable et al., 1974). Assume that at time zero the concentration of the parent nuclide on the surface of the ground is A_1^o (Bq m^{-2}) and that the effective dose equivalent H_E for an exposure period of one year is to be estimated. The contribution to effective dose from nuclear transformation of the parent nuclide would be given by

$$H_E = h_{E,1}^{gs} \frac{A_1^o}{\lambda_1} \left[1 - e^{-\lambda_1 T}\right] , \qquad \textbf{(A.1)}$$

where $h_{E,1}^{gs}$ denotes the effective dose equivalent coefficient from ground surface exposure for nuclide 1 (Sv per Bq s m^{-2}), λ_1 is the decay constant, in inverse seconds, for nuclide 1 ($\lambda = 0.6931.../T_{1/2}$), and T equals 3.15 x 10^7 *s* or one year. Using the Bateman equations, the activity at time t of chain members *i, i = 1, 2, ...,* can be expressed as

$$A_i(t) = A_1^o \prod_{j=1}^{i-1} f_{j,\,j+1}\,\lambda_j \sum_{j=1}^{i} \frac{e^{-\lambda_j t}}{\prod_{\substack{k=1\\k\neq j}}^{i} (\lambda_k - \lambda_j)} , \qquad \textbf{(A.2)}$$

where

$$\prod_{i=1}^{n} a_i = \begin{cases} a_1 * a_2 * \dots\ a_n, & if\ n \geq 1 \\ 1, & if\ n = 0 \end{cases} ,$$

and $f_{j,\,j+1}$ denotes the denotes the fraction of the nuclear transformations of chain member *j* forming member *j+1*. The effective dose equivalent associated with an exposure period of duration *T*, following a contamination event at $t = 0$ that results in a ground surface concentration of A_1^o, is

$$H_E = A_1^o \sum_{i=1}^{n} h_{E,i}^{gs} \prod_{j=1}^{i-1} f_{j,j+1} \lambda_j \sum_{j=1}^{i} \frac{1 - e^{-\lambda_j T}}{\lambda_j \prod_{\substack{k=1 \\ k \neq j}}^{i} (\lambda_k - \lambda_j)} \quad , \qquad \textbf{(A.3)}$$

where $h_{E,i}^{gs}$ denotes the effective dose equivalent coefficient for ground surface exposure to nuclide i, and all other factors are as defined above. If the parent radionuclide is long-lived relative to the decay products, then at times T such that $\lambda_i T > 5,\ i = 2 \ to \ n,$ H_E can be estimated as

$$H_E = A_1^o \frac{1 - e^{-\lambda_1 t}}{\lambda_1} \sum_{i=1}^{n} h_{E,i}^{gs} \prod_{j=1}^{i-1} f_{j,j+1} \quad . \qquad \textbf{(A.4)}$$

Under these conditions the activity of the decay products is in secular equilibrium with the parent's activity. For example, application of Eq. (A.4) to ^{137}Cs and its ^{137m}Ba decay product

$$H_E = A_{Cs-137}^o \frac{1 - e^{-\lambda_{Cs-137} t}}{\lambda_{Cs-137}} [\, h_{E,Cs-137}^{gs} + 0.946 \ h_{E,Ba-137m}^{gs} \,] \quad ,$$

would yield where 0.946 is the fraction of the ^{137}Cs nuclear transformations forming ^{137m}Ba. If the decay products are not short-lived relative to the parent, then it is necessary to evaluate Eq. (A.3). In many instances, the mathematical models describing the fate of radionuclides in the environment; e.g., their dispersion of following release to the atmosphere, includes an evaluation of the ingrowth of each radioactive decay product. The information in Table A.1 should be useful to those implementing such models.

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Hydrogen											
H-3	12.35y	B-							-	0.006	-
Beryllium											
Be-7	53.3d	EC							-	<	0.049
Be-10	1.6E6y	B-							-	0.252	-
Carbon											
C-11	20.38m	ECB+							-	0.385	1.020
C-14	5730y	B-							-	0.049	-
Nitrogen											
N-13	9.965m	ECB+							-	0.491	1.020
Oxygen											
O-15	122.24s	ECB+							-	0.734	1.021
Fluorine											
F-18	109.77m	ECB+							-	0.250	1.022
Neon											
Ne-19	17.22s	ECB+							-	0.963	1.022
Sodium											
Na-22	2.602y	ECB+							-	0.194	2.193
Na-24	15.00h	B-							-	0.554	4.121
Magnesium											
Mg-28	20.91h	B-	Al-28	1.000E+00					-	0.163	1.371
Aluminum											
Al-26	7.16E5y	ECB+							-	0.445	2.676
Al-28	2.240m	B-							-	1.242	1.779
Silicon											
Si-31	157.3m	B-							-	0.595	<
Si-32	450y	B-	P-32	1.000E+00					-	0.065	-
Phosphorus											
P-30	2.499m	ECB+							-	1.436	1.022
P-32	14.29d	B-							-	0.695	-
P-33	25.4d	B-							-	0.077	-
Sulphur											
S-35	87.44d	B-							-	0.049	-
Chlorine											
Cl-36	3.01E5y	ECB+B-							-	0.274	<
Cl-38	37.21m	B-							-	1.529	1.488
Cl-39	55.6m	B-	Ar-39	1.000E+00					-	0.823	1.438
Argon											
Ar-37	35.02d	EC							-	0.002	<
Ar-39	269y	B-							-	0.219	-
Ar-41	1.827h	B-							-	0.464	1.284
Potassium											
K-38	7.636m	ECB+							-	1.209	3.187
K-40	1.28E9y	B-EC							-	0.523	0.156
K-42	12.36h	B-							-	1.430	0.276
K-43	22.6h	B-							-	0.309	0.970
K-44	22.13m	B-							-	1.491	2.267
K-45	20m	B-	Ca-45	1.000E+00					-	0.984	1.866
Calcium											
Ca-41	1.4E5y	EC							-	0.002	<
Ca-45	163d	B-							-	0.077	<
Ca-47	4.53d	B-	Sc-47	1.000E+00					-	0.345	1.063
Ca-49	8.716m	B-	Sc-49	1.000E+00					-	0.870	3.165
Scandium											
Sc-43	3.891h	ECB+							-	0.313	1.096
Sc-44m	58.6h	ECIT	Sc-44	9.863E-01					-	0.033	0.280
Sc-44	3.927h	ECB+							-	0.597	2.137
Sc-46	83.83d	B-							-	0.112	2.009
Sc-47	3.351d	B-							-	0.163	0.108
Sc-48	43.7h	B-							-	0.229	3.349
Sc-49	57.4m	B-							-	0.822	0.001

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{1/2}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Titanium											
Ti-44	47.3y	EC	Sc-44	1.000E+00					-	0.013	0.135
Ti-45	3.08h	ECB+							-	0.373	0.870
Vanadium											
V-47	32.6m	ECB+							-	0.803	0.995
V-48	16.238d	ECB+							-	0.149	2.914
V-49	330d	EC							-	0.004	<
Chromium											
Cr-48	22.96h	ECB+	V-48	1.000E+00					-	0.008	0.436
Cr-49	42.09m	ECB+	V-49	1.000E+00					-	0.602	1.055
Cr-51	27.704d	EC							-	0.004	0.033
Manganese											
Mn-51	46.2m	ECB+	Cr-51	1.000E+00					-	0.934	0.998
Mn-52m	21.1m	ECB+IT	Mn-52	1.750E-02					-	1.132	2.409
Mn-52	5.591d	ECB+							-	0.075	3.458
Mn-53	3.7E6y	EC							-	0.004	0.001
Mn-54	312.5d	EC							-	0.004	0.836
Mn-56	2.5785h	B-							-	0.830	1.692
Iron											
Fe-52	8.275h	ECB+	Mn-52m	1.000E+00					-	0.194	0.740
Fe-55	2.7y	EC							-	0.004	0.002
Fe-59	44.529d	B-							-	0.118	1.189
Fe-60	1E5y	B-	Co-60m	1.000E+00					-	0.049	-
Cobalt											
Co-55	17.54h	ECB+	Fe-55	1.000E+00					-	0.429	1.994
Co-56	78.76d	ECB+							-	0.124	3.580
Co-57	270.9d	EC							-	0.019	0.125
Co-58m	9.15h	IT	Co-58	1.000E+00					-	0.023	0.002
Co-58	70.80d	ECB+							-	0.034	0.976
Co-60m	10.47m	ITB-	Co-60	9.975E-01					-	0.058	0.007
Co-60	5.271y	B-							-	0.097	2.504
Co-61	1.65h	B-							-	0.463	0.091
Co-62m	13.91m	B-							-	1.051	2.698
Nickel											
Ni-56	6.10d	EC	Co-56	1.000E+00					-	0.007	1.721
Ni-57	36.08h	ECB+	Co-57	1.000E+00					-	0.143	1.922
Ni-59	7.5E4y	EC							-	0.005	0.002
Ni-63	96y	B-							-	0.017	-
Ni-65	2.520h	B-							-	0.632	0.549
Ni-66	54.6h	B-	Cu-66	1.000E+00					-	0.067	-
Copper											
Cu-60	23.2m	ECB+							-	0.895	3.898
Cu-61	3.408h	ECB+							-	0.311	0.829
Cu-62	9.74m	ECB+							-	1.285	1.007
Cu-64	12.701h	B-ECB+							-	0.123	0.191
Cu-66	5.10m	B-							-	1.068	0.085
Cu-67	61.86h	B-							-	0.155	0.115
Zinc											
Zn-62	9.26h	ECB+	Cu-62	1.000E+00					-	0.033	0.439
Zn-63	38.1m	ECB+							-	0.918	1.100
Zn-65	243.9d	ECB+							-	0.007	0.584
Zn-69m	13.76h	ITB-	Zn-69	9.997E-01					-	0.022	0.417
Zn-69	57m	B-							-	0.321	<
Zn-71m	3.92h	B-							-	0.548	1.552
Zn-72	46.5h	B-	Ga-72	1.000E+00					-	0.102	0.152
Gallium											
Ga-65	15.2m	ECB+	Zn-65	1.000E+00					-	0.831	1.176
Ga-66	9.40h	ECB+							-	0.970	2.473
Ga-67	78.26h	EC							-	0.036	0.158
Ga-68	68.0m	ECB+							-	0.739	0.951
Ga-70	21.15m	B-EC							-	0.644	0.008
Ga-72	14.1h	B-							-	0.497	2.711
Ga-73	4.91h	B-							-	0.494	0.316

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Germanium											
Ge-66	2.27h	ECB+	Ga-66	1.000E+00					-	0.102	0.687
Ge-67	18.7m	ECB+	Ga-67	1.000E+00					-	1.297	1.406
Ge-68	288d	EC	Ga-68	1.000E+00					-	0.005	0.004
Ge-69	39.05h	ECB+							-	0.179	0.873
Ge-71	11.8d	EC							-	0.005	0.004
Ge-75	82.78m	B-							-	0.420	0.034
Ge-77	11.30h	B-	As-77	1.000E+00					-	0.648	1.086
Ge-78	87m	B-	As-78	1.000E+00					-	0.238	0.278
Arsenic											
As-69	15.2m	ECB+	Ge-69	1.000E+00					-	1.274	1.013
As-70	52.6m	ECB+							-	0.865	4.095
As-71	64.8h	ECB+	Ge-71	1.000E+00					-	0.119	0.574
As-72	26.0h	ECB+							-	1.026	1.794
As-73	80.30d	EC							-	0.060	0.016
As-74	17.76d	B-ECB+							-	0.268	0.759
As-76	26.32h	B-							-	1.064	0.430
As-77	38.8h	B-							-	0.229	0.009
As-78	90.7m	B-							-	1.356	1.252
Selenium											
Se-70	41.0m	ECB+	As-70	1.000E+00					-	0.489	0.999
Se-73m	39m	ECB+IT	As-73	2.700E-01	Se-73	7.300E-01			-	0.178	0.244
Se-73	7.15h	ECB+	As-73	1.000E+00					-	0.386	1.087
Se-75	119.8d	EC							-	0.015	0.394
Se-77m	17.45s	IT							-	0.072	0.088
Se-79	65000y	B-							-	0.056	-
Se-81m	57.25m	ITB-	Se-81	1.000E+00					-	0.085	0.018
Se-81	18.5m	B-							-	0.611	0.009
Se-83	22.5m	B-	Br-83	1.000E+00					-	0.508	2.429
Bromine											
Br-74m	41.5m	ECB+							-	1.412	4.082
Br-74	25.3m	ECB+							-	1.115	4.549
Br-75	98m	ECB+	Se-75	1.000E+00					-	0.524	1.216
Br-76	16.2h	ECB+							-	0.691	2.633
Br-77	56h	ECB+							-	0.009	0.321
Br-80m	4.42h	IT	Br-80	1.000E+00					-	0.060	0.024
Br-80	17.4m	B-ECB+							-	0.724	0.080
Br-82	35.30h	B-							-	0.139	2.642
Br-83	2.39h	B-	Kr-83m	1.000E+00					-	0.321	0.008
Br-84	31.80m	B-							-	1.229	1.788
Krypton											
Kr-74	11.50m	ECB+	Br-74	1.000E+00					-	0.792	1.169
Kr-76	14.8h	EC	Br-76	1.000E+00					-	0.015	0.435
Kr-77	74.7m	ECB+	Br-77	1.000E+00					-	0.642	1.016
Kr-79	35.04h	ECB+							-	0.024	0.257
Kr-81m	13s	IT	Kr-81	1.000E+00					-	0.059	0.131
Kr-81	2.1E5y	EC							-	0.005	0.012
Kr-83m	1.83h	IT							-	0.039	0.003
Kr-85m	4.48h	ITB-	Kr-85	2.110E-01					-	0.255	0.158
Kr-85	10.72y	B-							-	0.251	0.002
Kr-87	76.3m	B-	Rb-87	1.000E+00					-	1.324	0.793
Kr-88	2.84h	B-	Rb-88	1.000E+00					-	0.364	1.955
Rubidium											
Rb-79	22.9m	ECB+	Kr-79	1.000E+00					-	0.820	1.358
Rb-80	34s	ECB+							-	2.011	1.246
Rb-81m	32m	IT	Rb-81	1.000E+00					-	0.074	0.010
Rb-81	4.58h	ECB+	Kr-81	1.000E+00					-	0.197	0.623
Rb-82m	6.2h	ECB+							-	0.095	2.910
Rb-82	1.3m	ECB+							-	1.407	1.093
Rb-83	86.2d	EC	Kr-83m	7.620E-01					-	0.015	0.504
Rb-84	32.77d	ECB+B-							-	0.155	0.919
Rb-86	18.66d	B-							-	0.668	0.095
Rb-87	4.7E10y	B-							-	0.111	-

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Rubidium, cont'd											
Rb-88	17.8m	B-							-	2.066	0.629
Rb-89	15.2m	B-	Sr-89	1.000E+00					-	1.013	2.071
Strontium											
Sr-80	100m	EC	Rb-80	1.000E+00					-	0.005	0.008
Sr-81	25.5m	ECB+	Rb-81	1.000E+00					-	1.000	1.386
Sr-82	25d	EC	Rb-82	1.000E+00					-	0.005	0.008
Sr-83	32.4h	ECB+	Rb-83	1.000E+00					-	0.149	0.801
Sr-85m	69.5m	ITEC	Sr-85	8.790E-01					-	0.012	0.220
Sr-85	64.84d	EC							-	0.009	0.512
Sr-87m	2.805h	ECIT	Rb-87	3.000E-03					-	0.067	0.320
Sr-89	50.5d	B-							-	0.583	<
Sr-90	29.12y	B-	Y-90	1.000E+00					-	0.196	-
Sr-91	9.5h	B-	Y-91m	5.780E-01	Y-91	4.220E-01			-	0.656	0.697
Sr-92	2.71h	B-	Y-92	1.000E+00					-	0.196	1.339
Yttrium											
Y-86m	48m	ECB+IT	Y-86	9.931E-01					-	0.025	0.221
Y-86	14.74h	ECB+							-	0.226	3.589
Y-87	80.3h	ECB+	Sr-87m	9.990E-01					-	0.007	0.457
Y-88	106.64d	ECB+							-	0.007	2.692
Y-90m	3.19h	IT	Y-90	9.920E-01					-	0.047	0.629
Y-90	64.0h	B-							-	0.935	<
Y-91m	49.71m	IT	Y-91	1.000E+00					-	0.027	0.530
Y-91	58.51d	B-							-	0.602	0.004
Y-92	3.54h	B-							-	1.446	0.252
Y-93	10.1h	B-	Zr-93	1.000E+00					-	1.174	0.089
Y-94	19.1m	B-							-	1.675	1.110
Y-95	10.7m	B-	Zr-95	1.000E+00					-	1.528	0.894
Zirconium											
Zr-86	16.5h	EC	Y-86	1.000E+00					-	0.030	0.288
Zr-88	83.4d	EC	Y-88	1.000E+00					-	0.016	0.403
Zr-89	78.43h	ECB+							-	0.101	1.165
Zr-93	1.53E6y	B-	Nb-93m	1.000E+00					-	0.020	-
Zr-95	63.98d	B-	Nb-95m	7.000E-03	Nb-95	9.930E-01			-	0.116	0.739
Zr-97	16.90h	B-	Nb-97m	9.470E-01	Nb-97	5.300E-02			-	0.700	0.179
Niobium											
Nb-88	14.3m	ECB+	Zr-88	1.000E+00					-	1.237	4.126
Nb-89b	122m	ECB+	Zr-89	1.000E+00					-	1.115	1.391
Nb-89a	66m	ECB+	Zr-89	1.000E+00					-	0.834	1.925
Nb-90	14.60h	ECB+							-	0.403	4.224
Nb-93m	13.6y	IT							-	0.028	0.002
Nb-94	2.03E4y	B-							-	0.168	1.574
Nb-95m	86.6h	IT	Nb-95	1.000E+00					-	0.166	0.068
Nb-95	35.15d	B-							-	0.044	0.766
Nb-96	23.35h	B-							-	0.253	2.472
Nb-97m	60s	IT	Nb-97	1.000E+00					-	0.015	0.728
Nb-97	72.1m	B-							-	0.468	0.655
Nb-98	51.5m	B-							-	0.887	2.426
Molybdenum											
Mo-90	5.67h	ECB+	Nb-90	1.000E+00					-	0.204	0.827
Mo-93m	6.85h	IT	Mo-93	1.000E+00					-	0.097	2.250
Mo-93	3.5E3y	EC	Nb-93m	1.000E+00					-	0.006	0.011
Mo-99	66.0h	B-	Tc-99m	8.760E-01	Tc-99	1.240E-01			-	0.392	0.150
Mo-101	14.62m	B-	Tc-101	1.000E+00					-	0.589	1.368
Technetium											
Tc-93m	43.5m	ITEC	Mo-93	1.820E-01	Tc-93	8.180E-01			-	0.079	0.724
Tc-93	2.75h	EC	Mo-93	1.000E+00					-	0.006	1.459
Tc-94m	52m	ECB+							-	0.756	1.859
Tc-94	293m	ECB+							-	0.049	2.671
Tc-95m	61d	ECB+IT	Tc-95	4.000E-02					-	0.016	0.675
Tc-95	20h	EC							-	0.007	0.796
Tc-96m	51.5m	ITEC	Tc-96	9.800E-01					-	0.027	0.052
Tc-96	4.28d	EC							-	0.009	2.506

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Technetium, cont'd											
Tc-97m	87d	IT	Tc-97	1.000E+00					-	0.087	0.010
Tc-97	2.6E6y	EC							-	0.006	0.011
Tc-98	4.2E6y	B-							-	0.159	1.413
Tc-99m	6.02h	IT	Tc-99	1.000E+00					-	0.016	0.126
Tc-99	2.13E5y	B-							-	0.101	-
Tc-101	14.2m	B-							-	0.478	0.334
Tc-104	18.2m	B-							-	1.601	1.981
Ruthenium											
Ru-94	51.8m	EC	Tc-94m	1.000E+00					-	0.008	0.535
Ru-97	2.9d	EC	Tc-97m	7.550E-04	Tc-97	9.992E-01			-	0.013	0.240
Ru-103	39.28d	B-	Rh-103m	9.970E-01					-	0.075	0.469
Ru-105	4.44h	B-	Rh-105	1.000E+00					-	0.400	0.784
Ru-106	368.2d	B-	Rh-106	1.000E+00					-	0.010	-
Rhodium											
Rh-99m	4.7h	ECB+							-	0.032	0.685
Rh-99	16d	ECB+							-	0.042	0.608
Rh-100	20.8h	ECB+							-	0.070	2.767
Rh-101m	4.34d	ECIT	Rh-101	7.200E-02					-	0.020	0.307
Rh-101	3.2y	EC							-	0.032	0.269
Rh-102m	207d	ECB+ITB-	Rh-102	5.000E-02					-	0.168	0.486
Rh-102	2.9y	ECB+							-	0.012	2.140
Rh-103m	56.12m	IT							-	0.038	0.002
Rh-105	35.36h	B-							-	0.154	0.078
Rh-106m	132m	B-							-	0.313	2.915
Rh-106	29.9s	B-							-	1.413	0.205
Rh-107	21.7m	B-	Pd-107	1.000E+00					-	0.445	0.312
Palladium											
Pd-100	3.63d	EC	Rh-100	1.000E+00					-	0.044	0.129
Pd-101	8.27h	ECB+	Rh-101m	9.970E-01	Rh-101	3.000E-03			-	0.039	0.337
Pd-103	16.96d	EC	Rh-103m	1.000E+00					-	0.006	0.014
Pd-107	6.5E6y	B-							-	0.009	-
Pd-109	13.427h	B-							-	0.437	0.012
Silver											
Ag-102	12.9m	ECB+							-	0.819	3.353
Ag-103	65.7m	ECB+	Pd-103	1.000E+00					-	0.259	0.765
Ag-104m	33.5m	ECB+IT	Ag-104	3.300E-01					-	0.509	1.174
Ag-104	69.2m	ECB+							-	0.091	2.683
Ag-105	41.0d	ECB+							-	0.019	0.525
Ag-106m	8.41d	EC							-	0.013	2.822
Ag-106	23.96m	ECB+							-	0.508	0.711
Ag-108m	127y	ECIT	Ag-108	8.900E-02					-	0.016	1.627
Ag-108	2.37m	ECB+B-							-	0.610	0.018
Ag-109m	39.6s	IT							-	0.077	0.011
Ag-110m	249.9d	ITB-	Ag-110	1.330E-02					-	0.072	2.751
Ag-110	24.6s	B-EC							-	1.182	0.031
Ag-111	7.45d	B-							-	0.354	0.026
Ag-112	3.12h	B-							-	1.384	0.657
Ag-115	20.0m	B-	Cd-115m	6.600E-02	Cd-115	9.340E-01			-	1.042	0.707
Cadmium											
Cd-104	57.7m	ECB+	Ag-104	1.000E+00					-	0.032	0.259
Cd-107	6.49h	ECB+							-	0.087	0.034
Cd-109	464d	EC							-	0.083	0.026
Cd-113m	13.6y	B-							-	0.185	-
Cd-113	9.3E15y	B-							-	0.093	-
Cd-115m	44.6d	B-	In-115	1.000E+00					-	0.607	0.022
Cd-115	53.46h	B-	In-115m	1.000E+00					-	0.303	0.233
Cd-117m	3.36h	B-	In-117m	1.000E-02	In-117	9.900E-01			-	0.229	2.044
Cd-117	2.49h	B-	In-117m	9.200E-01	In-117	8.000E-02			-	0.439	1.087
Indium											
In-109	4.2h	ECB+	Cd-109	1.000E+00					-	0.047	0.672
In-110b	4.9h	ECB+							-	0.012	3.049
In-110a	69.1m	ECB+							-	0.626	1.557

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Indium, cont'd											
In-111	2.83d	EC							-	0.034	0.405
In-112	14.4m	B-ECB+							-	0.243	0.268
In-113m	1.658h	IT							-	0.134	0.258
In-114m	49.51d	ECIT	In-114	9.570E-01					-	0.143	0.094
In-114	71.9s	B-ECB+							-	0.771	0.003
In-115m	4.486h	ITB-	In-115	9.500E-01					-	0.172	0.161
In-115	5.1E15y	B-							-	0.152	-
In-116m	54.15m	B-							-	0.312	2.473
In-117m	116.5m	B-IT	In-117	4.710E-01					-	0.434	0.091
In-117	43.8m	B-	Sn-117m	3.200E-03					-	0.267	0.692
In-119m	18.0m	B-IT	In-119	2.500E-02					-	1.065	0.011
In-119	2.4m	B-	Sn-119m	1.090E-01					-	0.634	0.769
Tin											
Sn-110	4.0h	EC	In-110a	1.000E+00					-	0.014	0.301
Sn-111	35.3m	ECB+	In-111	1.000E+00					-	0.221	0.510
Sn-113	115.1d	EC	In-113m	1.000E+00					-	0.006	0.023
Sn-117m	13.61d	IT							-	0.161	0.158
Sn-119m	293.0d	IT							-	0.078	0.011
Sn-121m	55y	B-IT	Sn-121	7.760E-01					-	0.035	0.005
Sn-121	27.06h	B-							-	0.114	-
Sn-123m	40.08m	B-							-	0.475	0.140
Sn-123	129.2d	B-							-	0.520	0.007
Sn-125	9.64d	B-	Sb-125	1.000E+00					-	0.811	0.313
Sn-126	1.0E5y	B-	Sb-126m	1.000E+00					-	0.172	0.057
Sn-127	2.10h	B-	Sb-127	1.000E+00					-	0.534	1.910
Sn-128	59.1m	B-	Sb-128a	1.000E+00					-	0.255	0.666
Antimony											
Sb-115	31.8m	ECB+							-	0.238	0.909
Sb-116m	60.3m	ECB+							-	0.153	3.143
Sb-116	15.8m	ECB+							-	0.424	2.158
Sb-117	2.80h	ECB+							-	0.029	0.185
Sb-118m	5.00h	ECB+							-	0.040	2.585
Sb-119	38.1h	EC							-	0.026	0.023
Sb-120b	5.76d	EC							-	0.045	2.469
Sb-120a	15.89m	ECB+							-	0.308	0.452
Sb-122	2.70d	ECB-							-	0.565	0.441
Sb-124n	20.2m	IT	Sb-124m	1.000E+00					-	0.025	<
Sb-124m	93s	ITB-	Sb-124	8.000E-01					-	0.092	0.352
Sb-124	60.20d	B-							-	0.387	1.817
Sb-125	2.77y	B-	Te-125m	2.280E-01					-	0.100	0.431
Sb-126m	19.0m	ITB-	Sb-126	1.400E-01					-	0.591	1.548
Sb-126	12.4d	B-							-	0.283	2.834
Sb-127	3.85d	B-	Te-127m	1.760E-01	Te-127	8.240E-01			-	0.316	0.688
Sb-128b	9.01h	B-							-	0.438	3.093
Sb-128a	10.4m	B-							-	0.935	1.986
Sb-129	4.32h	B-	Te-129m	2.250E-01	Te-129	7.750E-01			-	0.408	1.437
Sb-130	40m	B-							-	0.722	3.264
Sb-131	23m	B-	Te-131m	9.930E-02	Te-131	9.007E-01			-	0.553	1.864
Tellurium											
Te-116	2.49h	EC	Sb-116	1.000E+00					-	0.053	0.073
Te-121m	154d	ECIT	Te-121	8.860E-01					-	0.080	0.217
Te-121	17d	EC							-	0.010	0.577
Te-123m	119.7d	IT	Te-123	1.000E+00					-	0.099	0.148
Te-123	1E13y	EC							-	0.006	0.020
Te-125m	58d	IT							-	0.109	0.036
Te-127m	109d	ITB-	Te-127	9.760E-01					-	0.082	0.011
Te-127	9.35h	B-							-	0.223	0.005
Te-129m	33.6d	ITB-	I-129	3.500E-01	Te-129	6.500E-01			-	0.260	0.038
Te-129	69.6m	B-	I-129	1.000E+00					-	0.544	0.059
Te-131m	30h	ITB-	I-131	7.780E-01	Te-131	2.220E-01			-	0.202	1.425
Te-131	25.0m	B-	I-131	1.000E+00					-	0.719	0.420
Te-132	78.2h	B-	I-132	1.000E+00					-	0.102	0.234

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Tellurium, cont'd											
Te-133m	55.4m	ITB-	I-133	8.700E-01	Te-133	1.300E-01			-	0.705	2.313
Te-133	12.45m	B-	I-133	1.000E+00					-	0.819	0.929
Te-134	41.8m	B-	I-134	1.000E+00					-	0.300	0.886
Iodine											
I-120m	53m	ECB+							-	1.244	5.297
I-120	81.0m	ECB+							-	1.423	2.729
I-121	2.12h	ECB+	Te-121	1.000E+00					-	0.083	0.419
I-122	3.62m	ECB+							-	1.055	0.946
I-123	13.2h	EC	Te-123m	5.000E-05	Te-123	9.999E-01			-	0.028	0.172
I-124	4.18d	ECB+							-	0.194	1.098
I-125	60.14d	EC							-	0.019	0.042
I-126	13.02d	ECB+B-							-	0.157	0.455
I-128	24.99m	ECB+B-							-	0.748	0.085
I-129	1.57E7y	B-							-	0.064	0.025
I-130	12.36h	B-							-	0.297	2.139
I-131	8.04d	B-	Xe-131m	1.110E-02					-	0.192	0.382
I-132m	83.6m	ITB-	I-132	8.600E-01					-	0.159	0.322
I-132	2.30h	B-							-	0.495	2.280
I-133	20.8h	B-	Xe-133m	2.900E-02	Xe-133	9.710E-01			-	0.411	0.607
I-134	52.6m	B-							-	0.622	2.625
I-135	6.61h	B-	Xe-135m	1.540E-01	Xe-135	8.460E-01			-	0.367	1.576
Xenon											
Xe-120	40m	ECB+	I-120	1.000E+00					-	0.055	0.432
Xe-121	40.1m	ECB+	I-121	1.000E+00					-	0.569	1.815
Xe-122	20.1h	EC	I-122	1.000E+00					-	0.010	0.068
Xe-123	2.08h	ECB+	I-123	1.000E+00					-	0.184	0.634
Xe-125	17.0h	ECB+	I-125	1.000E+00					-	0.034	0.271
Xe-127	36.41d	EC							-	0.033	0.280
Xe-129m	8.0d	IT							-	0.185	0.051
Xe-131m	11.9d	IT							-	0.144	0.020
Xe-133m	2.188d	IT	Xe-133	1.000E+00					-	0.192	0.041
Xe-133	5.245d	B-							-	0.136	0.046
Xe-135m	15.29m	ITB-	Cs-135	4.500E-05	Xe-135	9.999E-01			-	0.098	0.429
Xe-135	9.09h	B-	Cs-135	1.000E+00					-	0.317	0.249
Xe-138	14.17m	B-	Cs-138	1.000E+00					-	0.673	1.125
Cesium											
Cs-125	45m	ECB+	Xe-125	1.000E+00					-	0.347	0.678
Cs-126	1.64m	ECB+							-	1.464	1.086
Cs-127	6.25h	ECB+	Xe-127	1.000E+00					-	0.029	0.420
Cs-128	3.9m	ECB+							-	0.846	0.900
Cs-129	32.06h	ECB+							-	0.018	0.282
Cs-130	29.9m	ECB+							-	0.401	0.517
Cs-131	9.69d	EC							-	0.007	0.023
Cs-132	6.475d	ECB+B-							-	0.014	0.705
Cs-134m	2.90h	IT	Cs-134	1.000E+00					-	0.112	0.027
Cs-134	2.062y	ECB-							-	0.164	1.555
Cs-135m	53m	IT	Cs-135	1.000E+00					-	0.036	1.586
Cs-135	2.3E6y	B-							-	0.067	-
Cs-136	13.1d	B-							-	0.139	2.166
Cs-137	30.0y	B-	Ba-137m	9.460E-01					-	0.187	-
Cs-138	32.2m	B-							-	1.207	2.361
Barium											
Ba-126	96.5m	ECB+	Cs-126	1.000E+00					-	0.020	0.163
Ba-128	2.43d	EC	Cs-128	1.000E+00					-	0.009	0.076
Ba-131m	14.6m	IT	Ba-131	1.000E+00					-	0.109	0.077
Ba-131	11.8d	ECB+	Cs-131	1.000E+00					-	0.046	0.459
Ba-133m	38.9h	IT	Ba-133	1.000E+00					-	0.221	0.067
Ba-133	10.74y	EC							-	0.054	0.402
Ba-135m	28.7h	IT							-	0.208	0.060
Ba-137m	2.552m	IT							-	0.065	0.597
Ba-139	82.7m	B-							-	0.898	0.043
Ba-140	12.74d	B-	La-140	1.000E+00					-	0.313	0.183

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Barium, cont'd											
Ba-141	18.27m	B-	La-141	1.000E+00					-	0.901	0.845
Ba-142	10.6m	B-	La-142	1.000E+00					-	0.440	1.047
Lanthanum											
La-131	59m	ECB+	Ba-131	1.000E+00					-	0.208	0.671
La-132	4.8h	ECB+							-	0.522	2.011
La-134	6.67m	ECB+							-	0.739	0.698
La-135	19.5h	ECB+							-	0.007	0.036
La-137	6E4y	EC							-	0.007	0.024
La-138	1.35E11y	B-EC							-	0.037	1.236
La-140	40.272h	B-							-	0.537	2.315
La-141	3.93h	B-	Ce-141	1.000E+00					-	0.948	0.043
La-142	92.5m	B-							-	0.846	2.753
La-143	14.23m	B-	Ce-143	1.000E+00					-	1.324	0.094
Cerium											
Ce-134	72.0h	EC	La-134	1.000E+00					-	0.007	0.026
Ce-135	17.6h	ECB+	La-135	1.000E+00					-	0.244	1.776
Ce-137m	34.4h	ECIT	La-137	5.900E-03	Ce-137	9.941E-01			-	0.203	0.053
Ce-137	9.0h	EC	La-137	1.000E+00					-	0.017	0.036
Ce-139	137.66d	EC							-	0.036	0.160
Ce-141	32.501d	B-							-	0.171	0.076
Ce-143	33.0h	B-	Pr-143	1.000E+00					-	0.433	0.282
Ce-144	284.3d	B-	Pr-144m	1.780E-02	Pr-144	9.822E-01			-	0.092	0.021
Praseodymium											
Pr-136	13.1m	ECB+							-	0.743	2.101
Pr-137	76.6m	ECB+	Ce-137	1.000E+00					-	0.198	0.501
Pr-138m	2.1h	ECB+							-	0.224	2.478
Pr-138	1.45m	ECB+							-	1.159	0.813
Pr-139	4.51h	ECB+	Ce-139	1.000E+00					-	0.046	0.122
Pr-142m	14.6m	IT	Pr-142	1.000E+00					-	0.004	<
Pr-142	19.13h	B-EC							-	0.808	0.058
Pr-143	13.56d	B-							-	0.314	<
Pr-144m	7.2m	ITB-	Pr-144	9.990E-01					-	0.047	0.013
Pr-144	17.28m	B-							-	1.208	0.032
Pr-145	5.98h	B-							-	0.677	0.013
Pr-147	13.6m	B-	Nd-147	1.000E+00					-	0.807	0.863
Neodymium											
Nd-136	50.65m	ECB+	Pr-136	1.000E+00					-	0.093	0.293
Nd-138	5.04h	EC	Pr-138	1.000E+00					-	0.008	0.043
Nd-139m	5.5h	ECB+IT	Pr-139	8.800E-01	Nd-139	1.200E-01			-	0.111	1.572
Nd-139	29.7m	ECB+	Pr-139	1.000E+00					-	0.201	0.406
Nd-141m	62.4s	ECIT	Nd-141	9.996E-01					-	0.068	0.759
Nd-141	2.49h	ECB+							-	0.016	0.075
Nd-147	10.98d	B-	Pm-147	1.000E+00					-	0.270	0.140
Nd-149	1.73h	B-	Pm-149	1.000E+00					-	0.506	0.384
Nd-151	12.44m	B-	Pm-151	1.000E+00					-	0.649	0.916
Promethium											
Pm-141	20.90m	ECB+	Nd-141m	9.680E-04	Nd-141	9.990E-01			-	0.632	0.744
Pm-142	40.5s	ECB+							-	1.365	0.868
Pm-143	265d	EC							-	0.008	0.315
Pm-144	363d	EC							-	0.017	1.563
Pm-145	17.7y	EC							-	0.014	0.031
Pm-146	2020d	B-EC	Sm-146	3.590E-01					-	0.097	0.753
Pm-147	2.6234y	B-	Sm-147	1.000E+00					-	0.062	<
Pm-148m	41.3d	B-IT	Pm-148	4.600E-02					-	0.170	2.000
Pm-148	5.37d	B-							-	0.724	0.575
Pm-149	53.08h	B-							-	0.366	0.011
Pm-150	2.68h	B-							-	0.807	1.431
Pm-151	28.40h	B-	Sm-151	1.000E+00					-	0.306	0.321
Samarium											
Sm-141m	22.6m	ITECB+	Pm-141	9.969E-01	Sm-141	3.100E-03			-	0.435	1.984
Sm-141	10.2m	ECB+	Pm-141	1.000E+00					-	0.706	1.405
Sm-142	72.49m	ECB+	Pm-142	1.000E+00					-	0.034	0.094

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Samarium, cont'd											
Sm-145	340d	EC	Pm-145	1.000E+00					-	0.032	0.065
Sm-146	1.03E8y	A							2.474	-	-
Sm-147	1.06E11y	A							2.248	-	-
Sm-151	90y	B-							-	0.020	<
Sm-153	46.7h	B-							-	0.273	0.062
Sm-155	22.1m	B-	Eu-155	1.000E+00					-	0.566	0.103
Sm-156	9.4h	B-	Eu-156	1.000E+00					-	0.206	0.121
Europium											
Eu-145	5.94d	ECB+	Sm-145	1.000E+00					-	0.029	1.458
Eu-146	4.61d	ECB+	Sm-146	1.000E+00					-	0.048	2.504
Eu-147	24d	A ECB+	Pm-143	2.200E-05	Sm-147	1.000E+00			<	0.042	0.497
Eu-148	54.5d	A ECB+	Pm-144	9.400E-09					<	0.023	2.177
Eu-149	93.1d	EC							-	0.011	0.063
Eu-150b	34.2y	EC							-	0.044	1.496
Eu-150a	12.62h	B-ECB+							-	0.312	0.047
Eu-152m	9.32h	ECB+B-	Gd-152	7.200E-01					-	0.507	0.293
Eu-152	13.33y	B-ECB+	Gd-152	2.792E-01					-	0.139	1.155
Eu-154	8.8y	ECB-							-	0.292	1.242
Eu-155	4.96y	B-							-	0.063	0.061
Eu-156	15.19d	B-							-	0.423	1.329
Eu-157	15.15h	B-							-	0.395	0.262
Eu-158	45.9m	B-							-	0.963	1.057
Gadolinium											
Gd-145	22.9m	ECB+	Eu-145	1.000E+00					-	0.549	2.257
Gd-146	48.3d	EC	Eu-146	1.000E+00					-	0.130	0.250
Gd-147	38.1h	ECB+	Eu-147	1.000E+00					-	0.060	1.337
Gd-148	93y	A							3.183	-	-
Gd-149	9.4d	EC	Eu-149	1.000E+00					-	0.059	0.420
Gd-151	120d	A EC	Sm-147	8.000E-09					<	0.034	0.064
Gd-152	1.08E14y	A							2.148	-	-
Gd-153	242d	EC							-	0.044	0.106
Gd-159	18.56h	B-							-	0.304	0.050
Terbium											
Tb-147	1.65h	ECB+	Gd-147	1.000E+00					-	0.564	1.590
Tb-149	4.15h	ECB+A	Eu-145	2.000E-01	Gd-149	8.000E-01			0.793	0.186	1.614
Tb-150	3.27h	ECB+							-	0.546	1.679
Tb-151	17.6h	ECB+A	Eu-147	9.500E-05	Gd-151	1.000E+00			<	0.080	0.892
Tb-153	2.34d	ECB+	Gd-153	1.000E+00					-	0.049	0.229
Tb-154	21.4h	ECB+							-	0.081	2.352
Tb-155	5.32d	EC							-	0.034	0.140
Tb-156m	24.4h	IT	Tb-156	1.000E+00					-	0.024	0.025
Tb-156n	5.0h	IT	Tb-156	1.000E+00					-	0.084	0.004
Tb-156	5.34d	EC							-	0.103	1.826
Tb-157	150y	EC							-	0.005	0.003
Tb-158	150y	B-EC							-	0.116	0.798
Tb-160	72.3d	B-							-	0.257	1.124
Tb-161	6.91d	B-							-	0.197	0.035
Dysprosium											
Dy-155	10.0h	ECB+	Tb-155	1.000E+00					-	0.028	0.582
Dy-157	8.1h	EC	Tb-157	1.000E+00					-	0.013	0.357
Dy-159	144.4d	EC							-	0.013	0.045
Dy-165	2.334h	B-							-	0.449	0.026
Dy-166	81.6h	B-	Ho-166	1.000E+00					-	0.159	0.040
Holmium											
Ho-155	48m	ECB+	Dy-155	1.000E+00					-	0.241	0.387
Ho-157	12.6m	ECB+	Dy-157	1.000E+00					-	0.081	0.493
Ho-159	33m	ECB+	Dy-159	1.000E+00					-	0.052	0.366
Ho-161	2.5h	EC							-	0.033	0.062
Ho-162m	68m	ITEC	Ho-162	6.100E-01					-	0.078	0.576
Ho-162	15m	ECB+							-	0.062	0.168
Ho-164m	37.5m	IT	Ho-164	1.000E+00					-	0.092	0.047
Ho-164	29m	ECB-							-	0.148	0.030

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

Nuclide	T½	Decay Mode	Radioactive Decay Products and Fractional Yield: Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Energy (MeV nt⁻¹): Alpha	Elect	Photon
Holmium, cont'd											
Ho-166m	1.20E3y	B-							-	0.132	1.747
Ho-166	26.80h	B-							-	0.695	0.029
Ho-167	3.1h	B-							-	0.219	0.365
Erbium											
Er-161	3.24h	ECB+	Ho-161	1.000E+00					-	0.051	0.914
Er-165	10.36h	EC							-	0.008	0.038
Er-169	9.3d	B-							-	0.104	<
Er-171	7.52h	B-	Tm-171	1.000E+00					-	0.422	0.381
Er-172	49.3h	B-	Tm-172	1.000E+00					-	0.129	0.522
Thulium											
Tm-162	21.7m	ECB+							-	0.370	1.781
Tm-166	7.70h	ECB+							-	0.103	1.870
Tm-167	9.24d	EC							-	0.128	0.146
Tm-170	128.6d	ECB-							-	0.331	0.005
Tm-171	1.92y	B-							-	0.026	<
Tm-172	63.6h	B-							-	0.530	0.477
Tm-173	8.24h	B-							-	0.319	0.388
Tm-175	15.2m	B-	Yb-175	1.000E+00					-	0.555	1.053
Ytterbium											
Yb-162	18.9m	EC	Tm-162	1.000E+00					-	0.031	0.137
Yb-166	56.7h	EC	Tm-166	1.000E+00					-	0.042	0.086
Yb-167	17.5m	ECB+	Tm-167	1.000E+00					-	0.092	0.267
Yb-169	32.01d	EC							-	0.125	0.310
Yb-175	4.19d	B-							-	0.130	0.040
Yb-177	1.9h	B-	Lu-177	1.000E+00					-	0.430	0.187
Yb-178	74m	B-	Lu-178	1.000E+00					-	0.191	0.035
Lutetium											
Lu-169	34.06h	ECB+	Yb-169	1.000E+00					-	0.054	1.041
Lu-170	2.00d	ECB+							-	0.094	2.484
Lu-171	8.22d	EC							-	0.084	0.697
Lu-172	6.70d	ECB+							-	0.119	1.888
Lu-173	1.37y	EC							-	0.036	0.130
Lu-174m	142d	ECIT	Lu-174	9.930E-01					-	0.116	0.063
Lu-174	3.31y	ECB+							-	0.042	0.126
Lu-176m	3.68h	B-							-	0.477	0.014
Lu-176	3.60E10y	B-							-	0.296	0.491
Lu-177m	160.9d	B-IT	Lu-177	2.100E-01					-	0.272	1.003
Lu-177	6.71d	B-							-	0.148	0.035
Lu-178m	22.7m	B-							-	0.591	1.109
Lu-178	28.4m	B-							-	0.773	0.140
Lu-179	4.59h	B-							-	0.464	0.031
Hafnium											
Hf-170	16.01h	EC	Lu-170	1.000E+00					-	0.091	0.549
Hf-172	1.87y	EC	Lu-172	1.000E+00					-	0.118	0.118
Hf-173	24.0h	ECB+	Lu-173	1.000E+00					-	0.053	0.408
Hf-175	70d	EC							-	0.046	0.369
Hf-177m	51.4m	IT							-	0.500	2.252
Hf-178m	31y	IT							-	0.297	2.358
Hf-179m	25.1d	IT							-	0.188	0.901
Hf-180m	5.5h	IT							-	0.139	1.008
Hf-181	42.4d	B-							-	0.203	0.555
Hf-182m	61.5m	ITB-	Ta-182	5.400E-01	Hf-182	4.600E-01			-	0.235	0.933
Hf-182	9E6y	B-	Ta-182	1.000E+00					-	0.083	0.239
Hf-183	64m	B-	Ta-183	1.000E+00					-	0.451	0.752
Hf-184	4.12h	B-	Ta-184	1.000E+00					-	0.477	0.251
Tantalum											
Ta-172	36.8m	ECB+	Hf-172	1.000E+00					-	0.505	1.550
Ta-173	3.65h	ECB+	Hf-173	1.000E+00					-	0.358	0.585
Ta-174	1.2h	ECB+							-	0.367	0.627
Ta-175	10.5h	ECB+	Hf-175	1.000E+00					-	0.064	0.933
Ta-176	8.08h	ECB+							-	0.104	2.145
Ta-177	56.6h	EC							-	0.024	0.067

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{1/2}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Tantalum, cont'd											
Ta-178b	2.2h	EC							-	0.155	1.023
Ta-178a	9.31m	EC							-	0.034	0.109
Ta-179	664.9d	EC							-	0.008	0.032
Ta-180m	8.1h	ECB-							-	0.055	0.049
Ta-180	1.0E13y	EC							-	0.123	0.560
Ta-182m	15.84m	IT	Ta-182	1.000E+00					-	0.251	0.252
Ta-182	115.0d	B-							-	0.217	1.294
Ta-183	5.1d	B-							-	0.345	0.293
Ta-184	8.7h	B-							-	0.547	1.612
Ta-185	49m	B-	W-185	1.000E+00					-	0.725	0.193
Ta-186	10.5m	B-							-	0.992	1.560
Tungsten											
W-176	2.3h	EC	Ta-176	1.000E+00					-	0.073	0.177
W-177	135m	ECB+	Ta-177	1.000E+00					-	0.104	0.903
W-178	21.7d	EC	Ta-178a	1.000E+00					-	0.007	0.014
W-179	37.5m	EC	Ta-179	1.000E+00					-	0.027	0.060
W-181	121.2d	EC							-	0.011	0.040
W-185	75.1d	B-							-	0.127	<
W-187	23.9h	B-	Re-187	1.000E+00					-	0.312	0.481
W-188	69.4d	B-	Re-188	1.000E+00					-	0.100	0.002
Rhenium											
Re-177	14.0m	ECB+	W-177	1.000E+00					-	0.361	0.620
Re-178	13.2m	ECB+	W-178	1.000E+00					-	0.578	1.218
Re-180	2.43m	ECB+							-	0.156	1.183
Re-181	20h	ECB+	W-181	1.000E+00					-	0.137	0.771
Re-182b	64.0h	EC							-	0.213	1.886
Re-182a	12.7h	ECB+							-	0.088	1.179
Re-184m	165d	ITEC	Re-184	7.470E-01					-	0.141	0.390
Re-184	38.0d	EC							-	0.056	0.891
Re-186m	2.0E5y	IT	Re-186	1.000E+00					-	0.124	0.019
Re-186	90.64h	B-EC							-	0.345	0.021
Re-187	5E10y	B-							-	<	-
Re-188m	18.6m	IT	Re-188	1.000E+00					-	0.098	0.080
Re-188	16.98h	B-							-	0.780	0.058
Re-189	24.3h	B-	Os-189m	2.410E-01					-	0.340	0.069
Osmium											
Os-180	22m	ECB+	Re-180	1.000E+00					-	0.028	0.065
Os-181	105m	ECB+	Re-181	1.000E+00					-	0.108	1.222
Os-182	22h	EC	Re-182a	1.000E+00					-	0.056	0.435
Os-185	94d	EC							-	0.019	0.719
Os-189m	6.0h	IT							-	0.029	0.002
Os-190m	9.9m	IT							-	0.116	1.588
Os-191m	13.03h	IT	Os-191	1.000E+00					-	0.065	0.009
Os-191	15.4d	B-							-	0.135	0.080
Os-193	30.0h	B-							-	0.373	0.073
Os-194	6.0y	B-	Ir-194	1.000E+00					-	0.034	0.002
Iridium											
Ir-182	15m	ECB+	Os-182	1.000E+00					-	0.935	1.340
Ir-184	3.02h	ECB+							-	0.279	1.908
Ir-185	14.0h	ECB+	Os-185	1.000E+00					-	0.115	0.601
Ir-186a	15.8h	ECB+							-	0.113	1.641
Ir-186b	1.75h	ECB+							-	0.203	0.964
Ir-187	10.5h	EC							-	0.060	0.363
Ir-188	41.5h	ECB+							-	0.058	1.584
Ir-189	13.3d	EC	Os-189m	8.300E-02					-	0.049	0.081
Ir-190n	3.1h	ITEC	Ir-190m	5.000E-02					-	0.126	1.555
Ir-190m	1.2h	IT	Ir-190	1.000E+00					-	0.024	0.002
Ir-190	12.1d	EC							-	0.129	1.443
Ir-191m	4.94s	IT							-	0.096	0.075
Ir-192m	241y	IT	Ir-192	1.000E+00					-	-	0.161
Ir-192	74.02d	B-EC							-	0.217	0.818
Ir-194m	171d	B-							-	0.156	2.335

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

Nuclide	T½	Decay Mode	Radioactive Decay Products and Fractional Yield: Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Energy (MeV nt⁻¹): Alpha	Elect	Photon
Iridium, cont'd											
Ir-194	19.15h	B-							-	0.812	0.090
Ir-195m	3.8h	ITB-	Ir-195	4.000E-02					-	0.480	0.432
Ir-195	2.5h	B-							-	0.380	0.059
Platinum											
Pt-186	2.0h	A EC	Os-182	1.400E-06	Ir-186b	1.000E+00			<	0.012	0.740
Pt-188	10.2d	EC	Ir-188	1.000E+00					-	0.080	0.202
Pt-189	10.87h	ECB+	Ir-189	1.000E+00					-	0.055	0.325
Pt-191	2.8d	EC							-	0.064	0.304
Pt-193m	4.33d	IT	Pt-193	1.000E+00					-	0.137	0.013
Pt-193	50y	EC							-	0.007	0.002
Pt-195m	4.02d	IT							-	0.183	0.076
Pt-197m	94.4m	B-IT	Pt-197	9.670E-01					-	0.324	0.083
Pt-197	18.3h	B-							-	0.254	0.025
Pt-199	30.8m	B-	Au-199	1.000E+00					-	0.535	0.202
Pt-200	12.5h	B-	Au-200	1.000E+00					-	0.243	0.061
Gold											
Au-193	17.65h	EC	Pt-193	1.000E+00					-	0.064	0.160
Au-194	39.5h	ECB+							-	0.043	1.067
Au-195m	30.5s	IT	Au-195	1.000E+00					-	0.117	0.201
Au-195	183d	EC							-	0.051	0.085
Au-198m	2.30d	IT	Au-198	1.000E+00					-	0.289	0.577
Au-198	2.696d	B-							-	0.327	0.405
Au-199	3.139d	B-							-	0.143	0.089
Au-200m	18.7h	B-IT	Au-200	1.800E-01					-	0.276	2.087
Au-200	48.4m	B-							-	0.740	0.272
Au-201	26.4m	B-							-	0.422	0.053
Mercury											
Hg-193m	11.1h	ECB+IT	Au-193	9.200E-01	Hg-193	8.000E-02			-	0.139	1.046
Hg-193	3.5h	ECB+	Au-193	1.000E+00					-	0.125	0.203
Hg-194	260y	EC	Au-194	1.000E+00					-	0.007	0.003
Hg-195m	41.6h	ITEC	Au-195	4.580E-01	Hg-195	5.420E-01			-	0.150	0.214
Hg-195	9.9h	EC	Au-195	1.000E+00					-	0.065	0.204
Hg-197m	23.8h	ECIT	Hg-197	9.300E-01					-	0.215	0.094
Hg-197	64.1h	EC							-	0.066	0.070
Hg-199m	42.6m	IT							-	0.352	0.186
Hg-203	46.60d	B-							-	0.099	0.238
Thallium											
Tl-194m	32.8m	ECB+	Hg-194	1.000E+00					-	0.342	2.319
Tl-194	33m	EC	Hg-194	1.000E+00					-	0.030	0.779
Tl-195	1.16h	ECB+	Hg-195	1.000E+00					-	0.096	1.271
Tl-197	2.84h	ECB+	Hg-197	1.000E+00					-	0.061	0.409
Tl-198m	1.87h	ECB+IT	Tl-198	4.700E-01					-	0.201	1.195
Tl-198	5.3h	ECB+							-	0.041	2.006
Tl-199	7.42h	ECB+							-	0.056	0.249
Tl-200	26.1h	ECB+							-	0.040	1.311
Tl-201	3.044d	EC							-	0.043	0.093
Tl-202	12.23d	ECB+							-	0.023	0.468
Tl-204	3.779y	ECB-							-	0.238	0.001
Tl-206	4.20m	B-							-	0.537	<
Tl-207	4.77m	B-							-	0.493	0.002
Tl-208	3.07m	B-							-	0.598	3.375
Tl-209	2.20m	B-	Pb-209	1.000E+00					-	0.688	2.032
Lead											
Pb-195m	15.8m	ECB+	Tl-195	1.000E+00					-	0.302	1.599
Pb-198	2.4h	EC	Tl-198	1.000E+00					-	0.079	0.439
Pb-199	90m	ECB+	Tl-199	1.000E+00					-	0.054	1.476
Pb-200	21.5h	EC	Tl-200	1.000E+00					-	0.099	0.209
Pb-201	9.4h	ECB+	Tl-201	1.000E+00					-	0.058	0.758
Pb-202m	3.62h	ITEC	Tl-202	9.500E-02	Pb-202	9.050E-01			-	0.076	2.043
Pb-202	3E5y	EC	Tl-202	1.000E+00					-	0.006	0.002
Pb-203	52.05h	EC							-	0.052	0.312
Pb-205	1.43E7y	EC							-	0.007	0.002

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{1/2}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Lead, cont'd											
Pb-209	3.253h	B-							-	0.198	-
Pb-210	22.3y	B-	Bi-210	1.000E+00					-	0.038	0.005
Pb-211	36.1m	B-	Bi-211	1.000E+00					-	0.456	0.051
Pb-212	10.64h	B-	Bi-212	1.000E+00					-	0.176	0.148
Pb-214	26.8m	B-	Bi-214	1.000E+00					-	0.293	0.250
Bismuth											
Bi-200	36.4m	ECB+	Pb-200	1.000E+00					-	0.190	2.393
Bi-201	108m	EC	Pb-201	1.000E+00					-	0.258	1.339
Bi-202	1.67h	ECB+	Pb-202m	2.500E-03	Pb-202	9.975E-01			-	0.109	2.713
Bi-203	11.76h	ECB+	Pb-203	1.000E+00					-	0.080	2.384
Bi-205	15.31d	ECB+	Pb-205	1.000E+00					-	0.034	1.690
Bi-206	6.243d	EC							-	0.136	3.278
Bi-207	38y	ECB+							-	0.117	1.540
Bi-210m	3.0E6y	A	Tl-206	1.000E+00					4.913	0.047	0.257
Bi-210	5.012d	B-	Po-210	1.000E+00					-	0.389	-
Bi-211	2.14m	A B-	Tl-207	9.972E-01	Po-211	2.800E-03			6.550	0.010	0.047
Bi-212	60.55m	B-A	Tl-208	3.593E-01	Po-212	6.407E-01			2.174	0.472	0.186
Bi-213	45.65m	B-A	Tl-209	2.160E-02	Po-213	9.784E-01			0.126	0.442	0.133
Bi-214	19.9m	B-	Po-214	9.998E-01					-	0.659	1.508
Polonium											
Po-203	36.7m	ECB+	Bi-203	9.989E-01					-	0.164	1.644
Po-205	1.80h	A ECB+	Pb-201	1.400E-03	Bi-205	9.986E-01			0.007	0.060	1.581
Po-207	350m	ECB+	Bi-207	1.000E+00					-	0.052	1.331
Po-210	138.38d	A							5.297	<	<
Po-211	0.516s	A							7.442	<	0.008
Po-212	0.305µs	A							8.785	-	-
Po-213	4.2µs	A	Pb-209	1.000E+00					8.376	-	-
Po-214	164.3µs	A	Pb-210	1.000E+00					7.687	<	<
Po-215	0.00178s	A	Pb-211	1.000E+00					7.386	<	<
Po-216	0.15s	A	Pb-212	1.000E+00					6.779	<	<
Po-218	3.05m	A B-	Pb-214	9.998E-01	At-218	2.000E-04			6.001	<	<
Astatine											
At-207	1.80h	ECA	Bi-203	1.000E-01	Po-207	9.000E-01			0.576	0.080	1.325
At-211	7.214h	ECA	Bi-207	4.170E-01	Po-211	5.830E-01			2.446	0.006	0.039
At-215	0.10ms	A	Bi-211	1.000E+00					8.026	<	<
At-216	0.30ms	A	Bi-212	1.000E+00					7.799	<	0.002
At-217	0.0323s	A	Bi-213	1.000E+00					7.067	<	<
At-218	2s	A	Bi-214	9.990E-01					6.697	0.040	0.007
Radon											
Rn-218	35ms	A	Po-214	1.000E+00					7.132	<	<
Rn-219	3.96s	A	Po-215	1.000E+00					6.757	0.006	0.056
Rn-220	55.6s	A	Po-216	1.000E+00					6.288	<	<
Rn-222	3.8235d	A	Po-218	1.000E+00					5.489	<	<
Francium											
Fr-219	21ms	A	At-215	1.000E+00					7.313	<	0.003
Fr-220	27.4s	A	At-216	1.000E+00					6.637	0.028	0.012
Fr-221	4.8m	A	At-217	1.000E+00					6.304	0.010	0.031
Fr-222	14.4m	B-	Ra-222	1.000E+00					-	0.731	-
Fr-223	21.8m	B-	Ra-223	9.999E-01					-	0.400	0.059
Radium											
Ra-222	38.0s	A	Rn-218	1.000E+00					6.546	<	0.009
Ra-223	11.434d	A	Rn-219	1.000E+00					5.667	0.076	0.134
Ra-224	3.66d	A	Rn-220	1.000E+00					5.674	0.002	0.010
Ra-225	14.8d	B-	Ac-225	1.000E+00					-	0.107	0.014
Ra-226	1600y	A	Rn-222	1.000E+00					4.774	0.004	0.007
Ra-227	42.2m	B-	Ac-227	1.000E+00					-	0.439	0.167
Ra-228	5.75y	B-	Ac-228	1.000E+00					-	0.017	<
Actinium											
Ac-223	2.2m	A	Fr-219	1.000E+00					6.553	0.015	0.006
Ac-224	2.9h	A EC	Fr-220	1.000E-01	Ra-224	9.000E-01			0.611	0.040	0.200
Ac-225	10.0d	A	Fr-221	1.000E+00					5.787	0.022	0.018
Ac-226	29h	A B-EC	Th-226	8.280E-01	Ra-226	1.720E-01	Fr-222	6.000E-05	<	0.289	0.130

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield						Energy (MeV nt^{-1})		
Nuclide	$T_{½}$	Decay Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Actinium, cont'd											
Ac-227	21.773y	B-A	Fr-223	1.380E-02	Th-227	9.862E-01			0.068	0.016	<
Ac-228	6.13h	B-	Th-228	1.000E+00					-	0.475	0.971
Thorium											
Th-226	30.9m	A	Ra-222	1.000E+00					6.308	0.021	0.009
Th-227	18.718d	A	Ra-223	1.000E+00					5.884	0.053	0.110
Th-228	1.9131y	A	Ra-224	1.000E+00					5.400	0.021	0.003
Th-229	7340y	A	Ra-225	1.000E+00					4.873	0.116	0.096
Th-230	7.7E4y	A	Ra-226	1.000E+00					4.671	0.015	0.002
Th-231	25.52h	B-	Pa-231	1.000E+00					-	0.165	0.026
Th-232	1.405E10y	A	Ra-228	1.000E+00					3.996	0.012	0.001
Th-234	24.10d	B-	Pa-234m	9.980E-01	Pa-234	2.000E-03			-	0.060	0.009
Protactinium											
Pa-227	38.3m	ECA	Ac-223	8.500E-01	Th-227	1.500E-01			5.468	0.016	0.022
Pa-228	22h	A ECB+	Ac-224	2.000E-02	Th-228	9.800E-01			0.120	0.165	1.141
Pa-230	17.4d	A ECB-	U-230	9.500E-02	Th-230	9.050E-01	Ac-226	3.200E-05	<	0.068	0.652
Pa-231	3.276E4y	A	Ac-227	1.000E+00					4.969	0.065	0.048
Pa-232	1.31d	B-	U-232	1.000E+00					-	0.175	0.939
Pa-233	27.0d	B-	U-233	1.000E+00					-	0.196	0.204
Pa-234m	1.17m	B-IT	U-234	9.987E-01	Pa-234	1.300E-03			-	0.822	0.012
Pa-234	6.70h	B-	U-234	1.000E+00					-	0.494	1.919
Uranium											
U-230	20.8d	A	Th-226	1.000E+00					5.864	0.022	0.003
U-231	4.2d	ECA	Th-227	5.500E-05	Pa-231	1.000E+00			<	0.071	0.082
U-232	72y	A	Th-228	1.000E+00					5.302	0.017	0.002
U-233	1.585E5y	A	Th-229	1.000E+00					4.817	0.006	0.001
U-234	2.445E5y	A	Th-230	1.000E+00					4.758	0.013	0.002
U-235	703.8E6y	A	Th-231	1.000E+00					4.396	0.049	0.156
U-236	2.3415E7y	A	Th-232	1.000E+00					4.505	0.011	0.002
U-237	6.75d	B-	Np-237	1.000E+00					-	0.196	0.143
U-238	4.468E9y	SFA	Th-234	1.000E+00	SF	5.400E-05			4.187	0.010	0.001
U-239	23.54m	B-	Np-239	1.000E+00					-	0.412	0.053
U-240	14.1h	B-	Np-240m	1.000E+00					-	0.138	0.008
Neptunium											
Np-232	14.7m	ECB+	U-232	1.000E+00					-	0.106	1.203
Np-233	36.2m	EC	U-233	1.000E+00					-	0.014	0.091
Np-234	4.4d	ECB+	U-234	1.000E+00					-	0.069	1.442
Np-235	396.1d	ECA	Pa-231	1.400E-05	U-235	9.999E-01			<	0.010	0.007
Np-236a	115E3y	ECB-	Pu-236	8.900E-02	U-236	9.110E-01			-	0.208	0.136
Np-236b	22.5h	B-EC	Pu-236	4.800E-01	U-236	5.200E-01			-	0.087	0.051
Np-237	2.14E6y	A	Pa-233	1.000E+00					4.769	0.070	0.035
Np-238	2.117d	B-	Pu-238	1.000E+00					-	0.264	0.553
Np-239	2.355d	B-	Pu-239	1.000E+00					-	0.260	0.173
Np-240m	7.4m	B-	Pu-240	9.989E-01					-	0.683	0.337
Np-240	65m	B-	Pu-240	1.000E+00					-	0.528	1.313
Plutonium											
Pu-234	8.8h	A EC	U-230	6.000E-02	Np-234	9.400E-01			0.371	0.011	0.069
Pu-235	25.3m	ECA	U-231	2.700E-05	Np-235	1.000E+00			<	0.021	0.095
Pu-236	2.851y	SFA	U-232	1.000E+00	SF	8.100E-10			5.753	0.013	0.002
Pu-237	45.3d	A EC	U-233	5.000E-05	Np-237	1.000E+00			<	0.016	0.052
Pu-238	87.74y	SFA	U-234	1.000E+00	SF	1.840E-09			5.487	0.011	0.002
Pu-239	24065y	A	U-235	1.000E+00					5.148	0.007	<
Pu-240	6537y	SFA	U-236	1.000E+00	SF	4.950E-08			5.156	0.011	0.002
Pu-241	14.4y	A B-	U-237	2.450E-05	Am-241	1.000E+00			<	0.005	<
Pu-242	3.763E5y	SFA	U-238	1.000E+00	SF	5.500E-06			4.891	0.009	0.001
Pu-243	4.956h	B-	Am-243	1.000E+00					-	0.173	0.026
Pu-244	8.26E7y	SFA	U-240	1.000E+00	SF	1.250E-03			4.575	0.007	0.001
Pu-245	10.5h	B-	Am-245	1.000E+00					-	0.350	0.417
Pu-246	10.85d	B-	Am-246	1.000E+00					-	0.125	0.140
Americium											
Am-237	73.0m	A EC	Np-233	2.500E-04	Pu-237	9.997E-01			0.002	0.077	0.370
Am-238	98m	ECA	Np-234	1.000E-06	Pu-238	1.000E+00			<	0.052	0.891
Am-239	11.9h	A EC	Np-235	1.000E-04	Pu-239	9.999E-01			<	0.168	0.239

Table A.1. Summary Information on the Nuclear Transformation of the Radionuclides

			Radioactive Decay Products and Fractional Yield								
		Decay							Energy (MeV nt^{-1})		
Nuclide	$T_{1/2}$	Mode	Nuclide	Fraction	Nuclide	Fraction	Nuclide	Fraction	Alpha	Elect	Photon
Americium, cont'd											
Am-240	50.8h	A EC	Np-236b	1.900E-06	Pu-240	1.000E+00			<	0.075	1.029
Am-241	432.2y	A	Np-237	1.000E+00					5.479	0.052	0.033
Am-242m	152y	A IT	Np-238	4.800E-03	Am-242	9.952E-01			0.025	0.044	0.005
Am-242	16.02h	ECB-	Cm-242	8.270E-01	Pu-242	1.730E-01			-	0.179	0.018
Am-243	7380y	A	Np-239	1.000E+00					5.270	0.022	0.056
Am-244m	26m	B-	Cm-244	1.000E+00					-	0.509	0.002
Am-244	10.1h	B-	Cm-244	1.000E+00					-	0.342	0.807
Am-245	2.05h	B-	Cm-245	1.000E+00					-	0.288	0.032
Am-246m	25.0m	B-	Cm-246	1.000E+00					-	0.498	1.018
Am-246	39m	B-	Cm-246	1.000E+00					-	0.655	0.699
Curium											
Cm-238	2.4h	ECA	Pu-234	1.000E-01	Am-238	9.000E-01			0.652	0.010	0.077
Cm-240	27d	A	Pu-236	1.000E+00					6.247	0.011	0.002
Cm-241	32.8d	A EC	Pu-237	1.000E-02	Am-241	9.900E-01			0.059	0.133	0.502
Cm-242	162.8d	SFA	Pu-238	1.000E+00	SF	6.800E-08			6.102	0.010	0.002
Cm-243	28.5y	A EC	Pu-239	9.980E-01	Am-243	2.400E-03			5.797	0.138	0.134
Cm-244	18.11y	SFA	Pu-240	1.000E+00	SF	1.350E-06			5.795	0.009	0.002
Cm-245	8500y	A	Pu-241	1.000E+00					5.363	0.065	0.096
Cm-246	4730y	SFA	Pu-242	9.997E-01	SF	2.610E-04			5.376	0.008	0.002
Cm-247	1.56E7y	A	Pu-243	1.000E+00					4.949	0.021	0.316
Cm-248	3.39E5y	SFA	Pu-244	9.174E-01	SF	8.260E-02			4.651	0.006	0.001
Cm-249	64.15m	B-	Bk-249	1.000E+00					-	0.284	0.019
Cm-250	6900y	SFA B-	Pu-246	2.500E-01	Bk-250	1.400E-01	SF	6.100E-01	1.296	0.002	-
Berkelium											
Bk-245	4.94d	A EC	Am-241	1.200E-03	Cm-245	9.988E-01			0.007	0.133	0.234
Bk-246	1.83d	EC	Cm-246	1.000E+00					-	0.054	0.951
Bk-247	1380y	A	Am-243	1.000E+00					5.610	0.061	0.105
Bk-249	320d	SFB-A	Am-245	1.450E-05	Cf-249	1.000E+00	SF	4.700E-10	<	0.033	<
Bk-250	3.222h	B-	Cf-250	1.000E+00					-	0.293	0.887
Californium											
Cf-244	19.4m	A	Cm-240	1.000E+00					7.200	0.009	0.002
Cf-246	35.7h	SFA	Cm-242	9.997E-01	SF	2.000E-06			6.747	0.006	0.001
Cf-248	333.5d	SFA	Cm-244	1.000E+00	SF	2.900E-05			6.253	0.006	0.001
Cf-249	350.6y	A SF	Cm-245	1.000E+00	SF	5.200E-09			5.831	0.044	0.335
Cf-250	13.08y	SFA	Cm-246	9.992E-01	SF	7.700E-04			6.019	0.006	0.001
Cf-251	898y	A	Cm-247	1.000E+00					5.784	0.198	0.132
Cf-252	2.638y	SFA	Cm-248	9.691E-01	SF	3.092E-02			5.922	0.006	0.001
Cf-253	17.81d	B-A	Cm-249	3.100E-03	Es-253	9.969E-01			0.019	0.079	<
Cf-254	60.5d	SFA	Cm-250	3.100E-03	SF	9.969E-01			0.018	<	<
Einsteinium											
Es-250	2.1h	EC	Cf-250	1.000E+00					-	0.022	0.397
Es-251	33h	ECA	Bk-247	5.000E-03	Cf-251	9.950E-01			0.032	0.052	0.098
Es-253	20.47d	SFA	Bk-249	1.000E+00	SF	8.700E-08			6.628	0.004	0.001
Es-254m	39.3h	A B-	Bk-250	3.200E-03	Fm-254	9.800E-01			0.020	0.256	0.470
Es-254	275.7d	A	Bk-250	1.000E+00					6.423	0.071	0.019
Fermium											
Fm-252	22.7h	A	Cf-248	1.000E+00					7.034	0.005	0.001
Fm-253	3.00d	ECA	Cf-249	1.200E-01	Es-253	8.800E-01			0.822	0.022	0.083
Fm-254	3.240h	A	Cf-250	1.000E+00					7.182	0.006	0.001
Fm-255	20.07h	A	Cf-251	1.000E+00					7.019	0.098	0.014
Fm-257	100.5d	A	Cf-253	9.979E-01					6.511	0.121	0.111
Mendelevium											
Md-257	5.2h	A EC	Es-253	1.000E-01	Fm-257	9.000E-01			0.707	0.015	0.114
Md-258	55d	A	Es-254	1.000E+00					7.232	0.047	0.006

APPENDIX B
MODIFICATIONS TO THE HUMAN PHANTOM

Organ doses were computed for 25 organs in the Cristy adult hermaphrodite phantom (Cristy and Eckerman, 1987). Two modifications were made to the phantom before the calculations were performed. In the first, the head region was modified to include a neck 8.4 cm high and 10.8 cm in diameter, and the right elliptical cylinder comprising the lower portion of the head was shortened from 16.85 cm to 13.05 cm. The y-coordinate[1] of the center of the concentric cylinders bounding the lobes of the thyroid was changed from -4.00 cm to -2.30 cm to place the thyroid in an appropriate position for external dosimetry studies. The upper portion of the spine was also relocated to a more appropriate position by changing the y-coordinate of the center of the bounding elliptical cylinder from 5.50 cm to 1.45 cm.

The second modification was the addition of an esophagus model, which is divided into two parts. The thoracic portion lies within the upper trunk and contains a small amount of air (represented by a void in the model). It is described as the region between two right elliptical cylinders:

$$\left.\begin{array}{l} \left(\dfrac{x}{a}\right)^2 + \left(\dfrac{y - y_0}{b}\right)^2 \le 1 \\ \left(\dfrac{x}{a - d}\right)^2 + \left(\dfrac{y - y_0}{b - d}\right)^2 \ge 1 \end{array}\right\}, \qquad z_2 \le z \le z_3 , \qquad \textbf{(B.1)}$$

where a = 1.17 cm, b = 0.42 cm, d = 0.3 cm, y_0 = 2.575 cm, z_2 = 43.0 cm, and z_3 = 70.0 cm. The abdominal portion lies within the upper abdomen (middle trunk of the phantom) and is closed. It is described by a right circular cylinder:

$$y'^2 + z'^2 \le r^2, \qquad x'_1 \le x' \le x'_2 , \qquad \textbf{(B.2)}$$

---

[1]The origin of the coordinate system is at the center of the base of the trunk section of the phantom. The z-axis is directed upward toward the head, the x-axis is directed toward the left side of the phantom, and the y-axis is directed toward the posterior of the phantom.

where a point in the (x', y', z') coordinate system is related to the (x, y, z) coordinate system of the phantom by the following rotation-translation equations:

$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \alpha_1 & \beta_1 & \gamma_1 \\ \alpha_2 & \beta_2 & \gamma_2 \\ \alpha_3 & \beta_3 & \gamma_3 \end{bmatrix} \begin{bmatrix} x \\ y - y_0 \\ z - z_1 \end{bmatrix} , \qquad \textbf{(B.3)}$$

and where r = 0.7 cm, x_1' = 0.1 cm, x_2' = 7.8 cm, z_1 = 42.3 cm, α_1 = 0.7360836, β_1 = -0.6049687, γ_1 = -0.3036345, α_2 = 0.6349453, β_2 = 0.7725571, γ_2 = 0, α_3 = 0.2345750, β_3 = -0.1927913, and γ_3 = 0.9527886.

APPENDIX C
EXTERNAL BREMSSTRAHLUNG

When electrons decelerate in a medium, a fraction of their kinetic energy is converted into energy in the form of photons. In this context, the photons are called bremsstrahlung from the German word for braking radiation. This type of radiation is further specified as external bremsstrahlung. Bremsstrahlung emitted when an electron is ejected from the nucleus in the beta decay process is called internal bremsstrahlung. Generation of bremsstrahlung is a stochastically-governed process and the bremsstrahlung can range in energy from zero up to the initial kinetic energy of the electron. Hence, for a large collection of monoenergetic electrons, a continuous bremsstrahlung energy spectrum is generated.

Calculations of bremsstrahlung spectral shapes are quite tedious because of the complexity of the bremsstrahlung cross-section formulas. However, Pratt et al. (1977) tabulated bremsstrahlung cross-section data for electrons of kinetic energy between 1 keV and 2 MeV incident on neutral atoms of atomic number between 2 and 92. This tabulation is based on an extensive set of numerical calculations of the bremsstrahlung cross-sections carried out by Tseng and Pratt (1971) and by Lee et al. (1976). The cross-section values are believed to be accurate within at least 10%.

Dillman and Eckerman (1993) have tabulated scaled bremsstrahlung spectral shape data from electrons of kinetic energy between 1 keV and 10 MeV incident on neutral atoms of atomic number between 1 and 92. Their tables provide values of bremsstrahlung spectra, multiplied by a scaling factor of $100\,k/T$, as a function of k/T where k is the bremsstrahlung energy and T is the kinetic energy of the electron. These tables are based on the cross-section values of Pratt et al. (1977) with an extension of their data to electron kinetics energies up to 10 MeV.

Tables C.1 through C.3 provide scaled values of $S(k, T)$, the bremsstrahlung spectra produced at photon energy k for initial electron kinetic energy T in units of keV for air, water, and soil, respectively. The tabulated quantity is $S(k,\ T)$ in units of photons MeV^{-1}, multiplied by a dimensionless scaling factor of $100\ \ k/T$. The scaled quantity, designated as $S^{/}(k,\ T)$, is tabulated for a grid of 27 electron kinetic energy values ranging from 1 keV to 10 MeV; for each electron energy, there are entries for 12 values of *k/T* ranging from 0.0 to 0.95. The tabulated quantity approaches zero as *k/T* approaches 1.0 so a table entry at *k/T* = 1.0 is not necessary. The fraction of the initial kinetic energy of an electron that is converted to bremsstrahlung, that is, the radiation yield

Y, is given by

$$Y = \int_o^T \frac{k}{T} \, S(k, T) \, dk$$
$$= \frac{1}{100} \int_o^T S^{/}(k, T) \, dk \quad . \qquad \textbf{(C.1)}$$

The radiation yield Y must, of course, be less than 1. The values of $S^{/}(k, T)$ for the slowing-down medium are folded with the beta spectrum to obtain the bremsstrahlung spectrum associated with beta decay. Defining $S_{\beta}(k, T_o)$ as the bremsstrahlung spectrum (photons MeV^{-1} per Bq s) at energy k for a beta spectrum with endpoint kinetic energy T_0, we have

$$S_{\beta}(k, T_o) = \int_k^{T_o} Y_{\beta}(T) \, S(k, T) \, dT$$
$$= \int_k^{T_o} Y_{\beta}(T) \, \frac{S^{/}(k, T)}{100 k/T} \, dT \quad , \qquad \textbf{(C.2)}$$

where $Y_{\beta}(T)$ is the probability per unit energy of beta emission with kinetic energy T.

The beta spectrum Y_{β} may be calculated using the Fermi theory of beta decay. In this work we have used spectral data computed using the EDISTR code of Dillman (1980). Fig. C.1 shows the external bremsstrahlung spectrum of ^{85}Kr in air computed using these data. External bremsstrahlung spectra were calculated in this work only for beta particles slowing down in air, water, and in soil. We applied the information of Dillman and Eckerman (1993) to positrons even though important differences exist in the slowing-down process between electrons and positrons. For positron emitters, the annihilation photons, not bremsstrahlung, are the major penetrating radiations.

For exposure to contaminated soil, it has been assumed that all emitted beta particles slow down in the soil. This assumption overestimates the bremsstrahlung contribution for beta emitters on the soil surface.

Table C.1. Scaled External Bremsstrahlung Spectra from Electrons for Air

k/T T	0.00	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
1.0	6.71	5.19	4.29	3.31	2.69	2.20	1.76	1.37	0.997	0.649	0.318	0.157
2.5	4.04	3.45	3.07	2.58	2.16	1.79	1.43	1.11	0.809	0.525	0.256	0.126
5.0	3.34	3.06	2.82	2.37	1.96	1.60	1.26	0.965	0.693	0.444	0.215	0.105
10.0	3.14	2.89	2.64	2.15	1.72	1.36	1.06	0.794	0.563	0.356	0.170	0.0834
25.0	3.08	2.72	2.38	1.82	1.40	1.08	0.809	0.590	0.405	0.249	0.116	0.0557
50.0	3.02	2.53	2.14	1.57	1.17	0.871	0.638	0.453	0.303	0.180	0.0802	0.0380
75.0	2.96	2.42	2.00	1.43	1.05	0.766	0.553	0.386	0.253	0.147	0.0635	0.0295
100.0	2.90	2.32	1.90	1.33	0.960	0.697	0.497	0.342	0.220	0.126	0.0531	0.0243
200.0	2.72	2.08	1.64	1.10	0.772	0.543	0.375	0.250	0.155	0.0844	0.0334	0.0146
300.0	2.60	1.93	1.50	0.983	0.675	0.466	0.317	0.207	0.126	0.0668	0.0254	0.0108
400.0	2.51	1.83	1.41	0.909	0.616	0.420	0.282	0.182	0.109	0.0570	0.0212	0.0088
500.0	2.44	1.76	1.34	0.858	0.577	0.391	0.260	0.166	0.0992	0.0512	0.0187	0.0075
600.0	2.38	1.71	1.29	0.821	0.550	0.370	0.245	0.156	0.0925	0.0475	0.0171	0.0068
800.0	2.30	1.63	1.22	0.775	0.515	0.346	0.228	0.145	0.0855	0.0435	0.0154	0.0060
1000.0	2.24	1.58	1.18	0.747	0.497	0.332	0.220	0.140	0.0825	0.0418	0.0146	0.0056
1200.0	2.20	1.55	1.16	0.730	0.485	0.327	0.217	0.138	0.0814	0.0413	0.0144	0.0054
1400.0	2.15	1.52	1.14	0.718	0.478	0.323	0.216	0.138	0.0815	0.0414	0.0143	0.0054
1600.0	2.12	1.49	1.13	0.712	0.477	0.323	0.216	0.139	0.0823	0.0417	0.0144	0.0053
1800.0	2.09	1.48	1.12	0.707	0.476	0.323	0.217	0.140	0.0834	0.0423	0.0145	0.0054
2000.0	2.07	1.46	1.11	0.705	0.475	0.325	0.218	0.142	0.0845	0.0430	0.0148	0.0054
2500.0	2.02	1.44	1.09	0.705	0.479	0.330	0.224	0.147	0.0882	0.0452	0.0154	0.0057
3000.0	1.99	1.43	1.09	0.708	0.484	0.337	0.231	0.152	0.0919	0.0471	0.0161	0.0060
4000.0	1.94	1.42	1.09	0.716	0.498	0.350	0.243	0.161	0.0987	0.0508	0.0172	0.0064
5000.0	1.90	1.40	1.09	0.725	0.510	0.362	0.253	0.170	0.105	0.0541	0.0185	0.0068
6000.0	1.88	1.39	1.09	0.733	0.520	0.372	0.261	0.177	0.110	0.0571	0.0195	0.0072
8000.0	1.84	1.38	1.08	0.741	0.533	0.385	0.274	0.188	0.118	0.0620	0.0213	0.0079
10000.0	1.80	1.36	1.07	0.744	0.539	0.394	0.283	0.196	0.124	0.0659	0.0229	0.0086

Table C.2. Scaled External Bremsstrahlung Spectra from Electrons for Water

k/T T	0.00	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
1.0	5.8851	4.5348	3.7312	2.8741	2.3237	1.8935	1.5196	1.1743	0.8543	0.5551	0.2718	0.1340
2.5	3.5500	3.0241	2.6859	2.2375	1.8684	1.5386	1.2289	0.9472	0.6899	0.4460	0.2164	0.1067
5.0	2.9481	2.6837	2.4542	2.0525	1.6849	1.3652	1.0741	0.8191	0.5867	0.3746	0.1802	0.0884
10.0	2.7706	2.5242	2.2868	1.8513	1.4761	1.1574	0.8957	0.6699	0.4726	0.2974	0.1417	0.0693
25.0	2.7092	2.3644	2.0567	1.5611	1.1961	0.9141	0.6825	0.4947	0.3380	0.2060	0.0951	0.0457
50.0	2.6501	2.1986	1.8472	1.3263	0.9978	0.7386	0.5387	0.3807	0.2529	0.1487	0.0658	0.0310
75.0	2.5847	2.0978	1.7289	1.2265	0.8905	0.6503	0.4676	0.3250	0.2116	0.1218	0.0521	0.0240
100.0	2.5295	2.0069	1.6381	1.1362	0.8201	0.5926	0.4207	0.2881	0.1846	0.1048	0.0436	0.0198
200.0	2.3740	1.7977	1.4117	0.9463	0.6602	0.4626	0.3188	0.2114	0.1305	0.0706	0.0276	0.0119
300.0	2.2649	1.6708	1.2939	0.8450	0.5788	0.3984	0.2700	0.1753	0.1062	0.0561	0.0211	0.0088
400.0	2.1655	1.5802	1.2124	0.7817	0.5290	0.3595	0.2410	0.1545	0.0926	0.0481	0.0176	0.0072
500.0	2.1287	1.5256	1.1580	0.7382	0.4954	0.3350	0.2220	0.1419	0.0842	0.0433	0.0156	0.0062
600.0	2.0741	1.4803	1.1128	0.7074	0.4728	0.3178	0.2103	0.1337	0.0788	0.0402	0.0143	0.0056
800.0	2.0103	1.4168	1.0585	0.6684	0.4439	0.2970	0.1958	0.1247	0.0730	0.0307	0.0130	0.0050
1000.0	1.9671	1.3717	1.0223	0.6450	0.4285	0.2862	0.1895	0.1202	0.0706	0.0356	0.0123	0.0047
1200.0	1.9194	1.3443	1.0042	0.6315	0.4186	0.1868	0.1184	0.0698	0.0353	0.0122	0.0045	0.0045
1400.0	1.8827	1.3174	0.9862	0.6215	0.4132	0.2790	0.1859	0.1185	0.0700	0.0354	0.0122	0.0045
1600.0	1.8553	1.2993	0.9771	0.6161	0.4124	0.2791	0.1860	0.1194	0.0708	0.0358	0.0123	0.0044
1800.0	1.8279	1.2902	0.9682	0.6126	0.4115	0.2791	0.1869	0.1203	0.0718	0.0363	0.0124	0.0045
2000.0	1.8095	1.2722	0.9592	0.6108	0.4116	0.2810	0.1888	0.1222	0.0728	0.0370	0.0126	0.0045
2500.0	1.7711	1.2538	0.9505	0.6119	0.4153	0.2857	0.1943	0.1268	0.0761	0.0389	0.0132	0.0048
3000.0	1.7395	1.2441	0.9506	0.6148	0.4201	0.2921	0.1999	0.1314	0.0794	0.0407	0.0138	0.0051
4000.0	1.6886	1.2343	0.9513	0.6234	0.4330	0.3042	0.2109	0.1397	0.0855	0.0440	0.0149	0.0055
5000.0	1.6586	1.2249	0.9517	0.6319	0.4443	0.3153	0.2202	0.1480	0.0909	0.0469	0.0160	0.0058
6000.0	1.6392	1.2159	0.9522	0.6395	0.4536	0.3245	0.2274	0.1544	0.0959	0.0496	0.0169	0.0062
8000.0	1.6019	1.2068	0.9437	0.6481	0.4658	0.3366	0.2396	0.1637	0.1033	0.0540	0.0185	0.0069
10000.0	1.5742	1.1889	0.9441	0.6521	0.4725	0.3451	0.2480	0.1711	0.1089	0.0576	0.0200	0.0075

Table C.3. Scaled External Bremsstrahlung Spectra from Electrons for Soil

k/T T	0.00	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
1.0	7.60	5.92	4.91	3.80	3.09	2.54	2.04	1.59	1.17	0.764	0.375	0.186
2.5	4.58	3.91	3.48	2.94	2.48	2.06	1.67	1.31	0.957	0.626	0.307	0.152
5.0	3.80	3.48	3.21	2.73	2.29	1.88	1.51	1.16	0.842	0.544	0.264	0.130
10.0	3.58	3.33	3.06	2.53	2.06	1.66	1.30	0.990	0.709	0.453	0.218	0.107
25.0	3.54	3.17	2.82	2.21	1.74	1.36	1.04	0.771	0.537	0.335	0.157	0.0764
50.0	3.50	3.00	2.58	1.93	1.47	1.11	0.831	0.601	0.410	0.249	0.114	0.0545
75.0	3.46	2.88	2.42	1.76	1.32	0.982	0.723	0.514	0.344	0.205	0.0914	0.0433
100.0	3.40	2.77	2.30	1.65	1.21	0.893	0.649	0.455	0.300	0.176	0.0770	0.0360
200.0	3.21	2.50	2.00	1.37	0.973	0.694	0.487	0.329	0.209	0.117	0.0485	0.0219
300.0	3.09	2.33	1.83	1.22	0.849	0.592	0.407	0.270	0.167	0.0913	0.0365	0.0160
400.0	3.00	2.22	1.72	1.13	0.772	0.532	0.361	0.236	0.144	0.0772	0.0300	0.0130
500.0	2.91	2.13	1.64	1.06	0.720	0.492	0.331	0.214	0.130	0.0686	0.0262	0.0111
600.0	2.85	2.07	1.58	1.01	0.685	0.465	0.311	0.200	0.120	0.0632	0.0238	0.0099
800.0	2.76	1.97	1.50	0.955	0.639	0.432	0.287	0.184	0.110	0.0571	0.0211	0.0087
1000.0	2.69	1.91	1.45	0.919	0.613	0.414	0.276	0.177	0.105	0.0545	0.0198	0.0080
1200.0	2.63	1.87	1.41	0.896	0.598	0.405	0.270	0.173	0.104	0.0534	0.0193	0.0076
1400.0	2.59	1.84	1.38	0.881	0.589	0.401	0.268	0.173	0.103	0.0532	0.0190	0.0075
1600.0	2.54	1.81	1.37	0.871	0.586	0.399	0.268	0.173	0.104	0.0534	0.0191	0.0074
1800.0	2.51	1.79	1.36	0.864	0.584	0.398	0.269	0.174	0.105	0.0539	0.0191	0.0074
2000.0	2.48	1.78	1.34	0.860	0.582	0.400	0.270	0.176	0.106	0.0547	0.0194	0.0073
2500.0	2.42	1.74	1.33	0.859	0.586	0.404	0.276	0.181	0.110	0.0571	0.0199	0.0075
3000.0	2.39	1.72	1.32	0.861	0.592	0.412	0.283	0.187	0.114	0.0590	0.0205	0.0078
4000.0	2.31	1.70	1.31	0.868	0.605	0.427	0.297	0.198	0.122	0.0631	0.0218	0.0082
5000.0	2.25	1.68	1.31	0.876	0.618	0.440	0.308	0.207	0.128	0.0668	0.0231	0.0087
6000.0	2.22	1.66	1.30	0.883	0.627	0.450	0.317	0.215	0.134	0.0701	0.0242	0.0091
8000.0	2.15	1.63	1.29	0.889	0.640	0.464	0.331	0.227	0.143	0.0756	0.0263	0.0099
10000.0	2.10	1.60	1.28	0.883	0.645	0.472	0.340	0.236	0.150	0.0799	0.0280	0.0106

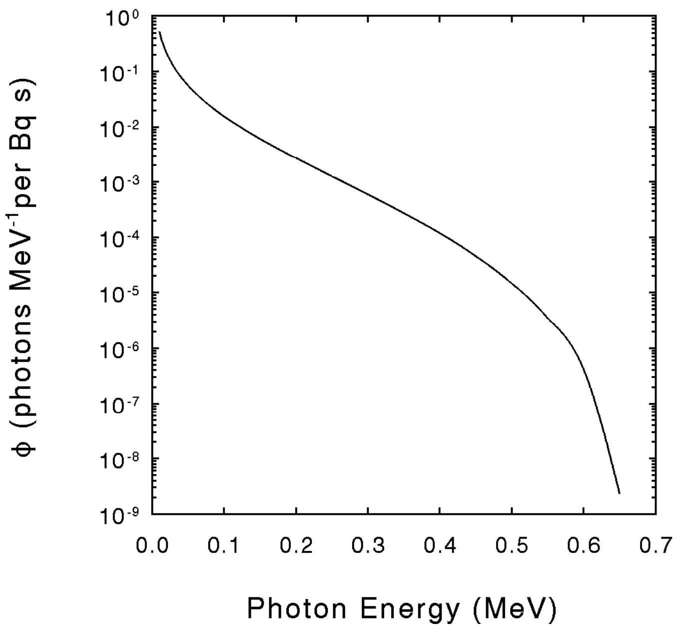

Fig. C.1. External bremsstrahlung spectrum of ^{85}Kr in air.

APPENDIX D
EXAMPLE CALCULATIONS

This appendix provides a series of example calculations intended to illustrate certain aspects of the data presented in Tables III.1 to III.7 and in Table A.1. It is not the purpose of this appendix to suggest or endorse formulations regarding the behavior of radionuclides in the environment. Thus, the examples are of a pedagogical nature.

Example 1. The concentration of ^{85}Kr, C_{Kr-85}, in the atmosphere at a location in the environs of a fuel reprocessing plant is estimated to be 1000 Bq m^{-3}. Compute the annual effective dose and the dose to skin. Assume the exposure is continuous and without benefit of any shielding by structures.

From Table III.1 the coefficients for air submersion for ^{85}Kr are 1.19 × 10^{-16} for the effective dose and 1.32 × 10^{-14} Sv per Bq s m^{-3} for the skin dose. The annual effective dose, H_E, can be estimated as the product of the dose rate and the exposure duration of 3.15 × 10^{7} s (1 year) as

$$\begin{aligned} H_E &= h_E\ C_{Kr}\ t \\ &= 1.19 \times 10^{-16}\ \frac{Sv\ m^3}{Bq\ s} \times 10^3\ \frac{Bq}{m^3} \times 3.15 \times 10^7\ s \\ &= 3.75 \times 10^{-6}\ Sv \quad (\,or\ 0.375\ mrem) \quad . \end{aligned}$$

The skin dose would be

$$\begin{aligned} H_{skin} &= h_{skin}\ C_{Kr}\ t \\ &= 1.32 \times 10^{-14}\ \frac{Sv\ m^3}{Bq\ s} \times 10^3\ \frac{Bq}{m^3} \times 3.15\ x\ 10^7\ s \\ &= 4.16 \times 10^{-4}\ Sv \quad (\,or\ 41.6\ mrem) \quad . \end{aligned}$$

Example 2. Consider that at time zero the ground surface was uniformly contaminated with pure ^{137}Cs at a level of 2 Bq m^{-2}. Calculate the effective dose equivalent rate, $\dot{H}_E$, at time zero and at ten years. Also compute the annual effective dose in the year following the initial deposition. Assume that radioactive decay is the only mechanism by which the radioactivity is removed from the ground surface.

The radiological properties of the radionuclides are summarized in Table A.1 of Appendix A. From that table it is seen that ^{137}Cs has a physical half-life of 30 years, undergoes beta decay, and emits, as electrons, a total energy of 0.187 MeV per nuclear transformation (nt). No alpha or photon radiations are emitted. In 94.6% of the ^{137}Cs transformations the radioactive decay product, ^{137m}Ba, is formed. Table A.1 indicates that ^{137m}Ba has a half-life of 2.552 minutes, forms no radioactive decay products, and emits electrons and photons with total energies of 0.065 and 0.597 MeV nt^{-1}, respectively. The energies listed in Table A.1, and quoted above, are the energy of all radiations of that type emitted per nuclear transformation. A nuclide emitting a single photon of energy 1 MeV in 1% of its transformations releases the same energy in photon radiation as another nuclide emitting photons of 0.01 MeV in 100% of its transformations. The dosimetric significance of these photons, however, can be quite different. Barium-137m emits a gamma ray of 0.6616 MeV in 89.8% of its nuclear transformations; the total energy emitted is 0.6616 × 0.898 or 0.594 MeV nt^{-1}. The tabulated value of 0.597 MeV includes the contribution from K x rays emitted following the internal conversion of the 0.6616 photon. Note that the sum of the emitted energies (0.065 + 0.597) is about 0.6616 MeV — the energy of the metastable state.

At time t = 0, the ground surface is uniformly contaminated with pure ^{137}Cs; the decay product, ^{137m}Ba is not present. From Table III.3, the effective dose coefficient, h_{Cs-137}, for ^{137}Cs distributed on the ground surface is 2.85 × 10^{-19} Sv s^{-1} per Bq m^{-2}. Note that the dose coefficient is stated here as an instantaneous dose rate per activity concentration. The dose rate at time zero is

$$\dot{H}_E = 2.85 \times 10^{-19} \frac{Sv\ m^2}{Bq\ s} \times 2.0 \frac{Bq}{m^2}$$

$$= 5.70 \times 10^{-19} \frac{Sv}{s} \ .$$

This dose is due to bremsstrahlung arising as the beta particles emitted by ^{137}Cs slow down in the ground. Recall that Table A.1 did not indicate the emission of photons by ^{137}Cs.

To compute the effective dose rate after ten years, we first compute the activities of ^{137}Cs and ^{137m}Ba on the ground surface at that time. Equation (A.2) of Appendix A provides the necessary formulation which yields

$$A_{Cs-137}(t) \;=\; A_{Cs-137}(0)\; e^{-\lambda_{Cs-137}\, t} \quad \text{, and}$$

$$A_{Ba-137m}(t) \;=\; A_{Cs-137}(0)\; \frac{f_{Cs-137 \to Ba-137m}\; \lambda_{Ba-137m}}{\lambda_{Ba-137m} \,-\, \lambda_{Cs-137}} \left[e^{-\lambda_{Cs-137}\, t} \,-\, e^{-\lambda_{Ba-137m}\, t}\right] \quad ,$$

where $f_{Cs-137 \to Ba-137m}$ is the fraction of the ^{137}Cs transformations forming ^{137m}Ba and $A_{Cs-137}(0)$ is the activity of ^{137}Cs on the ground surface at t = 0. The decay constant for ^{137}Cs, λ_{Cs-137}, is

$$\lambda_{Cs-137} \;=\; \frac{\ln(2)}{T_{1/2}}$$

$$=\; \frac{0.693}{30\ y \,\times\, 3.15 \,\times\, 10^{7}\ \frac{s}{y}}$$

$$=\; 7.33 \,\times\, 10^{-10}\ s^{-1} \quad ,$$

and for ^{137m}Ba, with $T_{1/2}$ of 2.552 minutes, the decay constant is 4.53×10^{-3} s^{-1}. The activity of ^{137}Cs on the ground surface at ten years (3.15×10^{8} s) is

$$A_{Cs-137}(10\ y) \;=\; 2\ e^{-7.33\ x\ 10^{-10}\ s^{-1} \,\times\, 3.15 \,\times\, 10^{8}\ s}$$

$$=\; 1.59\ \frac{Bq}{m^{2}} \quad ,$$

and that of ^{137m}Ba is

$$A_{Ba-137m}(t) \;=\; A_{Cs-137}(0)\; \frac{f_{Cs-137 \to Ba-137m}\; \lambda_{Ba-137m}}{\lambda_{Ba-137m} \,-\, \lambda_{Cs-137}} \left[e^{-\lambda_{Cs-137}\, t} \,-\, e^{-\lambda_{Ba-137m}\, t}\right]$$

$$=\; 2\ \frac{0.946 \,\times\, 4.53 \,\times\, 10^{-3}}{4.53 \,\times\, 10^{-3} \,-\, 7.33 \,\times\, 10^{-10}} \left[e^{-0.231} \,-\, e^{-1.43 \,\times\, 10^{6}}\right]$$

$$=\; 1.50\ \frac{Bq}{m^{2}} \quad .$$

The ^{137m}Ba is in secular equilibrium with its parent ^{137}Cs. A decay product is said to be in secular equilibrium when the ratio of its activity to that of the parent no longer changes with time; in the case of ^{137m}Ba this ratio is simply the fraction of ^{137}Cs transformations forming ^{137m}Ba (0.946). Using the dose coefficient from Table III.3, we obtain

$$\dot{H}_E(10\ y) = h_{Cs-137}\ A_{Cs-137}(10\ y) + h_{Ba-137m}\ A_{Ba-137}(10\ y)$$

$$= 2.85 \times 10^{-19}\ \frac{Sv\ m^2}{Bq\ s} \times 1.59\ \frac{Bq}{m^2} + 5.86 \times 10^{-16}\ \frac{Sv\ m^2}{Bq\ s} \times 1.50\ \frac{Bq}{m^2}$$

$$= 4.53 \times 10^{-19} + 8.79 \times 10^{-16}\ \frac{Sv}{s}$$

$$= 8.79 \times 10^{-16}\ \frac{Sv}{s} \quad .$$

The annual effective dose after one year of exposure is just the integral of the dose rate, or

$$H_E(1\ y) = \int_0^{1\ y} \dot{H}_E(t)\ dt$$

$$= h_{Cs-137} \int_0^{1\ y} A_{Cs-137}(t)\ dt + h_{Ba-137m} \int_0^{1\ y} A_{Ba-137m}(t)\ dt \quad .$$

Activity, by definition, is the rate at which nuclear transformations are occurring and thus, its time integral is the number of nuclear transformations during the time period. Equation (A.3) provides the necessary formulations to compute the number of nuclear transformations. The number of nuclear transformations of ^{137}Cs in the first year (3.15×10^7 s) is

$$\int_0^T A_{Cs-137}(t)\ dt = A_{Cs-137}(0)\ \frac{\left[1 - e^{-\lambda_{Cs-137} T}\right]}{\lambda_{Cs-137}}$$

$$= 6.23 \times 10^7\ \frac{Bq{-}s}{m^2} \quad ,$$

and that of ^{137m}Ba is

$$\int_0^T A_{Ba-137m}(t)\ dt = \int_0^T \frac{A_{Cs-137}(0)\ f_{Cs-137 \rightarrow Ba-137m}\ \lambda_{Ba-137m}}{\lambda_{Ba-137m} - \lambda_{Cs-137}} \left[e^{\lambda_{Ba-137m} t} - e^{\lambda_{Cs-137} t}\right] dt$$

$$= \frac{A_{Cs-137}(0)\ f_{Cs-137 \rightarrow Ba-137m}\ \lambda_{Ba-137m}}{\lambda_{Ba-137m} - \lambda_{Cs-137}} \left[\frac{(1 - e^{-\lambda_{Cs-137} T})}{\lambda_{Cs-137}} - \frac{(1 - e^{-\lambda_{Ba-137m} T})}{\lambda_{Ba-137m}}\right]$$

$$= 5.89 \times 10^7\ \frac{Bq\ s}{m^2} \quad .$$

The annual effective dose, H_E, is

$$H_E = 2.85 \times 10^{-19} \frac{Sv\ m^2}{Bq\ s} \times 6.23 \times 10^7 \frac{Bq\ s}{m^2} + 5.86 \times 10^{-16} \frac{Sv\ m^2}{Bq\ s} \times 5.89 \times 10^7 \frac{Bq\ s}{m^2}$$

$$= 3.45 \times 10^{-8}\ Sv \quad (or\ 0.00345\ mrem) \quad .$$

Example 3. Consider that the ^{137}Cs contamination of Example 2 was uniformly distributed within the top 5 cm of the soil at ten years. What is the effective dose rate for the volume-distributed ^{137}Cs and ^{137m}Ba activities?

The activities at ten years calculated above are valid. However, the activity is now considered to be distributed in the top 5 cm of the ground. The volume activity of ^{137}Cs is

$$A^V_{Cs-137}(t) = \frac{A_{Cs-137}(t)\ Bq/m^2}{5\ cm \times 10^{-2}\ m/cm}$$

$$= \frac{1.59}{0.05} \frac{Bq}{m^3}$$

$$= 31.8 \frac{Bq}{m^3} \quad .$$

and the volume activity of ^{137m}Ba is 30.0 Bq m^{-3}. From Table III.5, the effective dose coefficients for ^{137}Cs and ^{137m}Ba uniformly distributed in the top 5 cm of the ground are 3.07×10^{-21} and 1.09×10^{-17} Sv per Bq s m^{-3}, respectively. Thus, the effective dose rate is

$$\dot{H}_E = 3.07 \times 10^{-21} \frac{Sv\ m^3}{Bq\ s} \times 31.8 \frac{Bq}{m^3} + 1.09 \times 10^{-17} \frac{Sv\ m^3}{Bq\ s} \times 30.0 \frac{Bq}{m^3}$$

$$= 3.27 \times 10^{-16} \frac{Sv}{s} \quad .$$

Note that the dose rate from the volume-distributed activities is about a factor of three lower than the corresponding value had the activity remained on the ground surface.

Example 4. Soil concentrations of naturally occurring ^{40}K are typically about 370 Bq kg^{-1} with a range of 100 to 700 Bq kg^{-1}. Assuming that the potassium is uniformly distributed in the soil to an infinite depth and the density for the soil of interest is 1.9×10^3 kg m^{-3}, calculate the effective dose rate.

Tables III.4 - III.7 provide dose coefficients for radionuclides uniformly distributed to various depths in a soil having a density of 1.6×10^3 kg m^{-3}. Table III.7 gives dose coefficients for radionuclides distributed to an infinite depth. A radionuclide is said to be distributed to an infinite depth when a further increase in the thickness of the contaminated region does not result in an increase in the dose rate at the surface. For an infinitely thick source (Table III.7) the effective dose coefficient for ^{40}K is 5.57×10^{-18}. The introduction to Table III.7 notes that one can scale the dose coefficients in this table for a soil having density different from the value used in deriving the coefficients. Scaling is accomplished by multiplying the tabulated values by the ratio $1.6 \times 10^3/\rho$, where ρ is the soil density in kg m^{-3}. Therefore, the effective dose coefficient for the soil of interest is

$$5.57 \times 10^{-18} \frac{Sv\ m^3}{Bq\ s} \times \frac{1.6 \times 10^3}{1.9 \times 10^3} = 4.69 \times 10^{-18} \frac{Sv\ m^3}{Bq\ s} \quad .$$

The ^{40}K activity of 370 Bq kg^{-1} in a soil having a density 1.9×10^3 kg m^{-3} corresponds to a volumetric source strength of 7.0×10^5 Bq m^{-3}. Thus, the effective dose rate for this soil density and ^{40}K concentration is

$$\dot{H}_E = 4.69 \times 10^{-18} \frac{Sv\ m^3}{Bq\ s} \times 7.0 \times 10^5 \frac{Bq}{m^3}$$

$$= 3.28 \times 10^{-12} \frac{Sv}{s} \quad (or\ 10 \frac{mrem}{y}) \quad .$$

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OBTAINING COMPUTER FILES OF DOSE COEFFICIENTS

The dose coefficients for radionuclides from Federal Guidance Report No. 11 and Federal Guidance Report No. 12 are available on diskette from the Radiation Shielding Information Center (RSIC) at Oak Ridge National Laboratory. Data from Tables 2.1 and 2.2 of Federal Guidance Report No. 11 and data from Tables III.1 through III.7 of Federal Guidance Report No. 12 are included in the package as ASCII files, as well as computer routines for retrieving the data. The name and title of the data library package are DLC-167/FGR-DOSE, Dose Coefficients from Federal Guidance Reports 11 and 12.

Requests must include the name of the package and should be addressed to:

Radiation Shielding Information Center
Oak Ridge National Laboratory
P. O. Box 2008
Oak Ridge, TN 37831-6362

Phone Numbers:	Voice:	615-574-6176
	FAX:	615-574-6182
Electronic Mail:	EasyLink Mailbox:	62813374
	BitNet:	PDC@ORNLSTC
	Internet:	PDC@ORNL.GOV

Requestors should note that RSIC may assess a charge to cover the cost of packaging and transmitting computer codes and data libraries.