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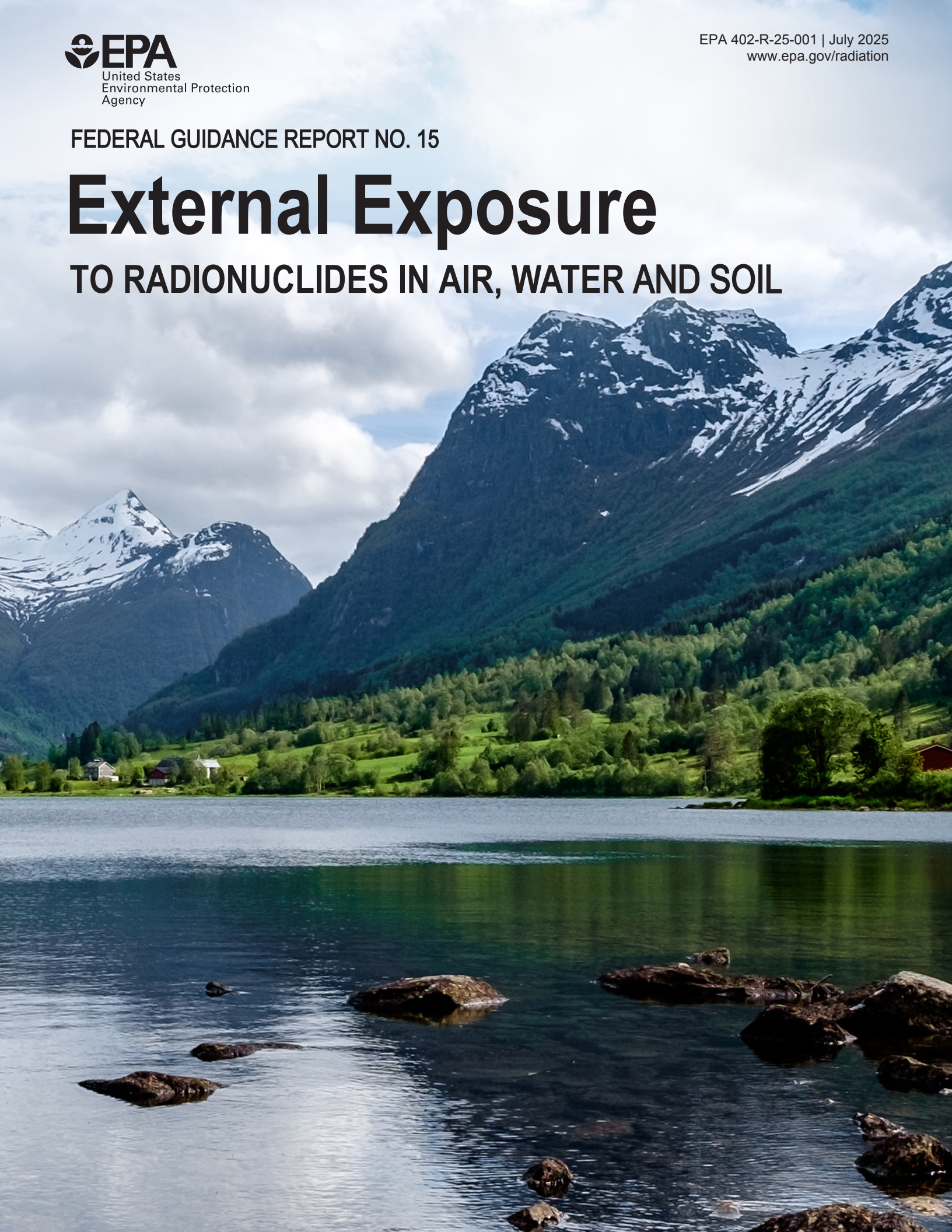
FEDERAL GUIDANCE REPORT NO. 15

External Exposure

TO RADIONUCLIDES IN AIR, WATER AND SOIL



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EPA 402-R-25-001

FEDERAL GUIDANCE REPORT NO. 15

EXTERNAL EXPOSURE TO RADIONUCLIDES IN AIR, WATER AND SOIL

External Dose Rate Coefficients for General Application

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A summary of revisions is provided at the end of the report

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PREFACE

The purpose of federal radiation protection guidance is to provide a common framework for ensuring that the assessment of exposure to ionizing radiation is carried out in a consistent manner. Federal guidance is issued by the Administrator of the U.S. Environmental Protection Agency (EPA) 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."

Federal Guidance Report No. 15, *External Exposure to Radionuclides in Air, Water and Soil*, is part of a series designed to provide technical information for use in implementing radiation protection programs. This report tabulates age-specific, reference person effective dose rate coefficients for 1,252 radionuclides based on external exposure to radionuclides distributed in air, water and soil. This report updates and expands Federal Guidance Report No. 12, *External Exposure to Radionuclides in Air, Water, and Soil* (EPA, 1993). Federal Guidance Report No. 15 incorporates advancements in scientific knowledge to help ensure that regulation of radiation exposure makes use of the best available information for relating concentrations of radionuclides in environmental media to dose in human populations due to external radiation.

The dose rate coefficients are intended for calculating age-specific effective doses from external exposure to environmental radionuclides. They were developed for use by federal agencies having regulatory responsibilities for protection of members of the public and/or workers. This guidance also may be used by those federal agencies with responsibilities related to the management of their own personnel and their contractor operations; for example, the U.S. Department of Energy (DOE) has derived age- and sex-weighted dose coefficients in DOE-STD-1196-2011 for assessing compliance with annual public dose limits. State and local authorities are encouraged to use the dose coefficients under their radiation protection authorities.

For the vast majority of radionuclides, external dose is due to x-rays, gamma radiation, conversion electrons and beta (negatron and positron) radiations. Dose rate coefficients are provided for the following exposure pathways: submersion in a contaminated atmospheric cloud (air submersion), immersion in contaminated water (water immersion), and exposure to contamination on or below the ground surface (ground exposure). For each exposure pathway, dose rate coefficients are provided for each of 1,252 radionuclides.

The dose coefficients developed in this report address the equivalent dose to tissues of the body and the effective dose as defined in International Commission on Radiological Protection (ICRP) Publication 103 (2007). The coefficients are based on the nuclear decay data of ICRP Publication 107 (2008) and a series of computational phantoms containing both male- and female-specific tissues (i.e., stylized hermaphrodites) representing newborns, children ages 1, 5, 10 and 15 years, and adults. Equivalent dose coefficients are derived for the tissues of the body including the male and female sex-specific tissues. Effective dose coefficients, the weighted sum of the average tissue-weighted equivalent dose in the male and female, are tabulated for the six ages. The equivalent dose and effective dose coefficients for external exposure to 1,252 radionuclides in the four environmental pathways are available electronically.[1] The effective dose coefficients tabulated in this report apply to a "reference person" of the stated age.

[1] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

This report discusses various methods for weighting or calculating a single coefficient for an individual isotope. Information is provided to allow the reader to modify dose rate coefficients relative to site-specific conditions (source depth profiles, air density or soil density).

The pertinent physical properties of the radionuclide are its radiological (physical) half-life and the types and energies of its emitted radiations. The methodology is built around the unifying concept of absorbed dose, defined as the mean energy deposited by ionizing radiation in the absorbing tissue per unit mass of tissue. The International System (SI) unit of absorbed dose is joules per kilogram ($J\ kg^{-1}$), called the gray (Gy).

Absorbed doses from ionizing radiation originating from radionuclides outside the body are predicted by radiation transport models that describe the movement of different types and energies of ionizing radiation through different materials and their deposition of energy in those materials. The external dose rate coefficient for a specific radionuclide depends on the type, intensity and energy of the emitted radiations, along with the mode of exposure, the age of the reference person, and the anatomy that governs the energy deposition in body. The radiation dose depends strongly on the temporal and spatial distribution of the radionuclide to which a reference person is exposed and the duration of the exposure.

The previous version of this report, Federal Guidance Report No. 12 (1993), used the principal dose quantity, effective dose, 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 (United Nations Scientific Committee on the Effects of Atomic Radiation [UNSCEAR], 2000, 2008; National Academy of Sciences–National Research Council [NAS–NRC], 2006; ICRP, 2007; EPA, 2011) and updated weighting factors have been recommended by ICRP (2007).

The tables in this report are available online,[2] allowing the user to easily integrate the data into programs for assessing dose.

Comments and suggested improvements should be addressed to the Radiation Protection Division, U.S. Environmental Protection Agency, 1200 Pennsylvania Ave NW (MC 6608-T), Washington, D.C. 20460 or radiation.questions@epa.gov.

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[2] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

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CHAPTER 1. INTRODUCTION

This report tabulates age-specific, reference person[3] effective dose rate coefficients for external exposure to photons and electrons emitted by radionuclides distributed in air, water and soil. The dose rate coefficients are intended for use in the calculation of age-specific effective doses from external exposure to radionuclides in the environment. Dose rate coefficients for calculation of equivalent doses to specific tissues are available online.[4]

Dose rate coefficients are provided for the following exposure pathways: submersion in a contaminated atmospheric cloud (air submersion); exposure to contamination on or below the ground surface (ground exposure); and immersion in contaminated water (water immersion). For each exposure pathway, dose rate coefficients are provided for 1,252 radionuclides. The coefficients are based on nuclear decay data of International Commission on Radiological Protection (ICRP) Publication 107 (2008) and a series of stylized hermaphrodite phantoms (i.e., phantoms containing both male and female reproductive organs) representing newborns, children ages 1, 5, 10 and 15 years, and adults (Han et al., 2006). These phantoms are modifications of age-specific mathematical phantoms originally developed at Oak Ridge National Laboratory (ORNL) (Cristy and Eckerman, 1987). The modifications address tissues considered in ICRP Publication 103 (2007) that were not identified in the original phantoms.

This report is made available to provide dose coefficients for external exposures consistent with ICRP Publication 103 (2007). At time of publication, no federal agencies have applied the ICRP Publication 103 system of protection in federal regulations. In addition, neither ICRP nor the National Council on Radiation Protection and Measurements (NCRP) have made recommendations regarding the appropriate use of age-specific dose coefficients in the radiation protection system. Federal Guidance Report No. 15 dose coefficients are not applicable for determining compliance with regulations that are based on earlier ICRP dosimetry methodologies. Although no federal agencies have used ICRP Publication 103-based age-specific dose coefficients in radiation protection systems, there have been limited examples of the use of age-specific coefficients. The U.S. Department of Energy (DOE) adopted ICRP Publication 60 (1991) in its radiation protection system (DOE Order 458.1) (DOE, 2011a) and used ICRP Publication 72 (1996) and Federal Guidance Report No. 13 (EPA, 1999) age-specific dose coefficients in DOE-STD-1196-2011 (DOE, 2011b) for estimating public doses from chronic (long-term) exposures of the public for assessing compliance with its dose limits. The standard utilizes age- and sex-weighted coefficients based on the population from 2010 U.S. census. The EPA Superfund program used Federal Guidance Report No. 13 age-specific risk factors when conducting assessments to estimate lifetime risks from chronic exposures. Unless an agency specifically authorizes use of ICRP Publication 103 in its regulations, the dose coefficients in this report should not be used for compliance purposes without approval of the appropriate regulatory authority.

[3] In ICRP Publication 103 (2007), "reference person" is defined as "An idealised person for whom the organ or tissue equivalent doses are calculated by averaging the corresponding doses of the Reference Male and Reference Female. The equivalent doses of the Reference Person are used for the calculation of the effective dose by multiplying these doses by the corresponding tissue weighting factors." (p. 31)

[4] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

This report updates and expands Federal Guidance Report No. 12 (EPA, 1993), which tabulates external dose coefficients for a reference adult for 825 radionuclides. The coefficients provided in Federal Guidance Report No. 12 were based on nuclear decay data of ICRP Publication 38 (1983) and a stylized dosimetric hermaphrodite phantom representing the reference adult.

Dose rate coefficients for external exposure relate the dose rate to organs and tissues of the body to the concentrations of radionuclides in environmental media. This situation is in contrast to the intake of radionuclides by inhalation or ingestion, where the radiations are emitted within the body and the committed dose is dependent on the activity intake of the radionuclide. In either circumstance, the dosimetric quantities of interest are the radiation doses received by the radiosensitive organs and tissues of the body. The types of radiation of concern for external exposures are those sufficiently penetrating to traverse the overlying tissues of the body and deposit ionizing energy in radiosensitive organs and tissues. Penetrating radiations considered in this report are limited to photons (x-rays, gamma rays and bremsstrahlung) and electrons (negatrons and positrons). The radiation dose depends strongly on the temporal and spatial distribution of the radionuclide to which a reference person is exposed and the duration of the exposure.

It is common practice to consider idealized exposure geometries in which the radionuclide concentration in the medium, seen from the location of an exposed individual, is uniform and effectively infinite or semi-infinite in extent. Even for such 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 $C(\tau)$ of a radionuclide at time τ, the equivalent dose $H_T(T_A, T_E)$ in tissue T of an individual of age T_A during an exposure of duration T_E can be expressed as

$$H_T(T_A, T_E) = \int_0^{T_E} C(\tau)\, \dot{h}_T(T_A + \tau)\, d\tau \qquad (1)$$

where $\dot{h}_T(\tau)$ is the time-dependent dose rate coefficient for external exposure. The coefficient $\dot{h}_T$ represents the dose rate to tissue T of the body of an individual of initial age T_A per unit time-integrated exposure expressed in terms of the time-integrated concentration of the radionuclide. This coefficient varies with time due to anatomical changes as the receptor grows from a newborn to an adult.

In the case of the adult, the integral dose in tissue T can be calculated as the product of the adult's dose rate coefficient and the time-integrated activity concentration of the radionuclide in the environment. This is possible because, unlike nonadults, the dose rate coefficient of the adult is assumed to be time-independent. In most applications of the dose coefficients, the annual equivalent dose H_T, rather than the instantaneous dose rate, is the quantity of interest, so for the adult, the time integral of the concentration must be evaluated. For nonadults, the integral defined in Eq. (1) must be evaluated. Depending on the nature of the application it may be advantageous to view the numerical value of the coefficient as either the instantaneous dose rate per unit concentration or as the dose per unit time-integrated concentration.

However, when considering nonadults, attention needs to be given to the magnitude of error in neglecting to consider the changes in the dose coefficient as the individual ages. In this report we follow the latter presentation.

The external dose rate coefficient for a specific radionuclide depends on the type, intensity and energy of the emitted radiations; the mode of exposure; the age of the reference person; and the anatomy that governs the energy deposition in the body. The dose rate 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 the radionuclide-specific dose rate coefficients involve three main steps:

1. Computation of the energy and angular distributions of the radiations incident on the body for a range of discrete initial energies of monoenergetic sources distributed in the environmental medium of interest.

2. For the incident radiation spectrum computed in step 1, evaluation of the transport and energy deposition in tissues of the body.

3. Calculation of the tissue dose rate coefficient for specific radionuclides, considering the energies and yields of the radiations emitted during nuclear decay of that radionuclide.

The result of the first two steps is a set of dose rate coefficients for monoenergetic sources of photons or electrons. The last step scales these coefficients to the emissions of the specified radionuclide.

1.1 Dosimetric quantities

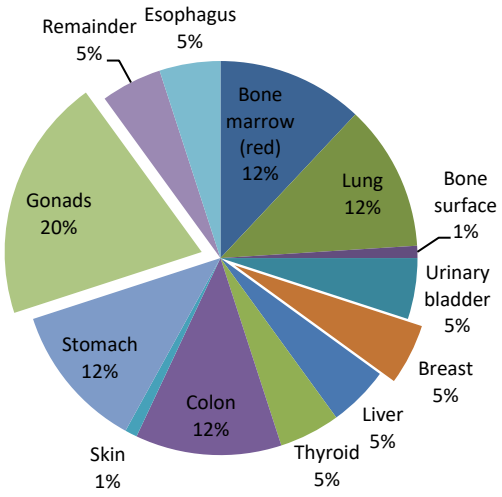
The fundamental measure of exposure to ionizing radiation is the absorbed dose. The absorbed dose to a tissue in which ionizing radiation is absorbed is the mean energy deposited in the tissue per unit mass of tissue. The International System (SI) unit of absorbed dose is joules per kilogram ($J\ kg^{-1}$), which is called the gray (Gy).

The quantity equivalent dose places all ionizing radiations on a common scale with regard to their potential stochastic risk (ICRP, 2007). The equivalent dose to a tissue is the absorbed dose multiplied by a radiation weighting factor that reflects the relative biological effectiveness (RBE) of the radiation type. A radiation weighting factor of 1 is recommended by ICRP for photons and electrons (ICRP, 2007). Because radiation weighting factors are unitless, the SI unit of equivalent dose is the same as that of absorbed dose ($J\ kg^{-1}$); however, it is called the sievert (Sv).

Dose-response relations for radiation-induced cancer, the dominant stochastic effect of ionizing radiation, are based largely on data for external exposures involving nearly uniform external irradiation of the human body by gamma rays or x-rays. In virtually all cases of radionuclide intake and in many cases of external exposure, radiation doses are distributed non-uniformly among tissues. A quantity called effective dose is used to compare stochastic risk from non-uniformly delivered dose with stochastic risk from uniform external exposure of the whole body (ICRP, 2007). Effective dose is used as a measure of stochastic risk

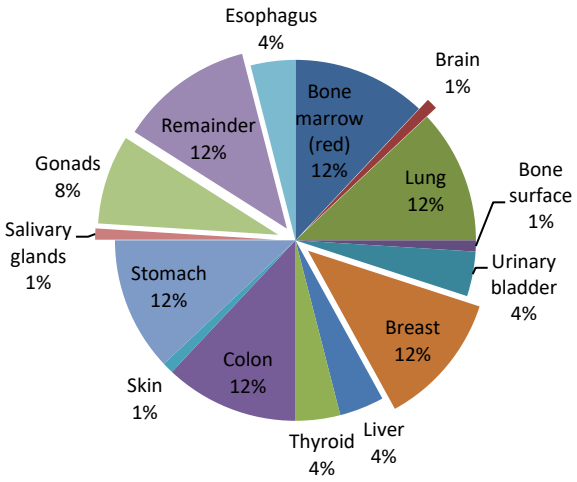
for either external exposure or internally deposited radionuclides, thus enabling the summation of these two types of exposure in the context of radiation protection. ICRP Publication 103 (2007) states, "effective dose is not recommended for epidemiological evaluations, nor should it be used for detailed specific retrospective investigations of individual exposure and risk" (p. 13).

The effective dose takes into account epidemiological findings that the relationship between equivalent dose and the probability of radiation effects depends on the organ or tissue irradiated. The effective dose is a weighted sum of equivalent doses to radiosensitive tissues, with the equivalent dose for a given tissue T weighted by a "tissue weighting factor," w_T. The weighting factors represent the relative contribution of the different tissues to the total risk for the case of uniform irradiation of the whole body. Effective dose is expressed in the same unit as equivalent dose (i.e., Sv). The tissue weighting factors applied in this report are those recommended in ICRP Publication 103 (2007). The weighting factors specified in ICRP Publication 103 are presented in Figure 1-1, along with the weighting factors recommended in ICRP Publication 60 (1991).



ICRP Publication 60 (1991)

In ICRP Publication 60, the w_T for Remainder is applied to the mass-weighted average dose to adrenals, brain, extrathoracic airways, small intestine, kidneys, muscle, pancreas, spleen, thymus and uterus, except when the following "splitting rule" applies: if one of these 10 tissues receives a dose greater than any of the 12 individual tissues for which weighting factors are specified, half of the weighting factor (0.025) is applied to that tissue and the other half is applied to the mass-weighted committed equivalent dose in the rest of the Remainder tissues.



ICRP Publication 103 (2007)

ICRP Publication 103 tissue weighting factors are used in this report to calculate effective dose rate coefficients.

In ICRP Publication 103, the w_T for Remainder is applied to the arithmetic mean of doses to adrenals, extrathoracic region, gallbladder, heart, kidneys, lymphatic nodes, muscle, oral mucosa, pancreas, prostate, small intestine, spleen, thymus and uterus/cervix.

Figure 1-1. Comparison of the tissue weighting factors of ICRP Publication 60 (1991) with those used in this report (ICRP Publication 103, 2007).

The dose coefficients developed in this report address the equivalent dose to tissues and the effective dose as defined in ICRP Publication 103 (2007). Effective dose rate coefficients are tabulated in this report and equivalent dose rate coefficients for individual tissues are available online.[5]

All effective dose rate coefficients presented in this report are sex-averaged and derived using mathematical hermaphrodite phantoms for newborns, children ages 1, 5, 10 and 15 years, and adults. Averaging of dose rate coefficients for males and females of a given age yields a dose rate coefficient for a "reference person" of that age. For example, the average of the tissue-specific dose rate coefficients developed separately for the 1-year-old male and the 1-year-old female (using doses to sex-specific reproductive organs in each case) for a given exposure scenario are available online.

This report tabulates dose rate coefficients for the radionuclides addressed in ICRP Publication 107 (2008). For the vast majority of radionuclides, external dose is due to x-rays, gamma, conversion electrons and beta (negatron and positron) radiations. For a few radionuclides, spontaneous fission produces penetrating radiations of potential importance, including fast neutrons. Prompt and delayed emissions for photons and beta particles following spontaneous fission are included in the decay data tabulations of ICRP Publication 107 (2008) and included in the calculations of dose rate coefficients in this report. The dose contribution from neutrons accompanying spontaneous fission, however, has not been considered because information has not been assembled on the neutron field resulting from environmental distribution of radionuclides undergoing spontaneous fission. The potential contribution to dose of long-lived fission products from radionuclides undergoing spontaneous fission also is not considered in the tabulated dose rate coefficient calculation.

1.2 Differences between Federal Guidance Report No. 15 and Federal Guidance Report No. 12

Since the publication of Federal Guidance Report No. 12 (EPA, 1993), there have been substantial changes in computational capabilities, radiation protection databases, anthropomorphic computational phantoms and ICRP guidance. These changes have facilitated improved calculation of organ dose as a result of exposure to contaminated environmental media. This section discusses some of the differences between this report and Federal Guidance Report No. 12.

The largest difference between the two reports is that this report incorporates six age-specific phantoms from newborn through adult while Federal Guidance Report No. 12 only considers a single age. Thus, this report contains six times more tissue and effective dose rate coefficient tables and the associated datasets are correspondingly larger.

Next, this report's effective doses are based on ICRP Publication 103 (2007) weighting factors while the Federal Guidance Report No. 12 effective dose numbers are based on ICRP Publication 26 (1977). In the context of external emitters, the most substantial effect of the updated tissue weighting coefficients is the inclusion of skin in the definition of effective dose. Many radionuclides, especially those that exclusively emit energy below 50 keV, have a skin dose which is much higher than other organ doses. For these radionuclides, the ICRP Publication 103 definition of effective dose would in general be larger than

[5] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

the effective dose computed under ICRP Publication 26 guidance. The most extreme example would be radionuclides for which 100 percent of the dose is deposited in skin. For these radionuclides, the Federal Guidance Report No. 12 (based on ICRP Publication 26) effective dose would be zero, while the Federal Guidance Report No. 15 (based on ICRP Publication 103) effective dose would be some positive quantity.

Advances in Monte Carlo computational power can be categorized into software advances and hardware advances. In the 25 years between the development of Federal Guidance Report No. 12 and this report, major advancements have been made in computer speed, availability, approachability and stability. The calculations in this work employed Monte Carlo N-Particle 6 (MCNP6) (Goorley et al., 2012) transport code in conjunction with Evaluated Nuclear Data File (ENDF/B-VI.8) (Herman and Trkov, 2005) cross sections. These advances have allowed for more precise calculations of organ doses from the Monte Carlo phase of the calculation, particularly at low photon energies.

Radionuclide dose rate coefficients included in this report are based on ICRP Publication 107 (2008), which includes a larger number of radionuclides and refinements to the decay data relative to ICRP Publication 38 (1983) that was used in Federal Guidance Report No. 12 calculations. Electron (negatron and positron) and photon emissions of the radionuclides addressed in ICRP Publication 107 were used to calculate the dose coefficients tabulated in this report. Notable differences between dose coefficients in this report and Federal Guidance Report No. 12 are present where substantial corrections have been made between the nuclear decay databases. Finally, because ICRP Publication 107 provides decay information for a larger number of radionuclides, this report correspondingly provides external dose rate coefficients for a larger number of radionuclides than were provided in Federal Guidance Report No. 12.

1.3 Organization of this report

The remainder of this report is organized as follows. Chapter 2 describes previous external dose computational methods leading up to the present work. Chapter 3 describes the calculation of the monoenergetic dose rate coefficients and tabulates these coefficients. Information is provided to allow the reader to modify dose rate coefficients relative to site-specific conditions (source depth profiles, air density or soil density). Chapter 4 tabulates effective dose rate coefficients for individual radionuclides for the six reference persons. Chapter 5 addresses some practical issues regarding application of the tabulated coefficients of Chapter 4.

Further details of the computational methods are discussed in the appendices. Appendix A summarizes the nuclear decay data required to evaluate the total external dose from exposure to radioactive decay chains. Appendix B describes the mathematical phantoms used in the calculations of external dose rate coefficients. Appendix C tabulates information on the bremsstrahlung spectra used in the calculations. Appendix D provides sample calculations illustrating the application of external dose rate coefficients.

CHAPTER 2. BACKGROUND

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; EPA, 1993; Petoussi-Henss et al., 2012). As a result of limitations in computational hardware and, to a limited extent, methods, these tabulations generally have relied on idealized assumptions regarding the exposure conditions. In some cases, the radiations incident on the body have 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. Irradiation from bremsstrahlung has been ignored in many cases, even though for many pure beta emitters it is the only radiation that is sufficiently penetrating to reach tissues below the surface of the body. In this report, we have minimized simplifying assumptions in an effort to improve estimates of dose rates to human tissues based on the hypothesized distributions of radionuclides in the environment.

Early estimates of submersion dose (Poston and Snyder, 1974; O'Brien and Sanna, 1978; Eckerman et al., 1980; Kocher, 1981, 1983; DOE, 1988) generally were based on Monte Carlo calculations with poor statistics for some organ doses due to limitations in the computer systems or minor errors in sampling the radiation field. Saito et al. (1990) published a compilation of organ doses due to air submersion based on Monte Carlo methods that appear to have overcome the limitations in earlier work.

The seminal work of Beck and de Planque (1968) on external dose due to contaminated soil was limited to calculation of air dose for photon energies between 0.25 and 2.25 MeV. These data were used later to generate a tabulation of air exposure rates for a number of radionuclides (Beck, 1980). The next generation of calculations (Kocher, 1981, 1983; Kocher and Sjoreen, 1985; DOE, 1988) produced dose estimates for many radionuclides but was limited by simplifying assumptions regarding the energy and angular dependence of the radiation field. The field was assumed to be equivalent to that of submersion and the point kernel method used for characterizing the field strength. Other efforts (Williams et al., 1985; Koblinger and Nagy, 1985; Jacob et al., 1986, 1988a, 1988b; Saito et al., 1990; Petoussi et al., 1991) have been based on 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 various thicknesses, as well as plane sources at the air-ground interface, but are only for effective dose based on rotational normal beam exposure (ICRP, 1987). The computational approach of Federal Guidance Report No. 12 (EPA, 1993) was a combination of deterministic and Monte Carlo methods. In that document, external dose rate coefficients for radionuclides in air, water and soil were derived using an adult hermaphrodite phantom (Cristy and Eckerman, 1987). With the exception of dose rate coefficients for skin, the dose rate coefficients in this report are based entirely on a Monte Carlo approach. The contribution of electrons to the skin dose rate coefficient is based on point kernel methodology.

As stated in Section 1.2, over two decades have transpired between the introduction of Federal Guidance Report No. 12 and the publication of this report. During that time, advances in both software and hardware facilitated improved calculation of organ dose as a result of exposure to contaminated air, water and soil. The dose coefficients calculated in this report are derived using MCNP6 (Goorley et al., 2012) radiation transport codes and ENDF/B-VI.8 (Herman and Trkov, 2005) cross sections. Aside from the computational streamlining, this report incorporates six age-specific phantoms from newborn through adult; Federal Guidance Report No. 12 (EPA, 1993) considered only an adult. Radionuclide dose rate coefficients are based on ICRP Publication 107 (2008), which includes a larger number of radionuclides and updated physical data relative to the ICRP Publication 38 (1983) dataset used in Federal Guidance Report No. 12. Several details of this report's methodology are summarized in Table 2-1.

Table 2-1. Details of the Federal Guidance Report No. 15 methodology.

Methodological component	Description and/or reference
Radiation transport	Only Monte Carlo, except for electron dose to skin (uses point kernel methodology)
Cross section library	ENDF/B-VI.8 (Herman and Trkov, 2005)
Mean free path definition	Total cross section, including coherent scatter
Phantom library	Reference newborns, children age 1, 5, 10 and 15 years, and adults
Tissue weighting factors	ICRP Publication 103 (2007) tissue weighting factors
Number of organs/tissues considered	29
Radiations considered	Photons and electrons (negatrons and positrons). Beta and photon radiations associated with spontaneous fission are considered; neutrons are not addressed.
Decay data	ICRP Publication 107 (2008) decay data
Number of radionuclides	1,252 radionuclides
Radiation transport code	MCNP6 (Goorley et al., 2012)
Water immersion method	Single-step with no coupling surface
Soil profile	Uniform concentration with depth
Monoenergetic interpolation grid	13 energies
Treatment of ground roughness	Ground roughness is represented as an infinite plane source at a depth of 0.5 g cm^{-2}, equivalent to 3 mm for a soil density of 1.6×10^3 kg m^{-3}
Variance reduction	Employed path-length stretching and reflective boundary conditions (primarily for low-energy photons)
Tissue compositions	Tissue-specific compositions and densities from ICRP Publication 89 (2002) and ICRU Report 46 (1992)

ENDF = Evaluated Nuclear Data File
ICRP = International Commission on Radiological Protection
ICRU = International Commission on Radiation Units and Measurements

CHAPTER 3. METHOD FOR MONOENERGETIC RESPONSE

Photons and electrons are the most significant radiations emitted by environmental radionuclides that can penetrate the body from outside to deposit ionizing energy in radiosensitive tissues. This chapter describes the radiation dose quantities used in this report and presents the methods used to calculate dose rate coefficients for external exposure to photons and electrons emitted from contaminated air, water, ground surfaces and ground volumes.

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. Thus tissue-specific dose rate coefficients are computed in stylized phantoms representing newborns, children age 1, 5, 10 and 15 years, and adults for monoenergetic photon sources at 13 energies, ranging from 0.01 to 5.0 MeV (Figure 3-1). Skin dose values for electrons are derived using the point kernel approximation. Bremsstrahlung photons generated by electrons in the environment are evaluated using the monoenergetic photon dose rate coefficients. Radionuclide-specific dose rate coefficients are derived by summing the product of the frequency of emission of each emitted photon and the energy-interpolated monoenergetic dose rate coefficient.

This chapter describes the methods used to compute tissue dose rate coefficients and effective dose rate coefficients. Effective dose rate coefficients are tabulated in this report. Effective dose rate coefficients and equivalent dose rate coefficients for individual organs are available online.[6]

3.1 Computational phantoms

This work utilizes a series of stylized computational phantoms. These phantoms were originally developed at ORNL in the early 1980s (Cristy and Eckerman, 1987) and modified in the mid-2000s by Han et al. (2006). The reader is referred to Appendix B for more information on the history and development of the phantoms.

The update of the phantoms by Han et al. included changes to the head, brain, extra-thoracic airways, kidneys and rectosigmoid colon, and explicit representations of the salivary glands, alimentary track mucosa, respiratory tract airways and the urinary bladder. Tissue compositions and densities were updated in accordance with ICRP Publication 89 (2002) and International Commission on Radiation Units and Measurements (ICRU) Report 46 (1992). The series of phantoms was translated for use with the MCNP6 (Goorley et al., 2012) general purpose radiation transport code.

During quality assurance efforts, several organ volumes in the updated phantoms were found to be imprecisely declared. These differences were found by comparing the track-length estimated volume obtained by the ray tracing capability within MCNP6 with the declared volume. Corrections were made whenever the disparity in volume was greater than 3 percent.

[6] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

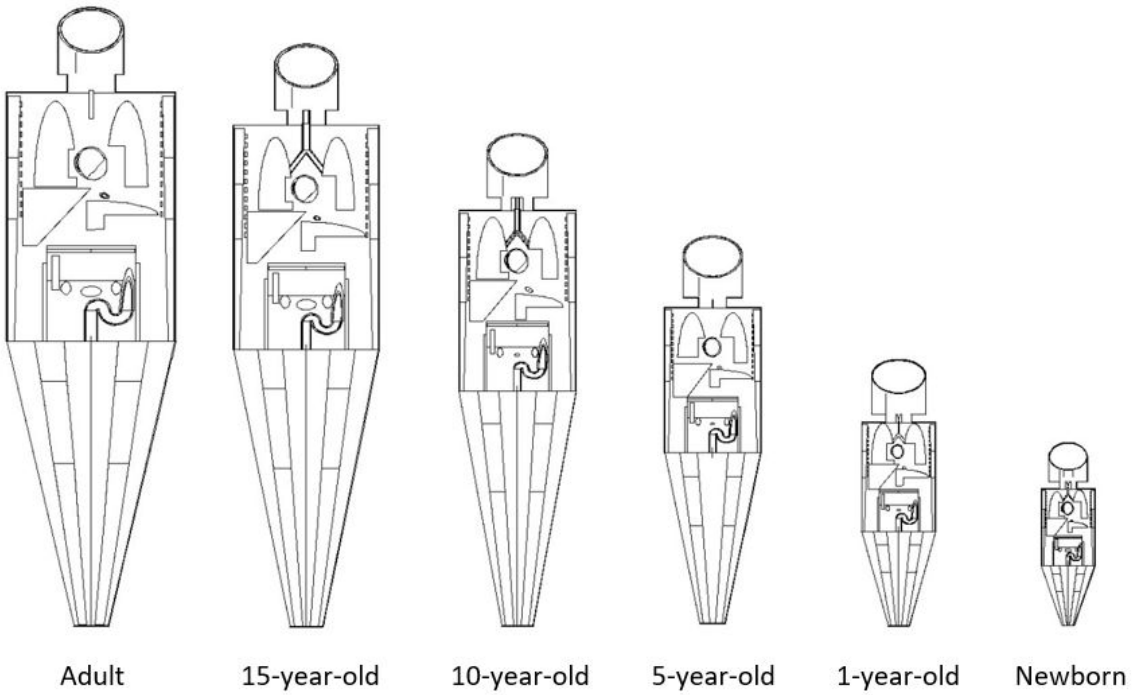


Figure 3-1. "Family" of phantoms including newborn through 15 years plus adults used in the derivation of external dose rate coefficients.

3.2 Exposure to contaminated soil

3.2.1 Summary of soil method

Dose rate coefficients for exposure to contaminated ground planes are based on the assumption that an individual is standing on the ground. A direct Monte Carlo simulation involves the combination of a deep penetration (i.e., transport through many mean free paths of air and/or soil) and a complex geometry (the human phantom). The approach used in this work involves dividing the problem into two steps:

1. Calculation of photons incident on the phantom (angular and energy fluence) recorded on a closed surface surrounding the phantom (Figure 3-2). For soil sources, a cylinder of height 200 cm and radius 30 cm was used to represent the closed surface. This closed surface serves as a coupling surface for the second step in the simulations.

2. Calculation of organ dose rate coefficients due to photons transported from the cylinder into the phantom (Figure 3-3). The effective dose rates for the reference persons are computed from the tissue dose rates using the tissue weighting factors recommended in ICRP Publication 103 (2007) (see Figure 1-1 and Table 3-1).

Table 3-1. ICRP Publication 103 (2007) tissue weighting factors for calculating effective dose rate coefficients.

Tissue	w_T	Representation in Phantom
Red marrow	0.12	Multiple trabecular bone regions
Colon	0.12	Multiple segments represented
Lung	0.12	Both left & right lobes
Stomach	0.12	Contents excluded
Breast	0.12	Both male & female
Gonads		
Testes	0.04	Male tissue
Ovaries	0.04	Female tissue
Bladder	0.04	Contents excluded
Esophagus	0.04	Explicit tissue region
Liver	0.04	Explicit tissue region
Thyroid	0.04	Explicit tissue region
Bone surface	0.01	Trabecular & cortical bone regions
Brain	0.01	Explicit tissue region
Salivary glands	0.01	Explicit tissue region
Skin	0.01	Explicit tissue region
Remainder		
Adrenals	0.00923	Explicit tissue region
Extrathoracic region	0.00923	Salivary glands surrogate
Gall bladder	0.00923	Contents excluded
Heart	0.00923	Contents excluded
Kidneys	0.00923	Explicit tissue region
Lymphatic nodes	0.00923	Soft tissue surrogate
Muscle	0.00923	Explicit tissue region
Oral mucosa	0.00923	Explicit tissue region
Pancreas	0.00923	Explicit tissue region
Prostate	0.00462	Male tissue
Small intestine	0.00923	Contents excluded
Spleen	0.00923	Explicit tissue region
Thymus	0.00923	Explicit tissue region
Uterus/cervix	0.00462	Female tissue

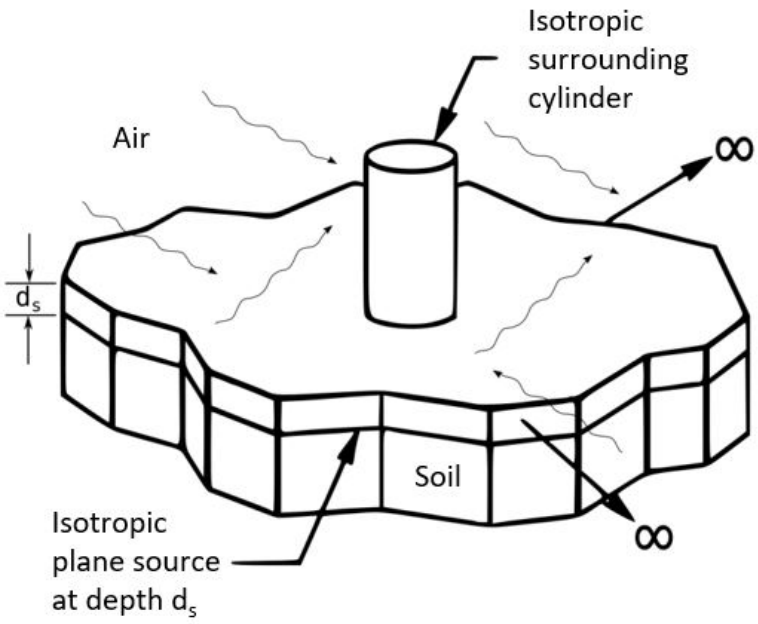


Figure 3-2. Radiation field due to a contaminated ground plane, on a cylinder surrounding the phantom.

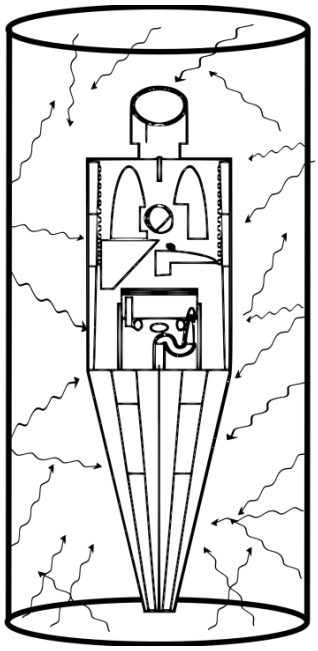


Figure 3-3. Angular current source on the coupling cylinder surrounding the phantom.

3.2.2 Environmental transport photons in soil

To eliminate the complexity of the human phantom from the calculation of the incident radiation field, the phantom was removed from the geometry description. This may be done if the presence of the phantom does not significantly perturb the incoming angular flow rate across the coupling cylinder. 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 closed surface. This is at most a second-order effect, as demonstrated by Saito et al. (1990).

3.2.2.1 Geometry overview

The sources for the contaminated soil calculations are infinite planar sources of monoenergetic photons with unit strength in becquerel per square meter (1 Bq m^{-2}), located at the air-ground interface or at a specified depth in the soil. The photons are emitted in an isotropic manner. The results of these plane source calculations are used to determine the tissue dose coefficients for a reference person standing at the air-ground interface. For instance, the tissue dose rate due to a source in the soil that is uniformly distributed from the surface to a specified depth may be computed by integrating the dose rates due to a series of plane sources at different depths. This approach is easily extended to a variety of subsurface distributions of radionuclides by performing an appropriately weighted integration of the doses due to a series of plane sources at different depths.

3.2.2.2 Soil composition

The assumed soil composition, given in Table 3-2, is typical of silty soil (ICRU, 1994) containing 30 percent water and 20 percent air by volume. The air composition (see Table 3-3) is the same as for the submersion dose calculations. The assumed soil density is 1.6×10^3 kg m^{-3}. In some circumstances, the radiation field above the air-ground interface can be scaled to account for differences in soil density (Beck and de Planque, 1968; Chen, 1991; Yu et al., 2015). The radiation field above the air-ground interface is relatively insensitive to soil composition for a plane surface source (Beck and de Planque, 1968), but this is not the case for photon emission within the soil at energies less than 100 keV (ICRU, 1994). At such energies the absorption properties differ for different soil types. Detailed information on the chemical composition of various soils has been tabulated by Helmke (1999). The issue of surface roughness for a contaminated surface plane is discussed in section 3.2.2.4. Changes in soil density have a much larger effect on the dose rate coefficient than changes to the elemental composition.

Table 3-2. 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

3.2.2.3 Soil depths considered

The radiation field due to isotropic infinite plane sources was computed for 13 energies and six depths into the soil. The monoenergetic photon energies ranged from 0.01 to 5.0 MeV. Source plane depths included 0 and 3 mm and four depths in an energy-dependent manner; that is, corresponding to 0.2, 1.0, 2.5 and 4.0 mean free paths at the specified photon energy. These depths were chosen to facilitate an accurate integration when determining dose rate coefficients for continuous source-depth profiles. The air-ground interface (0 mm) source is the mathematical idealized flat plane without anything other than air over the surface. This idealized geometry is rarely, if ever, present in the real world. Rather, there are a variety of conditions that provide shielding from ground surface sources, including the presence of vegetation, surface irregularities and, of course, migration of the deposited activity downward into the soil. The 3 mm source planar often is used to provide an accounting of the reduction in the dose rate resulting from the real-world departures (referred to as ground roughness) from a mathematical plane.

3.2.2.4 Ground roughness considerations

To account for these recognized dose-reduction conditions (collectively referred to as ground roughness), the dose rate coefficients for exposure to a contaminated ground surface have been calculated for an infinite planar source at a depth of 0.5 g cm^{-2} (equivalent to 3 mm for a soil density of 1.6×10^3 kg m^{-3}). The use of this relaxation mass of 0.5 g cm^{-2} is consistent with the results of previous studies in which it was shown that for a $^{137}Cs/^{137m}Ba$ source with this geometry, the air kerma is reduced by a factor of 0.67 compared to a plane source on the ground. This reduction corresponds to the plane source at 0.5 g cm^{-2} in the ground and is applicable in the first months after a wet deposition (Jacob et al., 1990; ICRU, 1994). It is consistent with earlier work by Jacob et al. (1986), Saito et al. (1990) and Petoussi et al. (1991) and with the more recent work of Petoussi-Henss et al. (2012). Dose rate coefficients are provided in this report for a contaminated planar source covered by 3 mm of soil representing ground roughness.

3.2.2.5 Total soil depth

The assumed effective dimensions of the half space of soil in the simulation varies with the depth of the ground plane. A total soil thickness of 3 mean free paths is employed for ground plane sources for depths of 0 mm, 3 mm and 0.2 and 1.0 mean free paths. However, for source planes at depths of 2.5 and 4 mean free paths, the total soil thicknesses are 3.5 and 5 mean free paths, respectively. Photons scattered at depths beyond the lower soil boundary are assumed to represent insignificant contributions to the dose rate coefficients because those photons would travel a minimum of 6 mean free paths and thus undergo significant attenuation.

3.2.2.6 Recording photons incident on the coupling surface

As previously mentioned in the first step for computing the dose rate coefficients, the radiation field incident on the cylindrical closed surface, in which the phantom is located in the second step of the calculation, was computed using the Monte Carlo transport code MCNP6 (Goorley et al., 2012). The "surface source write" feature of the code was used to record the position, angle and energy of photons incident on a coupling surface cylinder due to emission of monoenergetic photons from the ground plane source. As the phantom was not present in this step, the same surface source write file could be used for all reference persons. During this step, the volume inside of the coupling surface is filled with air.

Electrons liberated by photon interactions were not transported, but bremsstrahlung photons were generated and transported using the thick target assumption model available in MCNP6. For all photon energies and source depths, coupling cylinders 200 cm high with 30 cm radii were used. These coupling cylinders were chosen to be as small as possible while still completely enclosing the largest phantom. The distance between the base of the coupling cylinder and the air-soil interface was 0.01 cm. The coupling cylinder served as a passive detector/recorder of incident photons, thus the presence of the coupling surface did not affect the photon transport.

3.2.2.7 Geometry of the air above the soil

In all soil calculations, the maximum altitude of air was 3 mean free paths (at the source energy) above the height of the coupling cylinder. Photons scattered in the atmosphere at a height greater than 3 mean free paths will travel more than 6 mean free paths from the source plane to reach the coupling surface and, therefore, would not make a significant contribution to tissue dose.

3.2.3 Monoenergetic organ dose from photons in soil

Tissue dose rate coefficients in each phantom were computed using the photon fluence of the source write file. As described earlier, the uncollided and scattered photons from isotropic plane sources of radiation were recorded as a function of energy, angle and height above the air-ground interface. These recorded photons then serve as the source on the coupling cylinder surrounding the phantom for the tissue dose rate calculation. This was accomplished using the surface source read capabilities of MCNP6 in conjunction with the surface source write data previously described. Tissue dose rate coefficients were calculated for each combination of 13 source energies, 6 source plane depths and 6 phantoms.

3.2.3.1 Irradiation geometry

Phantoms were placed individually inside the coupling cylinder with the volume between the cylinder and phantom filled with air. The distance between the cylinder base and the phantom was less than 0.1 cm.

3.2.3.2 Calculating absorbed dose

Absorbed doses to tissues were computed using the kerma approximation. Tissue doses were calculated using an energy deposition tally in MCNP6 (*F6:P tally).[7] This tally was implemented as a track-length tally using tissue-specific heating numbers from NJOY. Absorbed dose rate coefficients for active marrow and bone surface were based on a track-length estimate of skeletal fluence (F4:P tally), combined with ICRP skeletal fluence-to-dose response functions (Eckerman 1984; Eckerman and Cristy, 1984). Sufficient photon histories were generated to yield an MCNP6 statistical error of less than 10 percent in all target tissues for which reasonably achievable. Larger error was accepted for relatively small, deep tissues at low energies. Statistical error was less than 5 percent for most tissues at all energies. Effective dose rate coefficients are presented in this report. Organ equivalent dose rate coefficients are available online.[8]

3.2.3.3 Variance reduction

Variance reduction (exponential transform path-length stretching) was employed in all materials for several low-energy photon cases. This was done to achieve statistical convergence on the deep, heavily shielded organs, such as the kidneys. Exponential transform path-length stretching as implemented in MCNP6 often was used for 30, 20, 15 and 10 keV photon energies. This Monte Carlo approach improves the performance of radiation transport calculations in highly shielded targets by simultaneously lengthening the calculational path-length and reducing the transported photon's statistical weight to allow a larger population of photon tracks to enter the target volume.

3.2.4 Dose rate coefficients for volumetric sources

Dose rate coefficients for volumetric sources were obtained by first interpolating the dose rate coefficients for the six planes over soil depth and then integrating over the source volume. This allowed determination of dose rate coefficients corresponding to thicknesses of 1, 5 and 15 cm, and for an effectively infinite source (4 mean free paths thick). For volumetric sources, the source concentration was assumed to be uniform over the entire volume.

If $\hat{h}_{T,P}(E,\tau)\ d\tau$ is the dose rate coefficient (Sv Bq^{-1} s^{-1} m^2) for tissue T for a plane isotropic source P at energy E and depth τ (mean free paths), then the dose rate coefficient for a volumetric source extending from the air-ground interface to depth L (cm) is

[7] The MCNP energy deposition tally (*F6:P) estimates the energy deposited by photons in tissue by considering the average photon track length, the photon energy, the tissue elemental composition and the tissue density.

[8] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

$$\hat{h}_{T,L}(E) = \frac{1}{\mu} \int_0^{\mu L} \hat{h}_{T,P}(E,\tau)\, d\tau \qquad (2)$$

where μ is the linear attenuation coefficient (including coherent scattering) for soil at energy E (Berger et al., 1998). The dose rate coefficients for each organ 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 then were numerically integrated.

3.2.5 Dose rate coefficients for electrons in soil

3.2.5.1 Electron skin dose

The contribution of electrons to dose to tissues 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 is 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 rate 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 107 (2008). The discussion of the computational details, presented below, is taken from Kocher (DOE, 1988).

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

$$z' = z + 1.14 \frac{\rho_t}{\rho_a}\, x \qquad (3)$$

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–NRC, 1964).

The electron dose rate coefficient for skin at the height z' in air above ground defined by Eq. (3) then is given by

$$e_{skin}(E) = \frac{1}{2}\, ER^a \int \Phi^a\,(r,E)\, d\sigma \qquad (4)$$

where the integral is over the ground surface, 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 ½ 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. (4) 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

$$F(r/r_o, E)\, d(r/r_o) = 4\pi\rho\Phi(r, E)\, r^2\, dr \tag{5}$$

where r_o 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.

Scaled point kernels in air, F^a, are obtained from those for water, F^w, given by Berger (1974) as

$$F^a(r/r_o^a, E) = \alpha' F^w(\alpha' r/r_o^a, E) \tag{6}$$

where α' is a scaling parameter that depends on the energy *E*. By expressing Eq. (4) in terms of the scaled point kernel in air, the electron dose rate coefficient for skin is

$$e_{skin}(E) = \frac{1}{4r_o^a}\,\frac{E}{\rho_a}\,R^a \int_{z'/r_o^a}^{\infty} \frac{1}{u}\, F^a(u, E)\, du \tag{7}$$

where *u* is the scaled distance r/r_o^a.

The above formulations 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. (3) 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. The result for a source distributed in the volume then was 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 Figure 3-4.

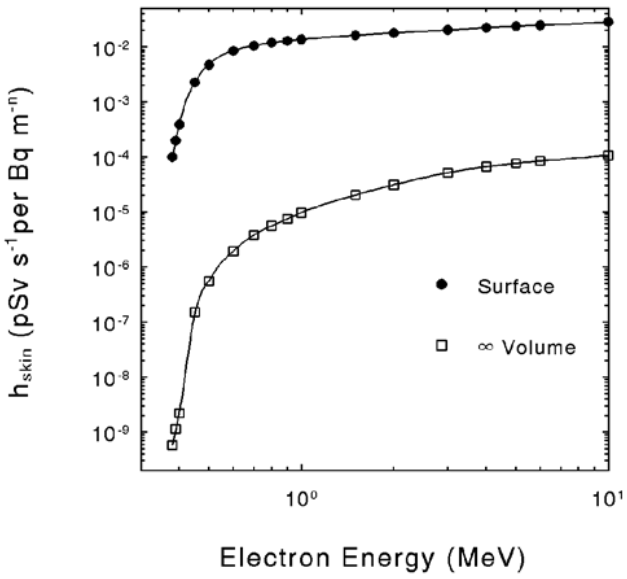


Figure 3-4. Electron skin dose rate coefficients for exposure to contaminated soil.

3.2.5.2 Electron dose from bremsstrahlung

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. Some radionuclides produce bremsstrahlung that is sufficiently penetrating to be of potential importance in the estimation of external dose. In this work, the contribution to dose rate coefficients from bremsstrahlung has been evaluated for all exposure modes. Bremsstrahlung energy is distributed from zero up to the initial electron energy. Although the bremsstrahlung yield is small (only about 0.2% for a 1.0 MeV electron in air) for pure beta emitters, it can be the only source of radiation sufficiently penetrating to irradiate deeper-lying radiosensitive tissues. Appendix C discusses the manner in which the bremsstrahlung spectra were evaluated in this report.

The energy spectra of emitted radiations are either discrete, as in the case of gamma emissions, or continuous, as in the case of beta particles and bremsstrahlung. The beta spectra from the ICRP Publication 107 (2008) dosimetric data file are used to evaluate the contribution of the beta particles to the skin dose and to determine the yield of bremsstrahlung.

3.3 Submersion in contaminated air

3.3.1 Summary of air calculation

Air submersion dose rate coefficients are calculated assuming an individual is exposed to uniformly contaminated air with a monoenergetic photon emitter. The approach involves dividing the problem into two steps:

1. Calculation of photons incident on the coupling surface similar to the soil calculation. For submersion, a rectangular prism of height 265 cm, width 90 cm and length 60 cm was used to represent the closed surface.

2. Calculation of tissue equivalent dose rate coefficients due to photons transported from the coupling surface into the phantom. The effective dose rate coefficient for each reference person is derived using the tissue weighting factors recommended in ICRP Publication 103 (2007) (Table 3-1).

3.3.2 Environmental transport of photons in air

3.3.2.1 Description of scenario

The air submersion exposure geometry involves an individual standing in a large volume of uniformly contaminated air. It is assumed that the individual is standing on an uncontaminated flat surface of infinite area. The source of radiation is a semi-infinite cloud containing a uniformly distributed monoenergetic photon emitter of strength (1 Bq m^{-3}) surrounding a human phantom standing on the air-ground interface.

3.3.2.2 Air composition and density

The air composition given in Table 3-3 is for conditions of 40 percent relative humidity, a pressure of 760 mmHg, a temperature of 20 °C, and a density of 1.2 kg m^{-3}. The dose rate coefficients for submersion can be scaled to account for a different air density. Air kerma as a function of air density is illustrated for 1 MeV photons in Figure 3-5. The functional relation between air kerma and air density is virtually independent of photon energy.

Table 3-3. Air composition.

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

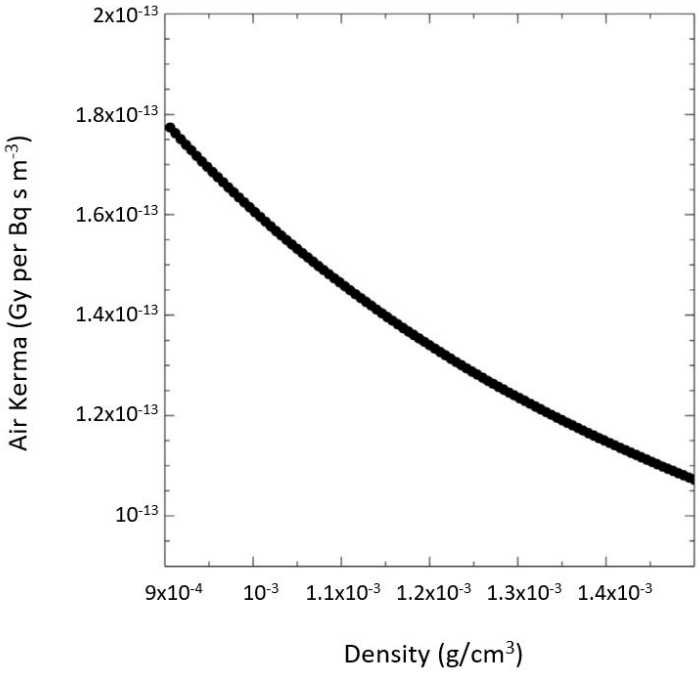


Figure 3-5. Kerma as a function of air density for 1 MeV photons.

3.3.2.3 Computational geometry

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). Ryman et al. (1981) showed this to be a good approximation for air dose (within 20%) at energies of 20 keV or greater. At energies less than 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 this has not been considered here because the increase over the dimensions of the body should be small.

The uniformly distributed monoenergetic photon emitter in an infinite volume is simulated using a finite geometry in the following manner. Consider a cube with side length 10 m containing an emitter of strength 1 Bq m^{-3}. An infinite volume is represented by setting reflective boundary conditions (Chilton et al., 1984) on the six walls of the cube. Photons contacting the wall do not pass through, but are reflected so that the angle of incidence is equal to the angle of reflection. No simulated photons escape; rather, they are down-scattered and absorbed within the air of the cube. Photon energy is not affected by wall reflections. The coupling surface (surface source write feature of MCNP6) is placed in the middle of the cube and records the position, angle and energy of incident photons as discussed in the soil section. The geometry is illustrated in Figure 3-6. This method produces energy-dependent fluence nearly identical to the deterministic method used in Federal Guidance Report No. 12 (EPA, 1993), as illustrated in Figure 3-7. Calculations were performed for 13 monoenergetic sources, ranging from 0.01 to 5.0 MeV.

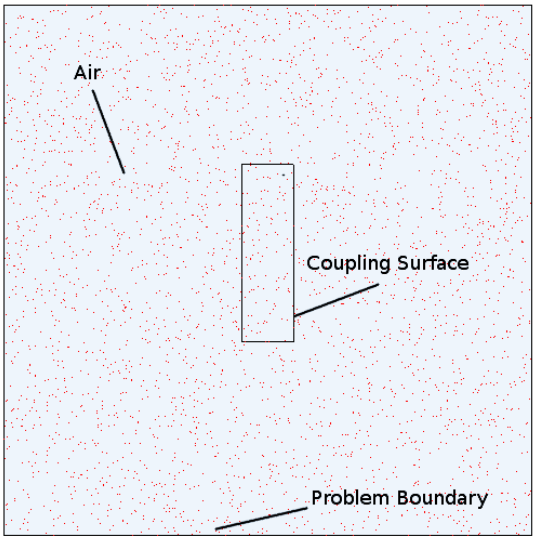


Figure 3-6. Geometry used for generating the air submersion coupling surface.
The dots denote source particle generated randomly within the cube.

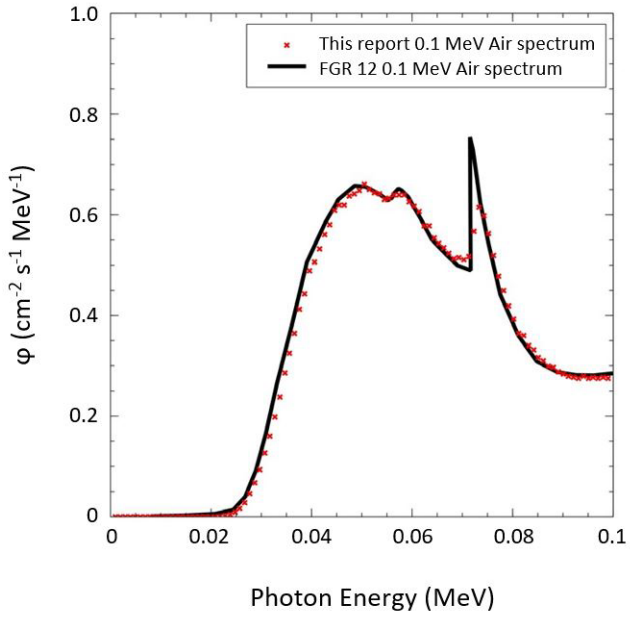


Figure 3-7. Comparison of energy spectra of 0.1 MeV scattered photons for a contaminated air source as estimated here and in Federal Guidance Report No. 12.
An air concentration of 1 Bq m^{-3} is assumed.

3.3.3 Submersion monoenergetic tissue dose rate coefficients from photons

As for the ground plane sources, tissue dose rate coefficients in each phantom are computed using the photon current of the source write file. Tissue doses were calculated using an energy deposition tally in MCNP6 (*F6:P tally) implemented as a track-length tally modified using heating numbers. This result then is divided by 2 to account for the semi-infinite geometry. Dose rate coefficients for active marrow and bone surface were based on a track-length fluence estimator (MCNP5 F4:P tally) combined with ICRP skeletal fluence-to-dose response functions (Cristy and Eckerman, 1987). Calculations were iterated such that the MCNP6 statistical error fell below 10 percent in all target tissues for which this could be reasonably achieved. At low energies, statistical error larger than 10 percent was accepted for small tissues located deep in the body. For most tissues, the statistical error was less than 5 percent at all energies. Effective dose rate coefficients are tabulated in this report. Effective dose rate coefficients and equivalent dose rate coefficients for individual organs are provided electronically.[9]

3.3.4 Organ dose from electrons in air

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

$$e_{skin}(E) = \frac{E}{\rho_a}\frac{R^a}{\alpha}\, q(x,E) G_{skin}(E) \tag{8}$$

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, q is the leakage correction factor, and G_{skin} is the geometrical reduction factor. Section 3.4.3 contains a more detailed description of q and G_{skin}.

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–NRC, 1964),

$$R^a = \left(\frac{1}{\rho}\frac{dE}{dx}\right)_t \div \left(\frac{1}{\rho}\frac{dE}{dx}\right)_a \tag{9}$$

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 rate coefficients for skin calculated using the DOSFACTER code for air submersion are shown in Figure 3-8.

[9] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

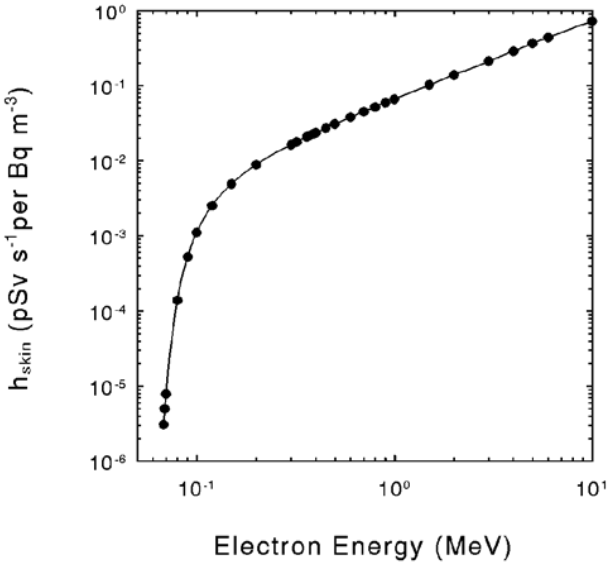


Figure 3-8. Electron skin dose rate coefficient for submersion in contaminated air.

3.3.4.1 Electron dose from bremsstrahlung

In this report, the contribution to dose rate coefficients from bremsstrahlung has been evaluated for electrons slowing down in air. Although the bremsstrahlung yield is small (about 0.2% for a 1.0 MeV electron) for pure beta emitters, it can be the only source of radiations sufficiently penetrating to irradiate deeper-lying radiosensitive tissues. Appendix C discusses the manner in which the bremsstrahlung spectra were evaluated.

3.4 Immersion in contaminated water

3.4.1 Summary of the method for water immersion

Tissue dose rate coefficients for water immersion are calculated under the assumption that an individual is completely immersed in an infinite volume of uniformly contaminated water. In contrast to air submersion, with Monte Carlo methods it is possible to simulate an effectively infinite pool using relatively small dimensions. This is because the linear attenuation coefficient of water is much greater than that of air. For derivation of dose rate coefficients for monoenergetic photons for the case of immersion in contaminated water, each phantom is placed in a relatively small container of water, source photons are generated, and organ doses are derived. This is in contrast to the soil and air methods where photon dose rates are derived by a two-step process. The radionuclide-specific contribution of electrons to skin dose is derived using a point kernel method, as in the case of air submersion. The radionuclide-specific contribution of bremsstrahlung photons from the electron source is derived by folding the monoenergetic photon dose rate coefficients with the bremsstrahlung spectrum. Effective dose rate coefficients for the reference persons are derived using the tissue weighting factors recommended in ICRP Publication 103 (2007) (Table 3-1).

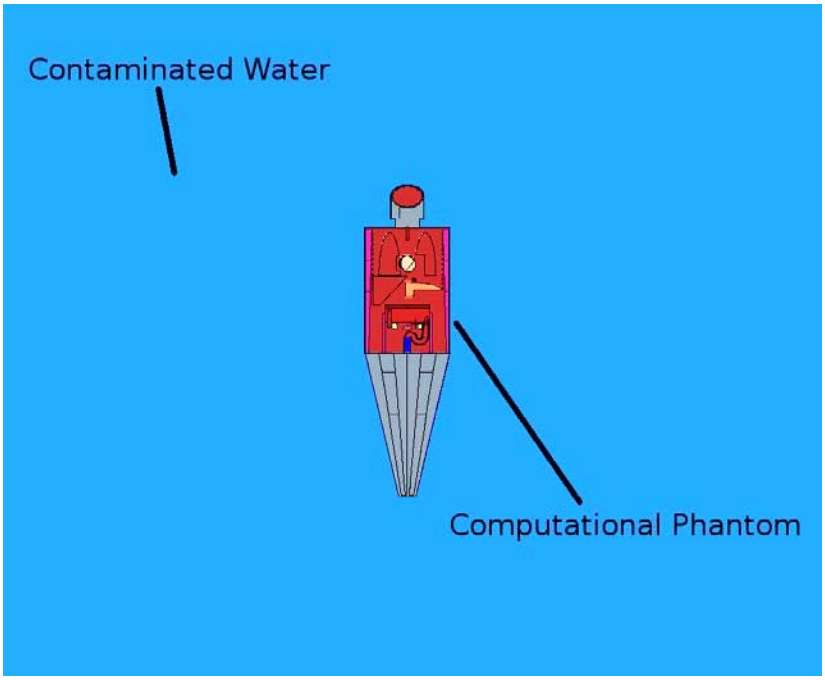


Figure 3-9. Computational geometry used for water immersion for estimating the adult organ dose rate coefficients.

3.4.2 Monoenergetic organ dose from photons in water

The source for the water immersion calculations is an infinite pool of water containing a uniformly distributed monoenergetic photon emitter of strength 1 Bq m^{-3}. A phantom is assumed to be completely immersed in the pool, as illustrated in Figure 3-9. The water density is 1.0×10^3 kg m^{-3} and the composition by mass fraction is 0.112 H and 0.888 O, representing pure water.

The computational phantoms are placed in a cube large enough to represent an infinite extent of contaminated water surrounding the phantom. Monoenergetic source photons are generated uniformly in the contaminated water. Tissue dose rate coefficients are derived using the energy deposition tally as implemented in the soil and water calculation. Dose rate coefficients for bone surface and red marrow are calculated using the track-length fluence tally modified by skeletal fluence-to-dose response functions (Cristy and Eckerman, 1987).

Although this method works for higher energies, it becomes inefficient below about 30 keV. For these energies, the theory of reciprocity is applied (Hiller et al., 2016). Tissues that were considered as targets in the forward run were modeled as sources and the water surrounding the body was treated as the target. This is possible for the case of the phantom immersed in water, where the energy absorption coefficients of all materials (water and tissue) are approximately similar. The reciprocal method cannot be applied to bone surface and red marrow due to the large difference between energy absorption coefficients for bone and water.

3.4.3 Organ dose from electrons in water

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

$$e_{skin}(E) = \frac{E}{\rho_W} R^W(E) q(E) G_{skin}(E) \tag{10}$$

In this equation, 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 in 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

$$R^W = \left(\frac{1}{\rho}\frac{dE}{dx}\right)_T \div \left(\frac{1}{\rho}\frac{dE}{dx}\right)_W \tag{11}$$

Because the stopping powers in tissue and water are nearly independent of energy, the ratio in Eq. (11) is evaluated at the emitted energy. The mass stopping powers in tissue and water used in the DOSFACTER code were reported in National Academy of Sciences–National Research Council Publication 1133 (NAS–NRC, 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):

$$q(x, E) = 1 - q_1(E) q_2(x/a) \tag{12}$$

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 rate coefficient for the skin, e_{skin} (dose per unit volume source), in water. The results are shown graphically in Figure 3-10.

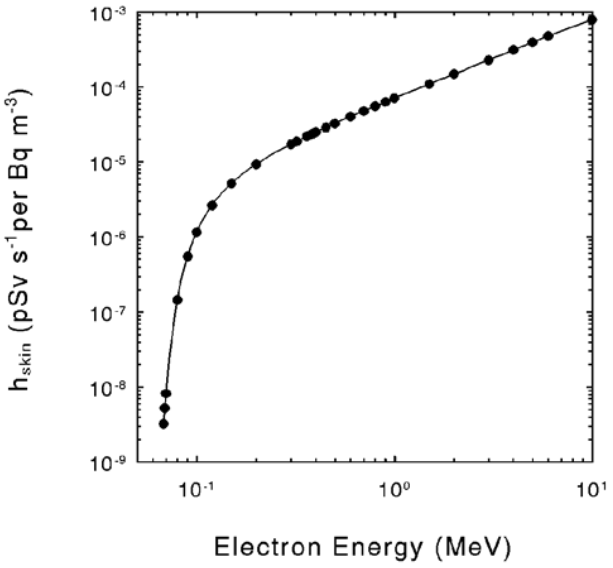


Figure 3-10. Electron skin dose rate coefficient for immersion in contaminated water.

3.4.3.1 Electron dose from bremsstrahlung

In this report, the contribution to dose rate coefficients from bremsstrahlung has been evaluated for water. Although the bremsstrahlung yield is small for pure beta emitters, it can be the only source of radiations sufficiently penetrating to irradiate deeper-lying radiosensitive tissues. Appendix C discusses the manner in which the bremsstrahlung spectra were evaluated in this report.

3.5 Tables of monoenergetic dose rate coefficients

Equivalent dose rate coefficients for monoenergetic photons irradiating each age-specific reference person are available online at https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil.

CHAPTER 4. RADIONUCLIDE DOSE RATE COEFFICIENTS

4.1 Dose rate coefficients for radionuclides

As described in earlier sections, the first step in the development of external dose rate coefficients for radionuclides is to derive dose rates to tissues for monoenergetic photon sources at 13 energies, ranging from 0.01 to 5.0 MeV. The next step is to derive radionuclide-specific dose rate coefficients by using the results for monoenergetic sources to construct the dose rate coefficients for the spectrum of energies for individual radionuclides.

For nearly all radionuclides addressed in this report, external dose is due entirely to gamma and electron emissions. For a few radionuclides, spontaneous fission also may produce penetrating radiations of potential importance. Prompt and delayed emissions for photons and β^+ and β^- particles following spontaneous fission are included in the decay data tabulations of ICRP Publication 107 (2008) and thus are included in the calculations of dose rate coefficients in this report. The contribution from neutrons accompanying spontaneous fission is not included in the dose rate coefficients tabulated in this report because detailed information has not been assembled on the radiation field resulting from distributed sources of neutrons in the environment. Remaining fission products also are not considered in the dose rate coefficient calculation.

The dose rate coefficients provided in this report are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Users should take caution when applying dose rate coefficients, particularly when considering radionuclides for which decay chain progeny are likely to have a greater contribution to dose than the parent (e.g., ^{90}Sr, ^{137}Cs and ^{222}Rn). For more information on application of the provided dose rate coefficients, see Chapter 5: Application Considerations. For each radionuclide, radioactive decay products, if formed, are identified in Appendix A: Nuclear Decay Data.

To facilitate application of the dose coefficients, including conversion to other units, the coefficients are tabulated to three significant figures. No indication of the level of uncertainty, a term for describing the lack of precision and accuracy of a given estimate, is intended or should be inferred from this practice. A calculated dose should be rounded appropriately. For a comprehensive discussion of uncertainties associated with estimates of dose from external exposures, see NCRP Report No. 158 (2007).

4.1.1 The ICRP Publication 107 Nuclear Decay Database

The energies and intensities of the radiations emitted in spontaneous nuclear transformations of radionuclides are provided in ICRP Publication 107 (2008), prepared by the Japan Atomic Energy Research Institute (JAERI) and ORNL. The nuclear decay data of Publication 107 are based on the Evaluated Nuclear Structure Data Files (ENSDF) of the U.S. Department of Energy's Nuclear Data Project as processed with an updated version of the EDISTR code (Dillman, 1980). The electronic data files accompanying ICRP Publication 107 (2008) include not only the full tabulations of the energies (average or unique) and intensities of the radiations, but also the beta spectra. The dose rate coefficients presented here for all environmental media (air, water and soil) are based on these data.

4.1.1.1 Derivation of radionuclide-specific dose rate coefficients based on monoenergetic data and radionuclide spectra

The equivalent dose rate coefficient h_T^S for tissue *T* and exposure mode *S* can be expressed as

$$h_T^S = \sum_{j=e,\gamma} \left[\sum_i y_j\,(E_i)\;\; \hat{h}_{T,j}^S(E_i) + \int_0^\infty y_j(E)\;\; \hat{h}_{T,j}^S(E_i)\; dE \right] \tag{13}$$

where $\hat{h}_{T,j}^S(E_i)$ is the equivalent dose rate coefficient for tissue *T* irradiated in exposure mode *S* by monoenergetic radiation of type *j* and energy E_i, $y_j(E_i)$ 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 outer summation is over all electron and photon emissions. 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 $\hat{h}_{T,j}^S(E_i)$, 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 (including bremsstrahlung), these data are tabulated for 29 target tissues of the body at each of 13 monoenergetic emissions; for electrons, only the skin is irradiated. Effective dose rate coefficients for reference persons, derived using the tissue weighting factors recommended in ICRP Publication 103 (2007) (Table 3-1), are presented for 1,252 radionuclides in Tables 4-1 through 4-7. Effective dose rate coefficients and equivalent dose rate coefficients for individual tissues are provided electronically.[10]

[10] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-1. Reference person effective dose rate coefficients for ground surface.

Explanation of entries

For each radionuclide, values for the age-dependent effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. The coefficients are for a soil density of 1.6×10^3 kg m^{-3}. The values in Table 4-1 account for ground roughness by assuming a 3 mm ground plane depth (see section 3.3.2.4 for explanation). Reference person organ equivalent dose coefficients h_T are provided electronically.[11]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^2), that is, the effective dose rate per planar activity concentration of the radionuclide

w_T: The tissue weighting factor

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^2) for tissue *T*.

The dose rate coefficients provided in Table 4-1 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

To convert from SI units (Sv Bq^{-1} s^{-1} m^2) to conventional units (mrem μCi^{-1} y^{-1} cm^2), multiply table entries by 1.168×10^{21}.

The coefficients are applicable for any soil density.

[11] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-1. Reference person effective dose rate coefficients for ground surface.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	3.84E-27	3.37E-27	2.73E-27	2.56E-27	1.01E-27	8.97E-28
Beryllium						
Be-7	4.18E-17	3.87E-17	3.68E-17	3.49E-17	3.21E-17	3.17E-17
Be-10	3.37E-18	3.34E-18	3.32E-18	3.30E-18	3.28E-18	3.28E-18
Carbon						
C-10	1.56E-15	1.45E-15	1.38E-15	1.32E-15	1.22E-15	1.21E-15
C-11	8.85E-16	8.21E-16	7.82E-16	7.44E-16	6.87E-16	6.78E-16
C-14	6.33E-21	4.95E-21	4.26E-21	3.87E-21	3.16E-21	3.06E-21
Nitrogen						
N-13	9.07E-16	8.43E-16	8.04E-16	7.66E-16	7.08E-16	6.99E-16
N-16	2.73E-15	2.62E-15	2.53E-15	2.46E-15	2.35E-15	2.34E-15
Oxygen						
O-14	2.59E-15	2.42E-15	2.30E-15	2.21E-15	2.08E-15	2.06E-15
O-15	9.47E-16	8.82E-16	8.43E-16	8.05E-16	7.48E-16	7.39E-16
O-19	9.14E-16	8.59E-16	8.21E-16	7.92E-16	7.49E-16	7.42E-16
Fluorine						
F-17	9.47E-16	8.83E-16	8.44E-16	8.06E-16	7.48E-16	7.39E-16
F-18	8.34E-16	7.71E-16	7.34E-16	6.97E-16	6.41E-16	6.32E-16
Neon						
Ne-19	9.73E-16	9.08E-16	8.69E-16	8.31E-16	7.73E-16	7.64E-16
Ne-24	5.52E-16	5.17E-16	4.96E-16	4.76E-16	4.45E-16	4.41E-16
Sodium						
Na-22	1.78E-15	1.65E-15	1.56E-15	1.49E-15	1.38E-15	1.37E-15
Na-24	3.02E-15	2.83E-15	2.69E-15	2.60E-15	2.46E-15	2.43E-15
Magnesium						
Mg-27	8.21E-16	7.64E-16	7.27E-16	6.96E-16	6.52E-16	6.46E-16
Mg-28	1.09E-15	1.01E-15	9.51E-16	9.08E-16	8.46E-16	8.37E-16
Aluminum						
Al-26	2.13E-15	1.98E-15	1.88E-15	1.80E-15	1.69E-15	1.67E-15
Al-28	1.47E-15	1.38E-15	1.32E-15	1.27E-15	1.20E-15	1.19E-15
Al-29	1.19E-15	1.11E-15	1.06E-15	1.02E-15	9.62E-16	9.53E-16
Silicon						
Si-31	7.09E-17	7.07E-17	7.06E-17	7.05E-17	7.03E-17	7.03E-17
Si-32	1.64E-20	1.33E-20	1.17E-20	1.07E-20	9.01E-21	8.76E-21
Phosphorus						
P-30	1.01E-15	9.46E-16	9.07E-16	8.68E-16	8.10E-16	8.01E-16
P-32	8.48E-17	8.46E-17	8.45E-17	8.44E-17	8.42E-17	8.42E-17
P-33	2.15E-20	1.76E-20	1.55E-20	1.43E-20	1.21E-20	1.18E-20
Sulfur						
S-35	6.73E-21	5.29E-21	4.57E-21	4.16E-21	3.42E-21	3.31E-21
S-37	2.05E-15	1.93E-15	1.85E-15	1.79E-15	1.71E-15	1.69E-15
S-38	1.29E-15	1.21E-15	1.15E-15	1.11E-15	1.05E-15	1.04E-15
Chlorine						
Cl-34	1.05E-15	9.80E-16	9.40E-16	9.01E-16	8.43E-16	8.33E-16
Cl-34m	1.63E-15	1.53E-15	1.45E-15	1.40E-15	1.31E-15	1.30E-15

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	1.10E-17	1.10E-17	1.09E-17	1.09E-17	1.09E-17	1.09E-17
Cl-38	1.20E-15	1.13E-15	1.08E-15	1.04E-15	9.90E-16	9.81E-16
Cl-39	1.24E-15	1.16E-15	1.10E-15	1.06E-15	9.94E-16	9.84E-16
Cl-40	3.03E-15	2.85E-15	2.72E-15	2.62E-15	2.48E-15	2.46E-15
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	2.46E-18	2.43E-18	2.42E-18	2.41E-18	2.39E-18	2.39E-18
Ar-41	1.06E-15	9.87E-16	9.37E-16	8.98E-16	8.43E-16	8.35E-16
Ar-42	3.99E-18	3.96E-18	3.94E-18	3.93E-18	3.91E-18	3.90E-18
Ar-43	1.32E-15	1.24E-15	1.18E-15	1.13E-15	1.07E-15	1.06E-15
Ar-44	1.53E-15	1.42E-15	1.35E-15	1.30E-15	1.22E-15	1.21E-15
Potassium						
K-38	2.55E-15	2.39E-15	2.28E-15	2.19E-15	2.06E-15	2.04E-15
K-40	1.84E-16	1.75E-16	1.69E-16	1.64E-16	1.58E-16	1.57E-16
K-42	3.63E-16	3.47E-16	3.36E-16	3.28E-16	3.16E-16	3.14E-16
K-43	8.24E-16	7.63E-16	7.26E-16	6.91E-16	6.37E-16	6.28E-16
K-44	1.92E-15	1.79E-15	1.71E-15	1.65E-15	1.55E-15	1.54E-15
K-45	1.50E-15	1.40E-15	1.33E-15	1.28E-15	1.21E-15	1.20E-15
K-46	2.26E-15	2.13E-15	2.03E-15	1.96E-15	1.85E-15	1.84E-15
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	2.26E-20	1.85E-20	1.64E-20	1.50E-20	1.28E-20	1.25E-20
Ca-47	8.60E-16	7.98E-16	7.56E-16	7.24E-16	6.78E-16	6.71E-16
Ca-49	2.21E-15	2.09E-15	2.00E-15	1.93E-15	1.84E-15	1.83E-15
Scandium						
Sc-42m	3.51E-15	3.26E-15	3.10E-15	2.97E-15	2.77E-15	2.74E-15
Sc-43	8.67E-16	8.05E-16	7.67E-16	7.31E-16	6.75E-16	6.66E-16
Sc-44	1.82E-15	1.69E-15	1.61E-15	1.53E-15	1.43E-15	1.41E-15
Sc-44m	2.27E-16	2.09E-16	1.99E-16	1.89E-16	1.73E-16	1.71E-16
Sc-46	1.64E-15	1.51E-15	1.43E-15	1.36E-15	1.27E-15	1.26E-15
Sc-47	8.86E-17	8.30E-17	7.80E-17	7.44E-17	6.79E-17	6.68E-17
Sc-48	2.71E-15	2.50E-15	2.37E-15	2.26E-15	2.11E-15	2.08E-15
Sc-49	1.01E-16	1.00E-16	1.00E-16	1.00E-16	9.98E-17	9.98E-17
Sc-50	2.70E-15	2.51E-15	2.39E-15	2.29E-15	2.15E-15	2.12E-15
Titanium						
Ti-44	1.00E-16	8.82E-17	8.03E-17	7.47E-17	6.89E-17	6.72E-17
Ti-45	7.64E-16	7.09E-16	6.76E-16	6.43E-16	5.94E-16	5.87E-16
Ti-51	4.12E-16	3.88E-16	3.74E-16	3.61E-16	3.39E-16	3.36E-16
Ti-52	1.90E-16	1.84E-16	1.78E-16	1.74E-16	1.65E-16	1.64E-16
Vanadium						
V-47	9.34E-16	8.71E-16	8.33E-16	7.96E-16	7.39E-16	7.31E-16
V-48	2.36E-15	2.18E-15	2.07E-15	1.97E-15	1.84E-15	1.81E-15
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	1.10E-15	1.02E-15	9.68E-16	9.28E-16	8.71E-16	8.61E-16
V-52	1.25E-15	1.17E-15	1.11E-15	1.07E-15	1.01E-15	1.00E-15
V-53	9.64E-16	8.99E-16	8.57E-16	8.22E-16	7.73E-16	7.66E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Chromium						
Cr-48	3.58E-16	3.31E-16	3.14E-16	2.99E-16	2.72E-16	2.69E-16
Cr-49	9.50E-16	8.83E-16	8.42E-16	8.03E-16	7.43E-16	7.34E-16
Cr-51	2.65E-17	2.44E-17	2.33E-17	2.21E-17	2.02E-17	2.00E-17
Cr-55	1.28E-16	1.28E-16	1.27E-16	1.27E-16	1.27E-16	1.27E-16
Cr-56	1.31E-16	1.24E-16	1.19E-16	1.16E-16	1.12E-16	1.11E-16
Manganese						
Mn-50m	3.91E-15	3.63E-15	3.45E-15	3.29E-15	3.07E-15	3.04E-15
Mn-51	9.50E-16	8.87E-16	8.49E-16	8.12E-16	7.55E-16	7.46E-16
Mn-52	2.79E-15	2.58E-15	2.44E-15	2.33E-15	2.17E-15	2.15E-15
Mn-52m	2.06E-15	1.92E-15	1.83E-15	1.75E-15	1.64E-15	1.62E-15
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	6.92E-16	6.38E-16	6.04E-16	5.75E-16	5.33E-16	5.27E-16
Mn-56	1.41E-15	1.31E-15	1.25E-15	1.20E-15	1.13E-15	1.11E-15
Mn-57	2.04E-16	1.98E-16	1.94E-16	1.90E-16	1.85E-16	1.84E-16
Mn-58m	2.07E-15	1.92E-15	1.83E-15	1.76E-15	1.65E-15	1.63E-15
Iron						
Fe-52	6.25E-16	5.80E-16	5.51E-16	5.24E-16	4.82E-16	4.75E-16
Fe-53	1.11E-15	1.04E-15	9.94E-16	9.50E-16	8.84E-16	8.73E-16
Fe-53m	2.44E-15	2.26E-15	2.14E-15	2.04E-15	1.91E-15	1.88E-15
Fe-55	1.29E-25	1.21E-25	1.13E-25	1.08E-25	9.74E-26	9.59E-26
Fe-59	9.51E-16	8.80E-16	8.33E-16	7.95E-16	7.43E-16	7.34E-16
Fe-60	1.23E-20	9.85E-21	8.57E-21	7.82E-21	6.50E-21	6.31E-21
Fe-61	1.23E-15	1.15E-15	1.09E-15	1.05E-15	9.87E-16	9.77E-16
Fe-62	5.25E-16	4.93E-16	4.74E-16	4.55E-16	4.26E-16	4.21E-16
Cobalt						
Co-54m	3.37E-15	3.13E-15	2.98E-15	2.85E-15	2.66E-15	2.63E-15
Co-55	1.69E-15	1.56E-15	1.49E-15	1.42E-15	1.32E-15	1.30E-15
Co-56	2.80E-15	2.60E-15	2.47E-15	2.37E-15	2.22E-15	2.20E-15
Co-57	9.58E-17	8.98E-17	8.41E-17	8.03E-17	7.25E-17	7.14E-17
Co-58	8.09E-16	7.46E-16	7.08E-16	6.73E-16	6.23E-16	6.15E-16
Co-58m	1.93E-21	1.26E-21	1.02E-21	9.30E-22	6.34E-22	5.99E-22
Co-60	1.99E-15	1.84E-15	1.74E-15	1.67E-15	1.56E-15	1.54E-15
Co-60m	3.61E-18	3.29E-18	3.08E-18	2.93E-18	2.72E-18	2.68E-18
Co-61	1.21E-16	1.13E-16	1.08E-16	1.04E-16	9.95E-17	9.84E-17
Co-62	1.40E-15	1.31E-15	1.25E-15	1.20E-15	1.14E-15	1.13E-15
Co-62m	2.23E-15	2.08E-15	1.97E-15	1.89E-15	1.78E-15	1.76E-15
Nickel						
Ni-56	1.41E-15	1.31E-15	1.24E-15	1.18E-15	1.09E-15	1.08E-15
Ni-57	1.54E-15	1.43E-15	1.35E-15	1.29E-15	1.21E-15	1.19E-15
Ni-59	1.30E-20	1.20E-20	1.15E-20	1.09E-20	1.00E-20	9.87E-21
Ni-63	1.88E-22	1.32E-22	1.08E-22	9.83E-23	7.01E-23	6.69E-23
Ni-65	5.07E-16	4.74E-16	4.53E-16	4.36E-16	4.12E-16	4.09E-16
Ni-66	2.04E-20	1.67E-20	1.47E-20	1.35E-20	1.15E-20	1.12E-20
Copper						
Cu-57	1.22E-15	1.14E-15	1.10E-15	1.05E-15	9.85E-16	9.74E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cu-59	1.35E-15	1.26E-15	1.21E-15	1.15E-15	1.08E-15	1.06E-15
Cu-60	3.15E-15	2.94E-15	2.79E-15	2.67E-15	2.50E-15	2.48E-15
Cu-61	7.19E-16	6.67E-16	6.35E-16	6.05E-16	5.60E-16	5.52E-16
Cu-62	9.87E-16	9.23E-16	8.84E-16	8.47E-16	7.90E-16	7.80E-16
Cu-64	1.56E-16	1.44E-16	1.37E-16	1.31E-16	1.20E-16	1.19E-16
Cu-66	2.03E-16	1.96E-16	1.92E-16	1.89E-16	1.84E-16	1.83E-16
Cu-67	9.29E-17	8.61E-17	8.12E-17	7.73E-17	7.04E-17	6.94E-17
Cu-69	5.34E-16	5.00E-16	4.79E-16	4.61E-16	4.36E-16	4.32E-16
Zinc						
Zn-60	1.41E-15	1.31E-15	1.25E-15	1.19E-15	1.11E-15	1.10E-15
Zn-61	1.42E-15	1.33E-15	1.27E-15	1.22E-15	1.14E-15	1.13E-15
Zn-62	3.66E-16	3.37E-16	3.20E-16	3.04E-16	2.79E-16	2.76E-16
Zn-63	1.03E-15	9.57E-16	9.15E-16	8.75E-16	8.14E-16	8.04E-16
Zn-65	4.68E-16	4.32E-16	4.09E-16	3.90E-16	3.64E-16	3.60E-16
Zn-69	2.08E-17	2.08E-17	2.07E-17	2.07E-17	2.07E-17	2.07E-17
Zn-69m	3.50E-16	3.23E-16	3.08E-16	2.92E-16	2.68E-16	2.64E-16
Zn-71	3.82E-16	3.61E-16	3.49E-16	3.37E-16	3.20E-16	3.18E-16
Zn-71m	1.36E-15	1.26E-15	1.20E-15	1.15E-15	1.06E-15	1.05E-15
Zn-72	1.17E-16	1.10E-16	1.03E-16	9.81E-17	8.92E-17	8.78E-17
Gallium						
Ga-64	2.75E-15	2.57E-15	2.45E-15	2.35E-15	2.20E-15	2.18E-15
Ga-65	1.06E-15	9.90E-16	9.45E-16	9.02E-16	8.37E-16	8.27E-16
Ga-66	1.93E-15	1.80E-15	1.72E-15	1.65E-15	1.55E-15	1.54E-15
Ga-67	1.26E-16	1.16E-16	1.10E-16	1.04E-16	9.50E-17	9.36E-17
Ga-68	8.86E-16	8.26E-16	7.89E-16	7.54E-16	7.01E-16	6.93E-16
Ga-70	8.33E-17	8.26E-17	8.22E-17	8.19E-17	8.14E-17	8.13E-17
Ga-72	2.13E-15	1.98E-15	1.88E-15	1.81E-15	1.69E-15	1.68E-15
Ga-73	3.32E-16	3.10E-16	2.96E-16	2.84E-16	2.64E-16	2.61E-16
Ga-74	2.49E-15	2.32E-15	2.21E-15	2.13E-15	2.00E-15	1.98E-15
Germanium						
Ge-66	5.61E-16	5.18E-16	4.92E-16	4.67E-16	4.29E-16	4.23E-16
Ge-67	1.30E-15	1.21E-15	1.16E-15	1.11E-15	1.03E-15	1.02E-15
Ge-68	2.13E-25	5.00E-25	2.82E-25	2.82E-25	1.67E-25	1.38E-25
Ge-69	7.86E-16	7.27E-16	6.90E-16	6.58E-16	6.12E-16	6.04E-16
Ge-71	2.16E-25	5.07E-25	2.86E-25	2.86E-25	1.69E-25	1.40E-25
Ge-75	6.91E-17	6.68E-17	6.54E-17	6.41E-17	6.20E-17	6.17E-17
Ge-77	9.54E-16	8.87E-16	8.45E-16	8.08E-16	7.52E-16	7.43E-16
Ge-78	2.36E-16	2.18E-16	2.08E-16	1.98E-16	1.81E-16	1.79E-16
Arsenic						
As-68	3.15E-15	2.93E-15	2.79E-15	2.67E-15	2.50E-15	2.47E-15
As-69	1.08E-15	1.01E-15	9.68E-16	9.26E-16	8.63E-16	8.53E-16
As-70	3.52E-15	3.26E-15	3.10E-15	2.96E-15	2.77E-15	2.73E-15
As-71	4.79E-16	4.44E-16	4.22E-16	4.01E-16	3.69E-16	3.64E-16
As-72	1.59E-15	1.48E-15	1.41E-15	1.35E-15	1.25E-15	1.24E-15
As-73	3.97E-18	3.31E-18	2.94E-18	2.67E-18	2.27E-18	2.21E-18
As-74	6.57E-16	6.09E-16	5.80E-16	5.52E-16	5.10E-16	5.04E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-76	4.62E-16	4.36E-16	4.20E-16	4.05E-16	3.83E-16	3.80E-16
As-77	1.23E-17	1.17E-17	1.14E-17	1.11E-17	1.06E-17	1.05E-17
As-78	1.17E-15	1.09E-15	1.04E-15	9.98E-16	9.37E-16	9.28E-16
As-79	1.34E-16	1.31E-16	1.30E-16	1.28E-16	1.26E-16	1.26E-16
Selenium						
Se-70	6.11E-16	5.65E-16	5.37E-16	5.11E-16	4.70E-16	4.64E-16
Se-71	1.47E-15	1.37E-15	1.31E-15	1.25E-15	1.17E-15	1.15E-15
Se-72	1.78E-17	1.44E-17	1.25E-17	1.12E-17	9.08E-18	8.84E-18
Se-73	9.48E-16	8.78E-16	8.36E-16	7.95E-16	7.34E-16	7.24E-16
Se-73m	2.36E-16	2.20E-16	2.10E-16	2.00E-16	1.85E-16	1.83E-16
Se-75	3.15E-16	2.91E-16	2.76E-16	2.63E-16	2.40E-16	2.36E-16
Se-77m	6.96E-17	6.51E-17	6.12E-17	5.83E-17	5.31E-17	5.23E-17
Se-79	7.27E-21	5.69E-21	4.90E-21	4.46E-21	3.64E-21	3.53E-21
Se-79m	7.03E-18	6.49E-18	6.04E-18	5.75E-18	5.17E-18	5.09E-18
Se-81	7.90E-17	7.83E-17	7.79E-17	7.76E-17	7.70E-17	7.69E-17
Se-81m	1.08E-17	1.00E-17	9.34E-18	8.92E-18	8.01E-18	7.89E-18
Se-83	2.13E-15	1.97E-15	1.87E-15	1.79E-15	1.67E-15	1.65E-15
Se-83m	9.17E-16	8.59E-16	8.21E-16	7.90E-16	7.45E-16	7.38E-16
Se-84	4.15E-16	3.88E-16	3.72E-16	3.57E-16	3.32E-16	3.28E-16
Bromine						
Br-72	2.63E-15	2.45E-15	2.33E-15	2.23E-15	2.08E-15	2.06E-15
Br-73	1.34E-15	1.25E-15	1.19E-15	1.14E-15	1.06E-15	1.05E-15
Br-74	3.48E-15	3.25E-15	3.10E-15	2.98E-15	2.81E-15	2.78E-15
Br-74m	3.32E-15	3.10E-15	2.95E-15	2.82E-15	2.64E-15	2.61E-15
Br-75	1.06E-15	9.87E-16	9.42E-16	8.98E-16	8.30E-16	8.20E-16
Br-76	2.22E-15	2.07E-15	1.97E-15	1.89E-15	1.76E-15	1.75E-15
Br-76m	2.45E-17	2.06E-17	1.85E-17	1.69E-17	1.45E-17	1.41E-17
Br-77	2.62E-16	2.42E-16	2.30E-16	2.19E-16	2.01E-16	1.98E-16
Br-77m	1.15E-17	1.07E-17	1.00E-17	9.57E-18	8.59E-18	8.46E-18
Br-78	9.87E-16	9.21E-16	8.81E-16	8.43E-16	7.85E-16	7.75E-16
Br-80	1.51E-16	1.46E-16	1.42E-16	1.40E-16	1.35E-16	1.35E-16
Br-80m	7.92E-18	5.92E-18	4.90E-18	4.39E-18	3.42E-18	3.31E-18
Br-82	2.16E-15	2.00E-15	1.90E-15	1.81E-15	1.68E-15	1.66E-15
Br-82m	5.63E-18	5.43E-18	5.30E-18	5.20E-18	5.04E-18	5.02E-18
Br-83	2.79E-17	2.74E-17	2.71E-17	2.68E-17	2.64E-17	2.63E-17
Br-84	1.41E-15	1.32E-15	1.26E-15	1.22E-15	1.15E-15	1.14E-15
Br-84m	2.33E-15	2.16E-15	2.05E-15	1.96E-15	1.84E-15	1.82E-15
Br-85	1.74E-16	1.70E-16	1.67E-16	1.64E-16	1.61E-16	1.60E-16
Krypton						
Kr-74	9.49E-16	8.82E-16	8.41E-16	8.03E-16	7.43E-16	7.33E-16
Kr-75	1.22E-15	1.14E-15	1.09E-15	1.04E-15	9.69E-16	9.58E-16
Kr-76	3.48E-16	3.20E-16	3.04E-16	2.89E-16	2.65E-16	2.61E-16
Kr-77	9.45E-16	8.82E-16	8.41E-16	8.03E-16	7.44E-16	7.34E-16
Kr-79	2.07E-16	1.92E-16	1.82E-16	1.73E-16	1.59E-16	1.57E-16
Kr-81	6.81E-19	6.28E-19	5.97E-19	5.69E-19	5.19E-19	5.12E-19
Kr-81m	1.05E-16	9.73E-17	9.21E-17	8.77E-17	8.00E-17	7.88E-17

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-83m	7.70E-21	5.75E-21	4.57E-21	4.16E-21	2.90E-21	2.76E-21
Kr-85	1.02E-17	1.00E-17	9.89E-18	9.79E-18	9.64E-18	9.62E-18
Kr-85m	1.39E-16	1.31E-16	1.24E-16	1.18E-16	1.09E-16	1.07E-16
Kr-87	7.34E-16	6.92E-16	6.64E-16	6.42E-16	6.09E-16	6.03E-16
Kr-88	1.46E-15	1.37E-15	1.30E-15	1.25E-15	1.18E-15	1.17E-15
Kr-89	1.59E-15	1.49E-15	1.42E-15	1.37E-15	1.29E-15	1.28E-15
Rubidium						
Rb-77	1.44E-15	1.34E-15	1.28E-15	1.22E-15	1.14E-15	1.13E-15
Rb-78	3.12E-15	2.92E-15	2.79E-15	2.68E-15	2.52E-15	2.50E-15
Rb-78m	2.71E-15	2.52E-15	2.40E-15	2.30E-15	2.15E-15	2.12E-15
Rb-79	1.30E-15	1.21E-15	1.15E-15	1.10E-15	1.02E-15	1.00E-15
Rb-80	1.19E-15	1.11E-15	1.06E-15	1.02E-15	9.49E-16	9.39E-16
Rb-81	4.31E-16	3.99E-16	3.80E-16	3.61E-16	3.33E-16	3.29E-16
Rb-81m	2.01E-17	1.86E-17	1.76E-17	1.67E-17	1.55E-17	1.53E-17
Rb-82	1.08E-15	1.01E-15	9.64E-16	9.23E-16	8.60E-16	8.50E-16
Rb-82m	2.40E-15	2.22E-15	2.10E-15	2.00E-15	1.86E-15	1.83E-15
Rb-83	4.06E-16	3.75E-16	3.57E-16	3.39E-16	3.12E-16	3.08E-16
Rb-84	7.64E-16	7.06E-16	6.70E-16	6.38E-16	5.92E-16	5.85E-16
Rb-84m	3.16E-16	2.92E-16	2.78E-16	2.64E-16	2.42E-16	2.39E-16
Rb-86	1.54E-16	1.48E-16	1.44E-16	1.41E-16	1.36E-16	1.36E-16
Rb-86m	4.59E-16	4.24E-16	4.03E-16	3.83E-16	3.53E-16	3.48E-16
Rb-87	5.04E-20	4.23E-20	3.77E-20	3.48E-20	3.00E-20	2.93E-20
Rb-88	6.61E-16	6.27E-16	6.02E-16	5.85E-16	5.59E-16	5.55E-16
Rb-89	1.83E-15	1.71E-15	1.62E-15	1.56E-15	1.47E-15	1.45E-15
Rb-90	1.55E-15	1.46E-15	1.40E-15	1.36E-15	1.29E-15	1.28E-15
Rb-90m	2.52E-15	2.36E-15	2.25E-15	2.16E-15	2.04E-15	2.02E-15
Strontium						
Sr-79	1.16E-15	1.08E-15	1.04E-15	9.92E-16	9.24E-16	9.13E-16
Sr-80	3.62E-16	3.35E-16	3.18E-16	3.02E-16	2.78E-16	2.75E-16
Sr-81	1.27E-15	1.18E-15	1.13E-15	1.07E-15	9.97E-16	9.85E-16
Sr-82	1.09E-20	9.85E-21	7.90E-21	7.47E-21	2.82E-21	2.50E-21
Sr-83	6.83E-16	6.32E-16	6.01E-16	5.72E-16	5.30E-16	5.23E-16
Sr-85	4.13E-16	3.82E-16	3.63E-16	3.45E-16	3.17E-16	3.13E-16
Sr-85m	1.78E-16	1.64E-16	1.56E-16	1.49E-16	1.36E-16	1.34E-16
Sr-87m	2.67E-16	2.47E-16	2.35E-16	2.23E-16	2.05E-16	2.02E-16
Sr-89	6.85E-17	6.84E-17	6.83E-17	6.82E-17	6.81E-17	6.80E-17
Sr-90	1.56E-18	1.54E-18	1.53E-18	1.52E-18	1.50E-18	1.50E-18
Sr-91	6.51E-16	6.06E-16	5.77E-16	5.53E-16	5.18E-16	5.13E-16
Sr-92	1.05E-15	9.77E-16	9.26E-16	8.86E-16	8.30E-16	8.21E-16
Sr-93	1.89E-15	1.76E-15	1.67E-15	1.60E-15	1.50E-15	1.48E-15
Sr-94	1.21E-15	1.13E-15	1.08E-15	1.04E-15	9.78E-16	9.69E-16
Yttrium						
Y-81	1.15E-15	1.08E-15	1.03E-15	9.88E-16	9.21E-16	9.10E-16
Y-83	1.25E-15	1.16E-15	1.11E-15	1.06E-15	9.89E-16	9.78E-16
Y-83m	7.83E-16	7.30E-16	6.98E-16	6.67E-16	6.19E-16	6.11E-16
Y-84m	3.39E-15	3.14E-15	2.99E-15	2.85E-15	2.65E-15	2.62E-15

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-85	9.61E-16	8.93E-16	8.51E-16	8.12E-16	7.51E-16	7.42E-16
Y-85m	1.13E-15	1.05E-15	1.00E-15	9.58E-16	8.94E-16	8.84E-16
Y-86	2.87E-15	2.66E-15	2.53E-15	2.41E-15	2.25E-15	2.22E-15
Y-86m	1.80E-16	1.67E-16	1.58E-16	1.51E-16	1.38E-16	1.36E-16
Y-87	3.67E-16	3.40E-16	3.23E-16	3.07E-16	2.82E-16	2.78E-16
Y-87m	2.56E-16	2.37E-16	2.25E-16	2.14E-16	1.96E-16	1.93E-16
Y-88	2.07E-15	1.92E-15	1.82E-15	1.74E-15	1.64E-15	1.62E-15
Y-89m	7.44E-16	6.87E-16	6.50E-16	6.19E-16	5.75E-16	5.68E-16
Y-90	1.09E-16	1.09E-16	1.09E-16	1.09E-16	1.08E-16	1.08E-16
Y-90m	5.31E-16	4.91E-16	4.67E-16	4.44E-16	4.07E-16	4.01E-16
Y-91	7.36E-17	7.32E-17	7.30E-17	7.28E-17	7.25E-17	7.25E-17
Y-91m	4.46E-16	4.12E-16	3.92E-16	3.72E-16	3.43E-16	3.39E-16
Y-92	3.51E-16	3.35E-16	3.24E-16	3.15E-16	3.03E-16	3.01E-16
Y-93	2.04E-16	1.98E-16	1.94E-16	1.91E-16	1.86E-16	1.85E-16
Y-94	7.94E-16	7.46E-16	7.14E-16	6.89E-16	6.52E-16	6.46E-16
Y-95	9.34E-16	8.80E-16	8.43E-16	8.15E-16	7.75E-16	7.69E-16
Zirconium						
Zr-85	1.36E-15	1.27E-15	1.21E-15	1.16E-15	1.08E-15	1.07E-15
Zr-86	2.27E-16	2.09E-16	1.98E-16	1.89E-16	1.72E-16	1.70E-16
Zr-87	8.71E-16	8.12E-16	7.77E-16	7.43E-16	6.92E-16	6.84E-16
Zr-88	3.20E-16	2.96E-16	2.82E-16	2.68E-16	2.45E-16	2.42E-16
Zr-89	9.59E-16	8.85E-16	8.39E-16	7.99E-16	7.41E-16	7.32E-16
Zr-89m	5.28E-16	4.89E-16	4.65E-16	4.42E-16	4.09E-16	4.03E-16
Zr-93	2.17E-22	1.52E-22	1.25E-22	1.13E-22	8.07E-23	7.69E-23
Zr-95	6.11E-16	5.63E-16	5.34E-16	5.08E-16	4.70E-16	4.64E-16
Zr-97	8.14E-16	7.58E-16	7.23E-16	6.92E-16	6.47E-16	6.40E-16
Niobium						
Nb-87	1.18E-15	1.10E-15	1.05E-15	1.01E-15	9.39E-16	9.28E-16
Nb-88	3.61E-15	3.35E-15	3.18E-15	3.03E-15	2.82E-15	2.79E-15
Nb-88m	3.49E-15	3.24E-15	3.08E-15	2.94E-15	2.74E-15	2.71E-15
Nb-89	1.19E-15	1.12E-15	1.07E-15	1.02E-15	9.59E-16	9.48E-16
Nb-89m	1.19E-15	1.10E-15	1.05E-15	1.01E-15	9.33E-16	9.22E-16
Nb-90	3.23E-15	3.01E-15	2.86E-15	2.74E-15	2.57E-15	2.55E-15
Nb-91	1.48E-18	1.34E-18	1.27E-18	1.20E-18	1.07E-18	1.05E-18
Nb-91m	2.01E-17	1.86E-17	1.76E-17	1.68E-17	1.56E-17	1.54E-17
Nb-92	1.24E-15	1.14E-15	1.08E-15	1.03E-15	9.55E-16	9.44E-16
Nb-92m	7.88E-16	7.27E-16	6.88E-16	6.55E-16	6.09E-16	6.02E-16
Nb-93m	4.05E-20	2.81E-20	2.46E-20	2.24E-20	1.05E-20	9.62E-21
Nb-94	1.29E-15	1.19E-15	1.13E-15	1.08E-15	9.97E-16	9.85E-16
Nb-94m	4.02E-18	3.68E-18	3.49E-18	3.33E-18	3.06E-18	3.02E-18
Nb-95	6.37E-16	5.87E-16	5.57E-16	5.29E-16	4.90E-16	4.84E-16
Nb-95m	5.36E-17	4.96E-17	4.72E-17	4.51E-17	4.13E-17	4.07E-17
Nb-96	2.04E-15	1.88E-15	1.78E-15	1.70E-15	1.57E-15	1.56E-15
Nb-97	6.05E-16	5.62E-16	5.36E-16	5.12E-16	4.76E-16	4.70E-16
Nb-98m	2.37E-15	2.19E-15	2.08E-15	1.99E-15	1.86E-15	1.84E-15
Nb-99	2.86E-16	2.76E-16	2.68E-16	2.62E-16	2.50E-16	2.49E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-99m	7.00E-16	6.62E-16	6.35E-16	6.15E-16	5.85E-16	5.81E-16
Molybdenum						
Mo-89	1.19E-15	1.11E-15	1.07E-15	1.02E-15	9.56E-16	9.45E-16
Mo-90	6.85E-16	6.35E-16	6.02E-16	5.74E-16	5.29E-16	5.22E-16
Mo-91	9.69E-16	9.07E-16	8.69E-16	8.33E-16	7.77E-16	7.69E-16
Mo-91m	1.19E-15	1.10E-15	1.05E-15	1.00E-15	9.36E-16	9.25E-16
Mo-93	2.27E-19	1.57E-19	1.38E-19	1.25E-19	5.84E-20	5.38E-20
Mo-93m	1.84E-15	1.71E-15	1.62E-15	1.55E-15	1.44E-15	1.42E-15
Mo-99	1.59E-16	1.50E-16	1.44E-16	1.39E-16	1.31E-16	1.29E-16
Mo-101	1.22E-15	1.13E-15	1.08E-15	1.03E-15	9.64E-16	9.53E-16
Mo-102	4.20E-17	4.09E-17	4.01E-17	3.94E-17	3.83E-17	3.81E-17
Technetium						
Tc-91	2.09E-15	1.95E-15	1.86E-15	1.79E-15	1.68E-15	1.66E-15
Tc-91m	1.36E-15	1.27E-15	1.22E-15	1.16E-15	1.08E-15	1.07E-15
Tc-92	3.24E-15	3.02E-15	2.87E-15	2.74E-15	2.56E-15	2.53E-15
Tc-93	1.22E-15	1.13E-15	1.07E-15	1.03E-15	9.62E-16	9.52E-16
Tc-93m	7.04E-16	6.57E-16	6.25E-16	6.00E-16	5.63E-16	5.57E-16
Tc-94	2.20E-15	2.03E-15	1.92E-15	1.83E-15	1.70E-15	1.67E-15
Tc-94m	1.67E-15	1.55E-15	1.48E-15	1.41E-15	1.32E-15	1.30E-15
Tc-95	6.53E-16	6.02E-16	5.71E-16	5.43E-16	5.02E-16	4.96E-16
Tc-95m	5.62E-16	5.19E-16	4.92E-16	4.68E-16	4.32E-16	4.26E-16
Tc-96	2.06E-15	1.90E-15	1.80E-15	1.72E-15	1.59E-15	1.57E-15
Tc-96m	3.41E-17	3.15E-17	2.98E-17	2.84E-17	2.63E-17	2.60E-17
Tc-97	3.58E-19	2.45E-19	2.14E-19	1.95E-19	9.76E-20	9.01E-20
Tc-97m	6.43E-19	4.93E-19	4.42E-19	4.13E-19	2.90E-19	2.79E-19
Tc-98	1.18E-15	1.09E-15	1.03E-15	9.82E-16	9.08E-16	8.96E-16
Tc-99	4.16E-20	3.48E-20	3.10E-20	2.86E-20	2.46E-20	2.40E-20
Tc-99m	1.00E-16	9.40E-17	8.81E-17	8.40E-17	7.63E-17	7.51E-17
Tc-101	3.29E-16	3.07E-16	2.95E-16	2.83E-16	2.63E-16	2.60E-16
Tc-102	2.47E-16	2.41E-16	2.37E-16	2.33E-16	2.28E-16	2.27E-16
Tc-102m	2.03E-15	1.89E-15	1.80E-15	1.72E-15	1.62E-15	1.60E-15
Tc-104	1.88E-15	1.76E-15	1.68E-15	1.61E-15	1.51E-15	1.50E-15
Tc-105	7.71E-16	7.23E-16	6.92E-16	6.66E-16	6.26E-16	6.20E-16
Ruthenium						
Ru-92	1.75E-15	1.62E-15	1.54E-15	1.47E-15	1.37E-15	1.35E-15
Ru-94	4.22E-16	3.90E-16	3.70E-16	3.52E-16	3.24E-16	3.20E-16
Ru-95	1.01E-15	9.34E-16	8.86E-16	8.45E-16	7.84E-16	7.74E-16
Ru-97	1.88E-16	1.74E-16	1.65E-16	1.57E-16	1.43E-16	1.41E-16
Ru-103	4.16E-16	3.85E-16	3.66E-16	3.48E-16	3.20E-16	3.15E-16
Ru-105	6.60E-16	6.12E-16	5.83E-16	5.56E-16	5.16E-16	5.10E-16
Ru-106	8.14E-24	5.49E-24	4.57E-24	4.19E-24	2.53E-24	2.37E-24
Ru-107	4.01E-16	3.79E-16	3.65E-16	3.53E-16	3.36E-16	3.33E-16
Ru-108	9.79E-17	9.45E-17	9.17E-17	8.96E-17	8.58E-17	8.52E-17
Rhodium						
Rh-94	3.23E-15	3.01E-15	2.86E-15	2.74E-15	2.57E-15	2.54E-15
Rh-95	2.13E-15	1.99E-15	1.89E-15	1.81E-15	1.69E-15	1.67E-15

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rh-95m	7.08E-16	6.60E-16	6.29E-16	6.02E-16	5.61E-16	5.54E-16
Rh-96	3.29E-15	3.05E-15	2.90E-15	2.77E-15	2.57E-15	2.54E-15
Rh-96m	1.08E-15	1.00E-15	9.53E-16	9.12E-16	8.52E-16	8.42E-16
Rh-97	1.24E-15	1.16E-15	1.10E-15	1.05E-15	9.76E-16	9.64E-16
Rh-97m	1.68E-15	1.57E-15	1.49E-15	1.43E-15	1.34E-15	1.33E-15
Rh-98	1.64E-15	1.52E-15	1.45E-15	1.39E-15	1.29E-15	1.28E-15
Rh-99	4.52E-16	4.17E-16	3.96E-16	3.76E-16	3.46E-16	3.41E-16
Rh-99m	5.29E-16	4.88E-16	4.64E-16	4.42E-16	4.07E-16	4.02E-16
Rh-100	2.11E-15	1.96E-15	1.86E-15	1.78E-15	1.67E-15	1.65E-15
Rh-100m	3.70E-17	3.35E-17	3.14E-17	2.98E-17	2.74E-17	2.70E-17
Rh-101	2.23E-16	2.06E-16	1.95E-16	1.86E-16	1.69E-16	1.66E-16
Rh-101m	2.29E-16	2.11E-16	2.01E-16	1.91E-16	1.75E-16	1.72E-16
Rh-102	4.32E-16	4.00E-16	3.81E-16	3.63E-16	3.36E-16	3.31E-16
Rh-102m	1.78E-15	1.64E-15	1.56E-15	1.48E-15	1.37E-15	1.35E-15
Rh-103m	1.35E-19	9.10E-20	7.72E-20	7.09E-20	4.37E-20	4.10E-20
Rh-104	1.26E-16	1.25E-16	1.24E-16	1.24E-16	1.23E-16	1.22E-16
Rh-104m	2.27E-17	1.90E-17	1.70E-17	1.55E-17	1.31E-17	1.28E-17
Rh-105	6.53E-17	6.03E-17	5.74E-17	5.47E-17	5.01E-17	4.94E-17
Rh-106	3.20E-16	3.06E-16	2.98E-16	2.90E-16	2.78E-16	2.76E-16
Rh-106m	2.35E-15	2.18E-15	2.07E-15	1.97E-15	1.83E-15	1.81E-15
Rh-107	3.04E-16	2.83E-16	2.72E-16	2.60E-16	2.42E-16	2.39E-16
Rh-108	4.40E-16	4.19E-16	4.06E-16	3.93E-16	3.75E-16	3.72E-16
Rh-109	3.57E-16	3.37E-16	3.26E-16	3.15E-16	2.97E-16	2.95E-16
Palladium						
Pd-96	1.20E-15	1.11E-15	1.06E-15	1.01E-15	9.33E-16	9.21E-16
Pd-97	1.96E-15	1.83E-15	1.74E-15	1.66E-15	1.55E-15	1.54E-15
Pd-98	3.28E-16	3.03E-16	2.87E-16	2.73E-16	2.51E-16	2.47E-16
Pd-99	1.08E-15	1.01E-15	9.57E-16	9.15E-16	8.51E-16	8.41E-16
Pd-100	7.34E-17	6.54E-17	6.00E-17	5.63E-17	5.12E-17	5.01E-17
Pd-101	2.72E-16	2.50E-16	2.38E-16	2.26E-16	2.08E-16	2.06E-16
Pd-103	1.21E-18	8.24E-19	7.08E-19	6.56E-19	4.12E-19	3.87E-19
Pd-107	3.93E-24	2.67E-24	2.25E-24	2.06E-24	1.17E-24	1.09E-24
Pd-109	3.29E-17	3.23E-17	3.19E-17	3.17E-17	3.13E-17	3.12E-17
Pd-109m	8.66E-17	8.01E-17	7.58E-17	7.22E-17	6.58E-17	6.48E-17
Pd-111	1.39E-16	1.36E-16	1.34E-16	1.32E-16	1.30E-16	1.29E-16
Pd-112	2.24E-19	1.56E-19	1.36E-19	1.25E-19	6.97E-20	6.51E-20
Pd-114	8.05E-17	7.88E-17	7.77E-17	7.68E-17	7.51E-17	7.49E-17
Silver						
Ag-99	1.99E-15	1.86E-15	1.77E-15	1.69E-15	1.58E-15	1.56E-15
Ag-100m	2.46E-15	2.29E-15	2.18E-15	2.09E-15	1.95E-15	1.93E-15
Ag-101	1.38E-15	1.28E-15	1.22E-15	1.17E-15	1.09E-15	1.07E-15
Ag-102	2.82E-15	2.62E-15	2.49E-15	2.38E-15	2.22E-15	2.19E-15
Ag-102m	1.55E-15	1.44E-15	1.37E-15	1.32E-15	1.24E-15	1.23E-15
Ag-103	7.01E-16	6.51E-16	6.18E-16	5.89E-16	5.46E-16	5.39E-16
Ag-104	2.21E-15	2.04E-15	1.94E-15	1.85E-15	1.71E-15	1.69E-15
Ag-104m	1.52E-15	1.41E-15	1.35E-15	1.29E-15	1.20E-15	1.19E-15

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-105	4.14E-16	3.81E-16	3.62E-16	3.44E-16	3.16E-16	3.12E-16
Ag-105m	8.25E-19	7.61E-19	7.22E-19	6.87E-19	6.30E-19	6.22E-19
Ag-106	6.43E-16	5.99E-16	5.73E-16	5.47E-16	5.08E-16	5.01E-16
Ag-106m	2.29E-15	2.11E-15	2.00E-15	1.91E-15	1.77E-15	1.75E-15
Ag-108	8.72E-17	8.58E-17	8.50E-17	8.43E-17	8.31E-17	8.29E-17
Ag-108m	1.35E-15	1.24E-15	1.18E-15	1.12E-15	1.03E-15	1.02E-15
Ag-109m	3.37E-18	2.82E-18	2.55E-18	2.40E-18	2.05E-18	2.00E-18
Ag-110	1.58E-16	1.56E-16	1.54E-16	1.53E-16	1.51E-16	1.50E-16
Ag-110m	2.26E-15	2.09E-15	1.98E-15	1.89E-15	1.75E-15	1.73E-15
Ag-111	4.99E-17	4.81E-17	4.71E-17	4.61E-17	4.45E-17	4.42E-17
Ag-111m	3.41E-18	2.99E-18	2.79E-18	2.64E-18	2.35E-18	2.31E-18
Ag-112	6.85E-16	6.44E-16	6.18E-16	5.96E-16	5.64E-16	5.59E-16
Ag-113	1.51E-16	1.46E-16	1.43E-16	1.41E-16	1.36E-16	1.36E-16
Ag-113m	1.99E-16	1.85E-16	1.77E-16	1.69E-16	1.57E-16	1.55E-16
Ag-114	3.95E-16	3.78E-16	3.68E-16	3.59E-16	3.45E-16	3.43E-16
Ag-115	4.92E-16	4.65E-16	4.47E-16	4.32E-16	4.11E-16	4.08E-16
Ag-116	1.79E-15	1.68E-15	1.60E-15	1.54E-15	1.45E-15	1.44E-15
Ag-117	1.10E-15	1.04E-15	9.89E-16	9.55E-16	9.04E-16	8.96E-16
Cadmium						
Cd-101	2.07E-15	1.93E-15	1.84E-15	1.76E-15	1.64E-15	1.63E-15
Cd-102	6.87E-16	6.36E-16	6.04E-16	5.74E-16	5.30E-16	5.23E-16
Cd-103	1.64E-15	1.52E-15	1.45E-15	1.39E-15	1.30E-15	1.29E-15
Cd-104	1.90E-16	1.74E-16	1.64E-16	1.56E-16	1.43E-16	1.41E-16
Cd-105	1.04E-15	9.64E-16	9.16E-16	8.77E-16	8.20E-16	8.11E-16
Cd-107	1.02E-17	8.62E-18	7.87E-18	7.43E-18	6.37E-18	6.23E-18
Cd-109	5.29E-18	4.08E-18	3.58E-18	3.35E-18	2.66E-18	2.57E-18
Cd-111m	2.27E-16	2.10E-16	1.99E-16	1.89E-16	1.73E-16	1.70E-16
Cd-113	3.63E-20	3.03E-20	2.70E-20	2.50E-20	2.15E-20	2.09E-20
Cd-113m	1.71E-18	1.68E-18	1.67E-18	1.66E-18	1.64E-18	1.64E-18
Cd-115	1.84E-16	1.71E-16	1.64E-16	1.57E-16	1.46E-16	1.44E-16
Cd-115m	9.79E-17	9.57E-17	9.42E-17	9.31E-17	9.14E-17	9.11E-17
Cd-117	8.99E-16	8.35E-16	7.93E-16	7.60E-16	7.11E-16	7.03E-16
Cd-117m	1.58E-15	1.47E-15	1.40E-15	1.34E-15	1.25E-15	1.24E-15
Cd-118	5.39E-19	5.22E-19	5.12E-19	5.06E-19	4.95E-19	4.93E-19
Cd-119	1.35E-15	1.26E-15	1.20E-15	1.15E-15	1.08E-15	1.07E-15
Cd-119m	1.86E-15	1.73E-15	1.65E-15	1.58E-15	1.49E-15	1.47E-15
Indium						
In-103	2.33E-15	2.17E-15	2.07E-15	1.98E-15	1.85E-15	1.83E-15
In-105	1.66E-15	1.55E-15	1.48E-15	1.41E-15	1.31E-15	1.30E-15
In-106	3.05E-15	2.83E-15	2.69E-15	2.56E-15	2.38E-15	2.35E-15
In-106m	2.37E-15	2.21E-15	2.11E-15	2.02E-15	1.89E-15	1.87E-15
In-107	1.24E-15	1.15E-15	1.09E-15	1.05E-15	9.76E-16	9.65E-16
In-108	3.19E-15	2.95E-15	2.80E-15	2.67E-15	2.48E-15	2.45E-15
In-108m	2.15E-15	2.01E-15	1.91E-15	1.84E-15	1.72E-15	1.70E-15
In-109	5.13E-16	4.73E-16	4.49E-16	4.28E-16	3.95E-16	3.90E-16
In-109m	5.14E-16	4.75E-16	4.52E-16	4.29E-16	3.97E-16	3.92E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-110	2.55E-15	2.35E-15	2.23E-15	2.12E-15	1.97E-15	1.94E-15
In-110m	1.36E-15	1.26E-15	1.20E-15	1.15E-15	1.07E-15	1.06E-15
In-111	3.19E-16	2.95E-16	2.79E-16	2.66E-16	2.42E-16	2.39E-16
In-111m	4.00E-16	3.70E-16	3.52E-16	3.35E-16	3.09E-16	3.04E-16
In-112	2.40E-16	2.23E-16	2.13E-16	2.03E-16	1.89E-16	1.86E-16
In-112m	1.92E-17	1.72E-17	1.59E-17	1.51E-17	1.35E-17	1.32E-17
In-113m	2.14E-16	1.98E-16	1.88E-16	1.79E-16	1.64E-16	1.61E-16
In-114	9.56E-17	9.52E-17	9.50E-17	9.48E-17	9.44E-17	9.44E-17
In-114m	6.06E-17	5.56E-17	5.26E-17	5.00E-17	4.57E-17	4.51E-17
In-115	3.26E-19	3.11E-19	3.02E-19	2.96E-19	2.86E-19	2.85E-19
In-115m	1.31E-16	1.21E-16	1.15E-16	1.09E-16	9.97E-17	9.83E-17
In-116m	1.97E-15	1.82E-15	1.73E-15	1.65E-15	1.55E-15	1.53E-15
In-117	5.84E-16	5.42E-16	5.14E-16	4.89E-16	4.50E-16	4.44E-16
In-117m	1.13E-16	1.08E-16	1.04E-16	1.01E-16	9.57E-17	9.48E-17
In-118	2.40E-16	2.34E-16	2.30E-16	2.27E-16	2.22E-16	2.21E-16
In-118m	2.32E-15	2.15E-15	2.04E-15	1.95E-15	1.82E-15	1.80E-15
In-119	7.08E-16	6.58E-16	6.27E-16	6.00E-16	5.60E-16	5.54E-16
In-119m	1.68E-16	1.63E-16	1.60E-16	1.58E-16	1.55E-16	1.54E-16
In-121	8.80E-16	8.20E-16	7.82E-16	7.50E-16	7.04E-16	6.97E-16
In-121m	1.98E-16	1.93E-16	1.90E-16	1.87E-16	1.84E-16	1.83E-16
Tin						
Sn-106	9.97E-16	9.21E-16	8.74E-16	8.32E-16	7.69E-16	7.59E-16
Sn-108	5.55E-16	5.12E-16	4.86E-16	4.62E-16	4.24E-16	4.18E-16
Sn-109	1.71E-15	1.59E-15	1.50E-15	1.44E-15	1.35E-15	1.33E-15
Sn-110	2.30E-16	2.12E-16	2.01E-16	1.91E-16	1.74E-16	1.72E-16
Sn-111	4.14E-16	3.84E-16	3.66E-16	3.49E-16	3.25E-16	3.21E-16
Sn-113	7.89E-18	6.36E-18	5.72E-18	5.38E-18	4.53E-18	4.42E-18
Sn-113m	3.17E-18	2.16E-18	1.75E-18	1.60E-18	1.17E-18	1.11E-18
Sn-117m	1.17E-16	1.08E-16	1.02E-16	9.67E-17	8.77E-17	8.63E-17
Sn-119m	2.97E-18	1.95E-18	1.57E-18	1.43E-18	9.89E-19	9.35E-19
Sn-121	6.04E-20	5.13E-20	4.61E-20	4.28E-20	3.72E-20	3.64E-20
Sn-121m	1.50E-18	1.03E-18	8.31E-19	7.52E-19	5.53E-19	5.28E-19
Sn-123	6.44E-17	6.39E-17	6.35E-17	6.32E-17	6.28E-17	6.27E-17
Sn-123m	1.59E-16	1.52E-16	1.45E-16	1.41E-16	1.32E-16	1.31E-16
Sn-125	3.60E-16	3.39E-16	3.26E-16	3.15E-16	3.00E-16	2.97E-16
Sn-125m	3.84E-16	3.62E-16	3.49E-16	3.36E-16	3.16E-16	3.13E-16
Sn-126	3.72E-17	3.31E-17	3.03E-17	2.85E-17	2.57E-17	2.52E-17
Sn-127	1.56E-15	1.45E-15	1.38E-15	1.32E-15	1.23E-15	1.22E-15
Sn-127m	5.96E-16	5.61E-16	5.39E-16	5.19E-16	4.88E-16	4.83E-16
Sn-128	4.82E-16	4.42E-16	4.19E-16	3.97E-16	3.64E-16	3.59E-16
Sn-129	9.60E-16	8.97E-16	8.57E-16	8.22E-16	7.72E-16	7.64E-16
Sn-130	8.06E-16	7.45E-16	7.07E-16	6.74E-16	6.24E-16	6.16E-16
Sn-130m	8.52E-16	7.97E-16	7.61E-16	7.32E-16	6.89E-16	6.83E-16
Antimony						
Sb-111	1.37E-15	1.28E-15	1.22E-15	1.17E-15	1.08E-15	1.07E-15
Sb-113	1.14E-15	1.06E-15	1.01E-15	9.64E-16	8.93E-16	8.82E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sb-114	2.28E-15	2.12E-15	2.02E-15	1.93E-15	1.81E-15	1.79E-15
Sb-115	7.64E-16	7.08E-16	6.74E-16	6.41E-16	5.92E-16	5.84E-16
Sb-116	1.86E-15	1.73E-15	1.64E-15	1.57E-15	1.47E-15	1.45E-15
Sb-116m	2.51E-15	2.32E-15	2.20E-15	2.09E-15	1.95E-15	1.92E-15
Sb-117	1.38E-16	1.28E-16	1.20E-16	1.14E-16	1.04E-16	1.02E-16
Sb-118	7.70E-16	7.19E-16	6.88E-16	6.59E-16	6.14E-16	6.07E-16
Sb-118m	2.09E-15	1.92E-15	1.82E-15	1.74E-15	1.62E-15	1.60E-15
Sb-119	4.93E-18	3.25E-18	2.60E-18	2.37E-18	1.65E-18	1.56E-18
Sb-120	4.10E-16	3.81E-16	3.64E-16	3.47E-16	3.22E-16	3.18E-16
Sb-120m	1.98E-15	1.82E-15	1.73E-15	1.65E-15	1.53E-15	1.51E-15
Sb-122	4.35E-16	4.07E-16	3.90E-16	3.73E-16	3.49E-16	3.45E-16
Sb-122m	4.08E-17	3.41E-17	3.04E-17	2.80E-17	2.48E-17	2.41E-17
Sb-124	1.50E-15	1.39E-15	1.32E-15	1.26E-15	1.18E-15	1.17E-15
Sb-124m	3.79E-16	3.50E-16	3.34E-16	3.17E-16	2.93E-16	2.89E-16
Sb-124n	1.88E-22	1.24E-22	9.88E-23	9.00E-23	6.31E-23	5.97E-23
Sb-125	3.59E-16	3.30E-16	3.13E-16	2.98E-16	2.73E-16	2.70E-16
Sb-126	2.33E-15	2.15E-15	2.04E-15	1.94E-15	1.80E-15	1.77E-15
Sb-126m	1.37E-15	1.27E-15	1.21E-15	1.15E-15	1.07E-15	1.06E-15
Sb-127	5.99E-16	5.54E-16	5.27E-16	5.02E-16	4.65E-16	4.59E-16
Sb-128	2.62E-15	2.42E-15	2.30E-15	2.19E-15	2.03E-15	2.00E-15
Sb-128m	1.70E-15	1.57E-15	1.50E-15	1.43E-15	1.33E-15	1.31E-15
Sb-129	1.22E-15	1.13E-15	1.07E-15	1.02E-15	9.53E-16	9.42E-16
Sb-130	2.77E-15	2.56E-15	2.43E-15	2.32E-15	2.15E-15	2.13E-15
Sb-130m	2.34E-15	2.17E-15	2.06E-15	1.97E-15	1.83E-15	1.81E-15
Sb-131	1.71E-15	1.59E-15	1.51E-15	1.44E-15	1.35E-15	1.33E-15
Sb-133	2.20E-15	2.04E-15	1.94E-15	1.86E-15	1.75E-15	1.73E-15
Tellurium						
Te-113	1.94E-15	1.81E-15	1.73E-15	1.65E-15	1.55E-15	1.53E-15
Te-114	1.02E-15	9.40E-16	8.91E-16	8.52E-16	7.93E-16	7.84E-16
Te-115	1.90E-15	1.77E-15	1.68E-15	1.61E-15	1.50E-15	1.48E-15
Te-115m	2.15E-15	2.00E-15	1.90E-15	1.82E-15	1.70E-15	1.68E-15
Te-116	7.31E-17	6.53E-17	6.07E-17	5.75E-17	5.18E-17	5.10E-17
Te-117	1.25E-15	1.16E-15	1.10E-15	1.05E-15	9.81E-16	9.70E-16
Te-118	5.21E-18	3.47E-18	2.76E-18	2.51E-18	1.79E-18	1.70E-18
Te-119	6.24E-16	5.75E-16	5.45E-16	5.19E-16	4.79E-16	4.73E-16
Te-119m	1.19E-15	1.10E-15	1.04E-15	9.96E-16	9.27E-16	9.16E-16
Te-121	4.72E-16	4.35E-16	4.13E-16	3.92E-16	3.61E-16	3.56E-16
Te-121m	1.70E-16	1.56E-16	1.48E-16	1.41E-16	1.28E-16	1.26E-16
Te-123	9.06E-21	6.03E-21	4.80E-21	4.36E-21	3.12E-21	2.96E-21
Te-123m	1.12E-16	1.04E-16	9.70E-17	9.23E-17	8.38E-17	8.24E-17
Te-125m	1.14E-17	7.80E-18	6.24E-18	5.66E-18	4.19E-18	4.00E-18
Te-127	9.84E-18	9.50E-18	9.30E-18	9.10E-18	8.80E-18	8.75E-18
Te-127m	3.80E-18	2.71E-18	2.23E-18	2.05E-18	1.60E-18	1.54E-18
Te-129	1.07E-16	1.03E-16	1.00E-16	9.83E-17	9.48E-17	9.42E-17
Te-129m	5.13E-17	4.86E-17	4.70E-17	4.58E-17	4.39E-17	4.36E-17
Te-131	4.22E-16	3.97E-16	3.80E-16	3.65E-16	3.43E-16	3.39E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-131m	1.19E-15	1.10E-15	1.04E-15	9.91E-16	9.19E-16	9.08E-16
Te-132	1.81E-16	1.65E-16	1.56E-16	1.48E-16	1.34E-16	1.32E-16
Te-133	1.03E-15	9.62E-16	9.16E-16	8.78E-16	8.22E-16	8.13E-16
Te-133m	1.53E-15	1.42E-15	1.35E-15	1.28E-15	1.20E-15	1.18E-15
Te-134	7.22E-16	6.66E-16	6.31E-16	6.00E-16	5.53E-16	5.45E-16
Iodine						
I-118	1.84E-15	1.71E-15	1.63E-15	1.56E-15	1.46E-15	1.44E-15
I-118m	3.22E-15	2.98E-15	2.84E-15	2.71E-15	2.51E-15	2.48E-15
I-119	8.13E-16	7.55E-16	7.20E-16	6.87E-16	6.36E-16	6.28E-16
I-120	2.17E-15	2.03E-15	1.93E-15	1.85E-15	1.73E-15	1.72E-15
I-120m	2.96E-15	2.74E-15	2.61E-15	2.49E-15	2.32E-15	2.29E-15
I-121	3.24E-16	2.98E-16	2.82E-16	2.69E-16	2.46E-16	2.43E-16
I-122	9.21E-16	8.60E-16	8.23E-16	7.87E-16	7.33E-16	7.25E-16
I-123	1.27E-16	1.17E-16	1.09E-16	1.04E-16	9.43E-17	9.27E-17
I-124	9.14E-16	8.47E-16	8.05E-16	7.68E-16	7.14E-16	7.05E-16
I-125	1.33E-17	9.05E-18	7.20E-18	6.52E-18	4.78E-18	4.55E-18
I-126	3.69E-16	3.41E-16	3.24E-16	3.08E-16	2.84E-16	2.81E-16
I-128	1.45E-16	1.41E-16	1.38E-16	1.35E-16	1.31E-16	1.31E-16
I-129	1.00E-17	7.06E-18	5.69E-18	5.13E-18	3.88E-18	3.72E-18
I-130	1.80E-15	1.66E-15	1.58E-15	1.50E-15	1.39E-15	1.37E-15
I-130m	1.06E-16	9.85E-17	9.42E-17	9.04E-17	8.45E-17	8.36E-17
I-131	3.21E-16	2.97E-16	2.82E-16	2.68E-16	2.46E-16	2.43E-16
I-132	1.92E-15	1.77E-15	1.68E-15	1.61E-15	1.49E-15	1.47E-15
I-132m	2.85E-16	2.63E-16	2.50E-16	2.38E-16	2.20E-16	2.17E-16
I-133	5.50E-16	5.11E-16	4.87E-16	4.65E-16	4.32E-16	4.27E-16
I-134	2.18E-15	2.02E-15	1.92E-15	1.83E-15	1.70E-15	1.69E-15
I-134m	2.29E-16	2.10E-16	1.98E-16	1.89E-16	1.72E-16	1.70E-16
I-135	1.27E-15	1.18E-15	1.12E-15	1.07E-15	1.01E-15	9.95E-16
Xenon						
Xe-120	3.12E-16	2.84E-16	2.68E-16	2.55E-16	2.34E-16	2.30E-16
Xe-121	1.21E-15	1.12E-15	1.07E-15	1.03E-15	9.58E-16	9.48E-16
Xe-122	4.52E-17	3.99E-17	3.70E-17	3.50E-17	3.14E-17	3.08E-17
Xe-123	5.27E-16	4.88E-16	4.62E-16	4.41E-16	4.09E-16	4.04E-16
Xe-125	2.08E-16	1.90E-16	1.79E-16	1.70E-16	1.54E-16	1.52E-16
Xe-127	2.18E-16	1.99E-16	1.88E-16	1.79E-16	1.62E-16	1.60E-16
Xe-127m	1.28E-16	1.18E-16	1.10E-16	1.05E-16	9.47E-17	9.32E-17
Xe-129m	2.39E-17	1.84E-17	1.57E-17	1.45E-17	1.19E-17	1.16E-17
Xe-131m	9.00E-18	6.86E-18	5.81E-18	5.36E-18	4.37E-18	4.23E-18
Xe-133	2.96E-17	2.53E-17	2.27E-17	2.11E-17	1.89E-17	1.85E-17
Xe-133m	2.57E-17	2.23E-17	2.05E-17	1.93E-17	1.71E-17	1.68E-17
Xe-135	2.24E-16	2.08E-16	1.98E-16	1.90E-16	1.75E-16	1.73E-16
Xe-135m	3.64E-16	3.37E-16	3.20E-16	3.05E-16	2.81E-16	2.77E-16
Xe-137	3.23E-16	3.10E-16	3.02E-16	2.95E-16	2.84E-16	2.82E-16
Xe-138	9.20E-16	8.61E-16	8.20E-16	7.89E-16	7.43E-16	7.35E-16
Cesium						
Cs-121	1.14E-15	1.07E-15	1.02E-15	9.76E-16	9.10E-16	8.99E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cs-121m	1.11E-15	1.03E-15	9.87E-16	9.44E-16	8.78E-16	8.67E-16
Cs-123	1.00E-15	9.31E-16	8.89E-16	8.49E-16	7.89E-16	7.80E-16
Cs-124	1.14E-15	1.07E-15	1.02E-15	9.81E-16	9.16E-16	9.06E-16
Cs-125	6.60E-16	6.13E-16	5.84E-16	5.57E-16	5.16E-16	5.10E-16
Cs-126	1.09E-15	1.02E-15	9.76E-16	9.34E-16	8.70E-16	8.60E-16
Cs-127	3.51E-16	3.22E-16	3.05E-16	2.90E-16	2.66E-16	2.62E-16
Cs-128	8.40E-16	7.83E-16	7.49E-16	7.16E-16	6.66E-16	6.58E-16
Cs-129	2.19E-16	1.99E-16	1.88E-16	1.79E-16	1.63E-16	1.60E-16
Cs-130	4.62E-16	4.29E-16	4.10E-16	3.92E-16	3.64E-16	3.59E-16
Cs-130m	4.52E-17	3.85E-17	3.46E-17	3.22E-17	2.85E-17	2.79E-17
Cs-131	8.61E-18	5.97E-18	4.75E-18	4.30E-18	3.22E-18	3.07E-18
Cs-132	5.87E-16	5.40E-16	5.12E-16	4.86E-16	4.48E-16	4.42E-16
Cs-134	1.30E-15	1.20E-15	1.14E-15	1.08E-15	1.00E-15	9.87E-16
Cs-134m	1.69E-17	1.49E-17	1.36E-17	1.28E-17	1.13E-17	1.11E-17
Cs-135	3.12E-20	2.59E-20	2.29E-20	2.12E-20	1.81E-20	1.76E-20
Cs-135m	1.33E-15	1.23E-15	1.16E-15	1.11E-15	1.03E-15	1.01E-15
Cs-136	1.74E-15	1.61E-15	1.52E-15	1.45E-15	1.35E-15	1.33E-15
Cs-137	3.08E-18	3.06E-18	3.04E-18	3.03E-18	3.02E-18	3.01E-18
Cs-138	1.96E-15	1.83E-15	1.74E-15	1.67E-15	1.57E-15	1.56E-15
Cs-138m	3.52E-16	3.27E-16	3.11E-16	2.98E-16	2.79E-16	2.76E-16
Cs-139	3.91E-16	3.74E-16	3.62E-16	3.53E-16	3.41E-16	3.39E-16
Cs-140	1.50E-15	1.41E-15	1.35E-15	1.30E-15	1.23E-15	1.21E-15
Barium						
Ba-124	4.80E-16	4.43E-16	4.20E-16	4.00E-16	3.70E-16	3.65E-16
Ba-126	4.66E-16	4.28E-16	4.05E-16	3.85E-16	3.55E-16	3.51E-16
Ba-127	6.63E-16	6.17E-16	5.89E-16	5.63E-16	5.24E-16	5.17E-16
Ba-128	4.46E-17	3.90E-17	3.61E-17	3.40E-17	3.03E-17	2.98E-17
Ba-129	2.78E-16	2.56E-16	2.43E-16	2.32E-16	2.14E-16	2.11E-16
Ba-129m	1.27E-15	1.18E-15	1.11E-15	1.06E-15	9.84E-16	9.72E-16
Ba-131	3.83E-16	3.51E-16	3.32E-16	3.15E-16	2.88E-16	2.84E-16
Ba-131m	5.49E-17	4.97E-17	4.58E-17	4.35E-17	3.86E-17	3.80E-17
Ba-133	3.16E-16	2.88E-16	2.72E-16	2.58E-16	2.35E-16	2.31E-16
Ba-133m	4.88E-17	4.33E-17	4.04E-17	3.82E-17	3.43E-17	3.38E-17
Ba-135m	4.26E-17	3.76E-17	3.50E-17	3.31E-17	2.96E-17	2.91E-17
Ba-137m	5.07E-16	4.69E-16	4.45E-16	4.24E-16	3.92E-16	3.87E-16
Ba-139	1.43E-16	1.40E-16	1.38E-16	1.36E-16	1.33E-16	1.32E-16
Ba-140	1.68E-16	1.56E-16	1.49E-16	1.43E-16	1.32E-16	1.31E-16
Ba-141	8.57E-16	8.00E-16	7.64E-16	7.33E-16	6.86E-16	6.79E-16
Ba-142	8.83E-16	8.17E-16	7.75E-16	7.40E-16	6.90E-16	6.82E-16
Lanthanum						
La-128	2.45E-15	2.28E-15	2.17E-15	2.07E-15	1.92E-15	1.90E-15
La-129	8.30E-16	7.71E-16	7.36E-16	7.02E-16	6.51E-16	6.43E-16
La-130	1.93E-15	1.79E-15	1.71E-15	1.63E-15	1.52E-15	1.50E-15
La-131	5.60E-16	5.17E-16	4.91E-16	4.68E-16	4.31E-16	4.25E-16
La-132	1.64E-15	1.53E-15	1.45E-15	1.39E-15	1.29E-15	1.28E-15
La-132m	5.54E-16	5.11E-16	4.84E-16	4.61E-16	4.24E-16	4.19E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-133	1.26E-16	1.15E-16	1.08E-16	1.03E-16	9.39E-17	9.26E-17
La-134	6.85E-16	6.39E-16	6.11E-16	5.85E-16	5.45E-16	5.38E-16
La-135	1.98E-17	1.59E-17	1.40E-17	1.29E-17	1.10E-17	1.07E-17
La-136	3.70E-16	3.44E-16	3.28E-16	3.13E-16	2.90E-16	2.86E-16
La-137	1.08E-17	7.75E-18	6.25E-18	5.63E-18	4.30E-18	4.13E-18
La-138	9.68E-16	8.95E-16	8.48E-16	8.10E-16	7.58E-16	7.49E-16
La-140	1.86E-15	1.73E-15	1.64E-15	1.58E-15	1.48E-15	1.46E-15
La-141	1.36E-16	1.34E-16	1.33E-16	1.32E-16	1.31E-16	1.30E-16
La-142	1.84E-15	1.72E-15	1.64E-15	1.58E-15	1.49E-15	1.48E-15
La-143	3.41E-16	3.26E-16	3.16E-16	3.08E-16	2.96E-16	2.95E-16
Cerium						
Ce-130	3.99E-16	3.66E-16	3.45E-16	3.29E-16	3.02E-16	2.98E-16
Ce-131	1.38E-15	1.28E-15	1.22E-15	1.16E-15	1.08E-15	1.07E-15
Ce-132	2.13E-16	1.95E-16	1.83E-16	1.74E-16	1.58E-16	1.55E-16
Ce-133	4.76E-16	4.38E-16	4.16E-16	3.96E-16	3.66E-16	3.61E-16
Ce-133m	1.38E-15	1.28E-15	1.21E-15	1.16E-15	1.07E-15	1.06E-15
Ce-134	1.36E-17	1.01E-17	8.36E-18	7.57E-18	5.98E-18	5.77E-18
Ce-135	6.74E-16	6.19E-16	5.87E-16	5.58E-16	5.13E-16	5.06E-16
Ce-137	2.17E-17	1.76E-17	1.55E-17	1.43E-17	1.22E-17	1.19E-17
Ce-137m	3.92E-17	3.43E-17	3.16E-17	2.97E-17	2.65E-17	2.60E-17
Ce-139	1.19E-16	1.09E-16	1.01E-16	9.58E-17	8.63E-17	8.49E-17
Ce-141	6.02E-17	5.59E-17	5.21E-17	4.96E-17	4.49E-17	4.42E-17
Ce-143	2.62E-16	2.42E-16	2.31E-16	2.21E-16	2.05E-16	2.02E-16
Ce-144	1.45E-17	1.32E-17	1.22E-17	1.16E-17	1.04E-17	1.02E-17
Ce-145	7.38E-16	6.83E-16	6.50E-16	6.21E-16	5.78E-16	5.72E-16
Praseodymium						
Pr-134	2.70E-15	2.50E-15	2.38E-15	2.27E-15	2.11E-15	2.08E-15
Pr-134m	2.00E-15	1.86E-15	1.78E-15	1.70E-15	1.59E-15	1.57E-15
Pr-135	7.78E-16	7.22E-16	6.88E-16	6.56E-16	6.09E-16	6.01E-16
Pr-136	1.81E-15	1.68E-15	1.60E-15	1.53E-15	1.42E-15	1.41E-15
Pr-137	3.23E-16	2.98E-16	2.83E-16	2.70E-16	2.50E-16	2.47E-16
Pr-138	8.02E-16	7.49E-16	7.17E-16	6.87E-16	6.41E-16	6.34E-16
Pr-138m	2.05E-15	1.89E-15	1.80E-15	1.71E-15	1.59E-15	1.57E-15
Pr-139	1.03E-16	9.32E-17	8.76E-17	8.31E-17	7.60E-17	7.49E-17
Pr-140	5.19E-16	4.83E-16	4.62E-16	4.42E-16	4.11E-16	4.06E-16
Pr-142	1.39E-16	1.35E-16	1.33E-16	1.31E-16	1.29E-16	1.28E-16
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	2.07E-17	2.06E-17	2.06E-17	2.06E-17	2.05E-17	2.05E-17
Pr-144	1.56E-16	1.54E-16	1.52E-16	1.51E-16	1.50E-16	1.49E-16
Pr-144m	7.21E-18	5.63E-18	4.81E-18	4.38E-18	3.59E-18	3.49E-18
Pr-145	9.60E-17	9.46E-17	9.37E-17	9.30E-17	9.19E-17	9.17E-17
Pr-146	9.30E-16	8.72E-16	8.33E-16	8.02E-16	7.57E-16	7.49E-16
Pr-147	4.85E-16	4.51E-16	4.31E-16	4.14E-16	3.88E-16	3.84E-16
Pr-148	9.47E-16	8.88E-16	8.50E-16	8.18E-16	7.72E-16	7.64E-16
Pr-148m	9.38E-16	8.77E-16	8.41E-16	8.07E-16	7.56E-16	7.48E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Neodymium						
Nd-134	4.58E-16	4.23E-16	4.00E-16	3.81E-16	3.50E-16	3.45E-16
Nd-135	1.14E-15	1.06E-15	1.01E-15	9.66E-16	8.95E-16	8.84E-16
Nd-136	2.18E-16	1.97E-16	1.85E-16	1.75E-16	1.59E-16	1.57E-16
Nd-137	9.84E-16	9.09E-16	8.62E-16	8.22E-16	7.63E-16	7.54E-16
Nd-138	2.72E-17	2.25E-17	1.99E-17	1.84E-17	1.57E-17	1.54E-17
Nd-139	3.86E-16	3.57E-16	3.39E-16	3.23E-16	2.99E-16	2.96E-16
Nd-139m	1.29E-15	1.18E-15	1.12E-15	1.07E-15	9.88E-16	9.75E-16
Nd-140	1.49E-17	1.12E-17	9.23E-18	8.27E-18	6.45E-18	6.23E-18
Nd-141	5.47E-17	4.80E-17	4.42E-17	4.16E-17	3.74E-17	3.68E-17
Nd-141m	5.87E-16	5.42E-16	5.14E-16	4.90E-16	4.54E-16	4.48E-16
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.21E-16	1.10E-16	1.04E-16	9.88E-17	9.06E-17	8.93E-17
Nd-149	3.50E-16	3.26E-16	3.11E-16	2.98E-16	2.76E-16	2.73E-16
Nd-151	7.54E-16	7.01E-16	6.67E-16	6.39E-16	5.96E-16	5.89E-16
Nd-152	1.57E-16	1.46E-16	1.40E-16	1.34E-16	1.24E-16	1.23E-16
Promethium						
Pm-136	2.45E-15	2.28E-15	2.17E-15	2.07E-15	1.92E-15	1.90E-15
Pm-137m	1.57E-15	1.46E-15	1.39E-15	1.32E-15	1.23E-15	1.21E-15
Pm-139	8.86E-16	8.26E-16	7.90E-16	7.55E-16	7.04E-16	6.96E-16
Pm-140	1.06E-15	9.88E-16	9.47E-16	9.07E-16	8.48E-16	8.39E-16
Pm-140m	2.61E-15	2.41E-15	2.29E-15	2.19E-15	2.03E-15	2.01E-15
Pm-141	6.70E-16	6.23E-16	5.95E-16	5.69E-16	5.30E-16	5.24E-16
Pm-142	8.43E-16	7.88E-16	7.55E-16	7.23E-16	6.75E-16	6.68E-16
Pm-143	2.55E-16	2.32E-16	2.19E-16	2.07E-16	1.91E-16	1.88E-16
Pm-144	1.30E-15	1.20E-15	1.14E-15	1.08E-15	9.94E-16	9.81E-16
Pm-145	1.74E-17	1.33E-17	1.12E-17	1.01E-17	8.02E-18	7.77E-18
Pm-146	6.26E-16	5.76E-16	5.46E-16	5.19E-16	4.78E-16	4.72E-16
Pm-147	1.70E-20	1.41E-20	1.25E-20	1.15E-20	9.80E-21	9.55E-21
Pm-148	5.40E-16	5.05E-16	4.83E-16	4.65E-16	4.39E-16	4.34E-16
Pm-148m	1.66E-15	1.53E-15	1.46E-15	1.39E-15	1.28E-15	1.26E-15
Pm-149	3.99E-17	3.91E-17	3.86E-17	3.81E-17	3.74E-17	3.73E-17
Pm-150	1.26E-15	1.18E-15	1.12E-15	1.07E-15	1.01E-15	9.95E-16
Pm-151	2.86E-16	2.65E-16	2.51E-16	2.39E-16	2.21E-16	2.18E-16
Pm-152	3.68E-16	3.50E-16	3.38E-16	3.28E-16	3.14E-16	3.12E-16
Pm-152m	1.31E-15	1.22E-15	1.16E-15	1.11E-15	1.04E-15	1.03E-15
Pm-153	1.37E-16	1.32E-16	1.28E-16	1.25E-16	1.20E-16	1.20E-16
Pm-154	1.47E-15	1.37E-15	1.30E-15	1.25E-15	1.18E-15	1.17E-15
Pm-154m	1.52E-15	1.42E-15	1.35E-15	1.29E-15	1.21E-15	1.20E-15
Samarium						
Sm-139	1.31E-15	1.22E-15	1.16E-15	1.11E-15	1.03E-15	1.02E-15
Sm-140	4.75E-16	4.38E-16	4.15E-16	3.96E-16	3.67E-16	3.62E-16
Sm-141	1.22E-15	1.14E-15	1.08E-15	1.03E-15	9.62E-16	9.50E-16
Sm-141m	1.62E-15	1.50E-15	1.42E-15	1.36E-15	1.26E-15	1.24E-15
Sm-142	8.85E-17	7.95E-17	7.44E-17	7.03E-17	6.37E-17	6.28E-17
Sm-143	4.96E-16	4.61E-16	4.40E-16	4.21E-16	3.91E-16	3.87E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-143m	5.80E-16	5.36E-16	5.08E-16	4.84E-16	4.48E-16	4.43E-16
Sm-145	3.76E-17	2.93E-17	2.49E-17	2.24E-17	1.81E-17	1.75E-17
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	9.92E-22	6.71E-22	5.61E-22	5.14E-22	3.35E-22	3.16E-22
Sm-153	5.15E-17	4.57E-17	4.20E-17	3.96E-17	3.52E-17	3.46E-17
Sm-155	1.43E-16	1.36E-16	1.31E-16	1.28E-16	1.21E-16	1.20E-16
Sm-156	9.32E-17	8.58E-17	8.07E-17	7.68E-17	7.00E-17	6.89E-17
Sm-157	4.34E-16	4.08E-16	3.91E-16	3.77E-16	3.54E-16	3.51E-16
Europium						
Eu-142	1.21E-15	1.13E-15	1.08E-15	1.04E-15	9.73E-16	9.63E-16
Eu-142m	3.00E-15	2.78E-15	2.64E-15	2.52E-15	2.34E-15	2.31E-15
Eu-143	1.05E-15	9.77E-16	9.33E-16	8.94E-16	8.36E-16	8.27E-16
Eu-144	1.08E-15	1.01E-15	9.67E-16	9.28E-16	8.68E-16	8.59E-16
Eu-145	1.01E-15	9.36E-16	8.86E-16	8.45E-16	7.87E-16	7.78E-16
Eu-146	1.94E-15	1.80E-15	1.70E-15	1.62E-15	1.51E-15	1.49E-15
Eu-147	3.78E-16	3.45E-16	3.25E-16	3.08E-16	2.83E-16	2.79E-16
Eu-148	1.83E-15	1.69E-15	1.60E-15	1.52E-15	1.41E-15	1.39E-15
Eu-149	4.62E-17	3.98E-17	3.64E-17	3.39E-17	2.96E-17	2.91E-17
Eu-150	1.28E-15	1.18E-15	1.12E-15	1.07E-15	9.81E-16	9.68E-16
Eu-150m	6.38E-17	6.04E-17	5.84E-17	5.66E-17	5.38E-17	5.34E-17
Eu-152	9.50E-16	8.76E-16	8.28E-16	7.90E-16	7.33E-16	7.24E-16
Eu-152m	3.00E-16	2.80E-16	2.68E-16	2.58E-16	2.43E-16	2.40E-16
Eu-152n	5.44E-17	4.89E-17	4.50E-17	4.24E-17	3.81E-17	3.74E-17
Eu-154	1.02E-15	9.45E-16	8.95E-16	8.54E-16	7.94E-16	7.85E-16
Eu-154m	4.75E-17	4.14E-17	3.75E-17	3.49E-17	3.10E-17	3.03E-17
Eu-155	4.52E-17	4.06E-17	3.74E-17	3.52E-17	3.14E-17	3.08E-17
Eu-156	1.00E-15	9.32E-16	8.85E-16	8.48E-16	7.97E-16	7.88E-16
Eu-157	2.67E-16	2.46E-16	2.34E-16	2.23E-16	2.05E-16	2.03E-16
Eu-158	1.14E-15	1.06E-15	1.01E-15	9.63E-16	9.04E-16	8.95E-16
Eu-159	3.38E-16	3.16E-16	3.02E-16	2.91E-16	2.74E-16	2.72E-16
Gadolinium						
Gd-142	9.30E-16	8.65E-16	8.24E-16	7.88E-16	7.34E-16	7.25E-16
Gd-143m	1.84E-15	1.71E-15	1.63E-15	1.55E-15	1.44E-15	1.43E-15
Gd-144	7.83E-16	7.29E-16	6.95E-16	6.66E-16	6.22E-16	6.15E-16
Gd-145	1.86E-15	1.74E-15	1.65E-15	1.58E-15	1.49E-15	1.47E-15
Gd-145m	5.87E-16	5.42E-16	5.15E-16	4.91E-16	4.55E-16	4.49E-16
Gd-146	1.86E-16	1.67E-16	1.53E-16	1.44E-16	1.28E-16	1.25E-16
Gd-147	1.15E-15	1.06E-15	9.99E-16	9.50E-16	8.77E-16	8.66E-16
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	4.28E-16	3.92E-16	3.70E-16	3.51E-16	3.20E-16	3.16E-16
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	4.92E-17	4.25E-17	3.87E-17	3.60E-17	3.13E-17	3.07E-17
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	7.32E-17	6.32E-17	5.69E-17	5.30E-17	4.57E-17	4.47E-17

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-159	6.25E-17	5.84E-17	5.61E-17	5.40E-17	5.06E-17	5.01E-17
Gd-162	3.70E-16	3.44E-16	3.28E-16	3.13E-16	2.88E-16	2.85E-16
Terbium						
Tb-146	2.96E-15	2.76E-15	2.62E-15	2.51E-15	2.36E-15	2.33E-15
Tb-147	1.78E-15	1.65E-15	1.56E-15	1.49E-15	1.39E-15	1.37E-15
Tb-147m	1.52E-15	1.41E-15	1.34E-15	1.29E-15	1.20E-15	1.19E-15
Tb-148	1.96E-15	1.82E-15	1.73E-15	1.66E-15	1.55E-15	1.53E-15
Tb-148m	2.64E-15	2.43E-15	2.31E-15	2.20E-15	2.03E-15	2.01E-15
Tb-149	1.09E-15	1.01E-15	9.53E-16	9.09E-16	8.44E-16	8.33E-16
Tb-149m	1.16E-15	1.07E-15	1.02E-15	9.67E-16	8.95E-16	8.84E-16
Tb-150	1.89E-15	1.76E-15	1.67E-15	1.60E-15	1.50E-15	1.48E-15
Tb-150m	2.11E-15	1.95E-15	1.85E-15	1.76E-15	1.62E-15	1.60E-15
Tb-151	8.10E-16	7.45E-16	7.05E-16	6.69E-16	6.14E-16	6.06E-16
Tb-151m	6.26E-17	5.68E-17	5.34E-17	5.04E-17	4.59E-17	4.52E-17
Tb-152	1.20E-15	1.11E-15	1.06E-15	1.01E-15	9.39E-16	9.28E-16
Tb-152m	6.23E-16	5.72E-16	5.41E-16	5.14E-16	4.70E-16	4.63E-16
Tb-153	2.62E-16	2.38E-16	2.24E-16	2.12E-16	1.93E-16	1.90E-16
Tb-154	1.72E-15	1.60E-15	1.51E-15	1.45E-15	1.36E-15	1.35E-15
Tb-155	1.33E-16	1.19E-16	1.09E-16	1.03E-16	9.16E-17	8.99E-17
Tb-156	1.55E-15	1.43E-15	1.35E-15	1.29E-15	1.20E-15	1.18E-15
Tb-156m	2.54E-17	2.09E-17	1.84E-17	1.66E-17	1.37E-17	1.34E-17
Tb-156n	2.49E-18	2.09E-18	1.85E-18	1.69E-18	1.44E-18	1.40E-18
Tb-157	2.96E-18	2.35E-18	2.03E-18	1.82E-18	1.46E-18	1.42E-18
Tb-158	6.54E-16	6.01E-16	5.67E-16	5.39E-16	4.99E-16	4.93E-16
Tb-160	9.23E-16	8.52E-16	8.06E-16	7.68E-16	7.14E-16	7.05E-16
Tb-161	2.19E-17	1.82E-17	1.62E-17	1.48E-17	1.26E-17	1.23E-17
Tb-162	9.65E-16	8.94E-16	8.49E-16	8.11E-16	7.53E-16	7.44E-16
Tb-163	6.83E-16	6.33E-16	6.03E-16	5.74E-16	5.28E-16	5.21E-16
Tb-164	2.05E-15	1.91E-15	1.81E-15	1.73E-15	1.61E-15	1.59E-15
Tb-165	7.59E-16	7.10E-16	6.78E-16	6.52E-16	6.15E-16	6.09E-16
Dysprosium						
Dy-148	5.94E-16	5.46E-16	5.17E-16	4.91E-16	4.51E-16	4.45E-16
Dy-149	1.29E-15	1.19E-15	1.12E-15	1.07E-15	9.99E-16	9.88E-16
Dy-150	2.29E-16	2.10E-16	1.98E-16	1.88E-16	1.71E-16	1.69E-16
Dy-151	1.10E-15	1.02E-15	9.63E-16	9.18E-16	8.52E-16	8.41E-16
Dy-152	2.30E-16	2.10E-16	1.98E-16	1.88E-16	1.70E-16	1.67E-16
Dy-153	6.94E-16	6.35E-16	5.99E-16	5.69E-16	5.24E-16	5.17E-16
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	5.35E-16	4.92E-16	4.64E-16	4.41E-16	4.07E-16	4.02E-16
Dy-157	2.82E-16	2.57E-16	2.43E-16	2.30E-16	2.09E-16	2.06E-16
Dy-159	2.93E-17	2.35E-17	2.05E-17	1.84E-17	1.49E-17	1.45E-17
Dy-165	6.58E-17	6.37E-17	6.24E-17	6.14E-17	5.97E-17	5.95E-17
Dy-165m	1.46E-17	1.32E-17	1.23E-17	1.16E-17	1.05E-17	1.03E-17
Dy-166	3.00E-17	2.56E-17	2.31E-17	2.12E-17	1.85E-17	1.80E-17
Dy-167	5.19E-16	4.84E-16	4.64E-16	4.44E-16	4.14E-16	4.09E-16
Dy-168	3.54E-16	3.29E-16	3.13E-16	2.98E-16	2.75E-16	2.72E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Holmium						
Ho-150	1.74E-15	1.62E-15	1.54E-15	1.48E-15	1.37E-15	1.36E-15
Ho-153	9.05E-16	8.38E-16	7.98E-16	7.61E-16	7.05E-16	6.96E-16
Ho-153m	9.48E-16	8.79E-16	8.37E-16	7.98E-16	7.38E-16	7.29E-16
Ho-154	1.65E-15	1.54E-15	1.46E-15	1.40E-15	1.30E-15	1.28E-15
Ho-154m	2.08E-15	1.93E-15	1.83E-15	1.74E-15	1.61E-15	1.59E-15
Ho-155	5.13E-16	4.73E-16	4.48E-16	4.27E-16	3.94E-16	3.89E-16
Ho-156	1.74E-15	1.62E-15	1.53E-15	1.47E-15	1.36E-15	1.35E-15
Ho-157	4.72E-16	4.31E-16	4.06E-16	3.85E-16	3.52E-16	3.47E-16
Ho-159	3.03E-16	2.75E-16	2.57E-16	2.42E-16	2.19E-16	2.15E-16
Ho-160	1.39E-15	1.28E-15	1.21E-15	1.15E-15	1.07E-15	1.05E-15
Ho-161	3.54E-17	2.91E-17	2.57E-17	2.34E-17	1.95E-17	1.90E-17
Ho-162	1.27E-16	1.14E-16	1.07E-16	1.01E-16	9.16E-17	9.02E-17
Ho-162m	4.45E-16	4.08E-16	3.84E-16	3.65E-16	3.37E-16	3.33E-16
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	2.77E-17	2.42E-17	2.23E-17	2.09E-17	1.88E-17	1.85E-17
Ho-164m	2.94E-17	2.40E-17	2.10E-17	1.89E-17	1.57E-17	1.52E-17
Ho-166	1.01E-16	9.87E-17	9.72E-17	9.61E-17	9.45E-17	9.43E-17
Ho-166m	1.35E-15	1.24E-15	1.18E-15	1.12E-15	1.03E-15	1.02E-15
Ho-167	3.11E-16	2.87E-16	2.73E-16	2.59E-16	2.37E-16	2.34E-16
Ho-168	8.13E-16	7.57E-16	7.21E-16	6.90E-16	6.46E-16	6.39E-16
Ho-168m	4.17E-18	3.41E-18	3.00E-18	2.70E-18	2.23E-18	2.17E-18
Ho-170	1.48E-15	1.37E-15	1.30E-15	1.24E-15	1.16E-15	1.14E-15
Erbium						
Er-154	5.24E-17	4.52E-17	4.13E-17	3.83E-17	3.36E-17	3.29E-17
Er-156	4.34E-17	3.63E-17	3.24E-17	2.96E-17	2.52E-17	2.46E-17
Er-159	7.79E-16	7.18E-16	6.80E-16	6.48E-16	5.99E-16	5.92E-16
Er-161	8.05E-16	7.40E-16	6.99E-16	6.65E-16	6.15E-16	6.07E-16
Er-163	2.69E-17	2.21E-17	1.94E-17	1.75E-17	1.45E-17	1.42E-17
Er-165	2.51E-17	2.05E-17	1.80E-17	1.62E-17	1.34E-17	1.30E-17
Er-167m	7.73E-17	7.09E-17	6.69E-17	6.35E-17	5.76E-17	5.67E-17
Er-169	4.55E-20	3.83E-20	3.43E-20	3.17E-20	2.74E-20	2.68E-20
Er-171	3.34E-16	3.10E-16	2.95E-16	2.81E-16	2.59E-16	2.55E-16
Er-172	4.28E-16	3.93E-16	3.73E-16	3.53E-16	3.24E-16	3.19E-16
Er-173	7.51E-16	6.97E-16	6.62E-16	6.33E-16	5.88E-16	5.82E-16
Thulium						
Tm-161	1.02E-15	9.39E-16	8.86E-16	8.46E-16	7.85E-16	7.75E-16
Tm-162	1.53E-15	1.42E-15	1.35E-15	1.30E-15	1.21E-15	1.20E-15
Tm-163	1.04E-15	9.55E-16	9.02E-16	8.60E-16	7.98E-16	7.89E-16
Tm-164	6.88E-16	6.40E-16	6.09E-16	5.83E-16	5.43E-16	5.37E-16
Tm-165	4.54E-16	4.15E-16	3.92E-16	3.71E-16	3.40E-16	3.35E-16
Tm-166	1.54E-15	1.43E-15	1.35E-15	1.29E-15	1.20E-15	1.19E-15
Tm-167	1.13E-16	1.01E-16	9.41E-17	8.84E-17	7.89E-17	7.76E-17
Tm-168	1.02E-15	9.40E-16	8.89E-16	8.45E-16	7.78E-16	7.68E-16
Tm-170	2.41E-17	2.37E-17	2.34E-17	2.33E-17	2.30E-17	2.29E-17
Tm-171	4.21E-19	3.53E-19	3.15E-19	2.86E-19	2.47E-19	2.41E-19

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-172	4.24E-16	3.96E-16	3.78E-16	3.64E-16	3.44E-16	3.40E-16
Tm-173	3.42E-16	3.17E-16	3.02E-16	2.88E-16	2.65E-16	2.61E-16
Tm-174	1.49E-15	1.38E-15	1.31E-15	1.25E-15	1.16E-15	1.14E-15
Tm-175	9.38E-16	8.69E-16	8.26E-16	7.88E-16	7.32E-16	7.23E-16
Tm-176	1.63E-15	1.52E-15	1.44E-15	1.38E-15	1.29E-15	1.28E-15
Ytterbium						
Yb-162	1.99E-16	1.81E-16	1.70E-16	1.60E-16	1.45E-16	1.43E-16
Yb-163	6.13E-16	5.67E-16	5.38E-16	5.13E-16	4.77E-16	4.71E-16
Yb-164	3.84E-17	3.28E-17	2.96E-17	2.72E-17	2.35E-17	2.30E-17
Yb-165	2.67E-16	2.42E-16	2.27E-16	2.14E-16	1.96E-16	1.93E-16
Yb-166	5.94E-17	4.99E-17	4.45E-17	4.05E-17	3.47E-17	3.38E-17
Yb-167	2.01E-16	1.80E-16	1.66E-16	1.56E-16	1.38E-16	1.36E-16
Yb-169	2.49E-16	2.23E-16	2.06E-16	1.93E-16	1.72E-16	1.69E-16
Yb-175	3.24E-17	2.98E-17	2.82E-17	2.68E-17	2.45E-17	2.41E-17
Yb-177	2.00E-16	1.87E-16	1.79E-16	1.73E-16	1.63E-16	1.62E-16
Yb-178	3.47E-17	3.23E-17	3.08E-17	2.94E-17	2.71E-17	2.68E-17
Yb-179	8.93E-16	8.30E-16	7.92E-16	7.56E-16	7.03E-16	6.94E-16
Lutetium						
Lu-165	9.19E-16	8.50E-16	8.06E-16	7.69E-16	7.13E-16	7.04E-16
Lu-167	1.31E-15	1.22E-15	1.15E-15	1.10E-15	1.03E-15	1.02E-15
Lu-169	1.04E-15	9.58E-16	9.05E-16	8.63E-16	8.03E-16	7.94E-16
Lu-169m	1.02E-22	6.90E-23	5.45E-23	4.94E-23	3.64E-23	3.47E-23
Lu-170	1.92E-15	1.78E-15	1.69E-15	1.62E-15	1.52E-15	1.50E-15
Lu-171	5.26E-16	4.81E-16	4.53E-16	4.30E-16	3.95E-16	3.90E-16
Lu-171m	2.22E-19	1.91E-19	1.71E-19	1.57E-19	1.40E-19	1.37E-19
Lu-172	1.58E-15	1.46E-15	1.38E-15	1.31E-15	1.22E-15	1.20E-15
Lu-172m	9.76E-22	7.63E-22	6.51E-22	5.82E-22	4.62E-22	4.49E-22
Lu-173	1.38E-16	1.22E-16	1.13E-16	1.05E-16	9.39E-17	9.21E-17
Lu-174	8.62E-17	7.68E-17	7.11E-17	6.67E-17	6.06E-17	5.97E-17
Lu-174m	4.16E-17	3.55E-17	3.20E-17	2.93E-17	2.57E-17	2.51E-17
Lu-176	3.94E-16	3.63E-16	3.44E-16	3.27E-16	2.99E-16	2.94E-16
Lu-176m	5.40E-17	5.27E-17	5.19E-17	5.13E-17	5.04E-17	5.03E-17
Lu-177	2.82E-17	2.60E-17	2.45E-17	2.32E-17	2.11E-17	2.08E-17
Lu-177m	8.14E-16	7.49E-16	7.08E-16	6.72E-16	6.12E-16	6.03E-16
Lu-178	1.84E-16	1.76E-16	1.71E-16	1.67E-16	1.62E-16	1.61E-16
Lu-178m	8.89E-16	8.21E-16	7.79E-16	7.41E-16	6.80E-16	6.70E-16
Lu-179	7.62E-17	7.42E-17	7.30E-17	7.19E-17	7.01E-17	6.98E-17
Lu-180	1.28E-15	1.19E-15	1.13E-15	1.08E-15	1.01E-15	9.96E-16
Lu-181	5.61E-16	5.23E-16	5.00E-16	4.79E-16	4.47E-16	4.42E-16
Hafnium						
Hf-167	5.67E-16	5.26E-16	5.02E-16	4.79E-16	4.43E-16	4.37E-16
Hf-169	5.45E-16	5.02E-16	4.77E-16	4.52E-16	4.16E-16	4.10E-16
Hf-170	3.54E-16	3.24E-16	3.05E-16	2.89E-16	2.64E-16	2.60E-16
Hf-172	7.08E-17	6.12E-17	5.53E-17	5.10E-17	4.48E-17	4.38E-17
Hf-173	3.16E-16	2.89E-16	2.71E-16	2.57E-16	2.33E-16	2.30E-16
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-175	2.87E-16	2.62E-16	2.47E-16	2.34E-16	2.13E-16	2.10E-16
Hf-177m	1.88E-15	1.73E-15	1.64E-15	1.55E-15	1.42E-15	1.40E-15
Hf-178m	1.85E-15	1.71E-15	1.62E-15	1.54E-15	1.41E-15	1.39E-15
Hf-179m	7.53E-16	6.94E-16	6.56E-16	6.23E-16	5.69E-16	5.60E-16
Hf-180m	8.16E-16	7.51E-16	7.12E-16	6.76E-16	6.18E-16	6.09E-16
Hf-181	4.41E-16	4.07E-16	3.86E-16	3.66E-16	3.36E-16	3.31E-16
Hf-182	1.97E-16	1.81E-16	1.72E-16	1.64E-16	1.49E-16	1.47E-16
Hf-182m	7.52E-16	6.92E-16	6.55E-16	6.22E-16	5.71E-16	5.63E-16
Hf-183	6.80E-16	6.29E-16	5.97E-16	5.70E-16	5.30E-16	5.23E-16
Hf-184	2.09E-16	1.93E-16	1.83E-16	1.75E-16	1.61E-16	1.59E-16
Tantalum						
Ta-170	1.02E-15	9.48E-16	9.05E-16	8.66E-16	8.07E-16	7.98E-16
Ta-172	1.41E-15	1.31E-15	1.24E-15	1.19E-15	1.10E-15	1.09E-15
Ta-173	4.68E-16	4.30E-16	4.06E-16	3.86E-16	3.57E-16	3.53E-16
Ta-174	8.16E-16	7.56E-16	7.18E-16	6.86E-16	6.38E-16	6.30E-16
Ta-175	8.71E-16	8.03E-16	7.58E-16	7.23E-16	6.72E-16	6.64E-16
Ta-176	1.71E-15	1.59E-15	1.50E-15	1.44E-15	1.35E-15	1.33E-15
Ta-177	4.83E-17	4.20E-17	3.82E-17	3.53E-17	3.13E-17	3.06E-17
Ta-178	9.12E-17	8.17E-17	7.58E-17	7.13E-17	6.50E-17	6.39E-17
Ta-178m	9.44E-16	8.68E-16	8.21E-16	7.79E-16	7.11E-16	7.01E-16
Ta-179	1.68E-17	1.42E-17	1.27E-17	1.16E-17	1.01E-17	9.84E-18
Ta-180	3.37E-17	2.89E-17	2.60E-17	2.39E-17	2.10E-17	2.05E-17
Ta-182	1.03E-15	9.50E-16	8.97E-16	8.56E-16	7.97E-16	7.88E-16
Ta-182m	2.05E-16	1.88E-16	1.76E-16	1.66E-16	1.51E-16	1.48E-16
Ta-183	2.35E-16	2.14E-16	2.01E-16	1.90E-16	1.73E-16	1.70E-16
Ta-184	1.33E-15	1.23E-15	1.17E-15	1.11E-15	1.03E-15	1.02E-15
Ta-185	1.96E-16	1.86E-16	1.79E-16	1.73E-16	1.64E-16	1.63E-16
Ta-186	1.29E-15	1.20E-15	1.14E-15	1.09E-15	1.01E-15	1.00E-15
Tungsten						
W-177	7.39E-16	6.78E-16	6.40E-16	6.07E-16	5.59E-16	5.51E-16
W-178	1.02E-17	8.65E-18	7.74E-18	7.07E-18	6.24E-18	6.07E-18
W-179	3.48E-17	2.92E-17	2.60E-17	2.38E-17	2.08E-17	2.03E-17
W-179m	4.06E-17	3.59E-17	3.30E-17	3.08E-17	2.77E-17	2.72E-17
W-181	2.71E-17	2.30E-17	2.06E-17	1.88E-17	1.66E-17	1.62E-17
W-185	1.25E-19	1.10E-19	1.01E-19	9.52E-20	8.55E-20	8.39E-20
W-185m	1.83E-17	1.66E-17	1.54E-17	1.45E-17	1.31E-17	1.29E-17
W-187	3.88E-16	3.58E-16	3.40E-16	3.24E-16	3.00E-16	2.96E-16
W-188	1.58E-18	1.44E-18	1.37E-18	1.30E-18	1.18E-18	1.16E-18
W-190	1.33E-16	1.22E-16	1.14E-16	1.08E-16	1.00E-16	9.86E-17
Rhenium						
Re-178	1.36E-15	1.26E-15	1.20E-15	1.15E-15	1.08E-15	1.06E-15
Re-179	8.66E-16	7.99E-16	7.57E-16	7.21E-16	6.67E-16	6.58E-16
Re-180	9.91E-16	9.13E-16	8.63E-16	8.21E-16	7.62E-16	7.53E-16
Re-181	6.53E-16	6.00E-16	5.67E-16	5.38E-16	4.95E-16	4.89E-16
Re-182	1.43E-15	1.32E-15	1.24E-15	1.18E-15	1.10E-15	1.08E-15
Re-182m	9.65E-16	8.88E-16	8.38E-16	7.99E-16	7.44E-16	7.35E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-183	1.15E-16	1.03E-16	9.45E-17	8.84E-17	7.97E-17	7.81E-17
Re-184	7.29E-16	6.70E-16	6.33E-16	6.01E-16	5.56E-16	5.49E-16
Re-184m	3.06E-16	2.80E-16	2.64E-16	2.50E-16	2.30E-16	2.27E-16
Re-186	4.06E-17	3.92E-17	3.82E-17	3.74E-17	3.62E-17	3.60E-17
Re-186m	1.01E-17	8.57E-18	7.66E-18	7.01E-18	6.14E-18	5.99E-18
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	1.40E-16	1.36E-16	1.34E-16	1.31E-16	1.28E-16	1.27E-16
Re-188m	4.85E-17	4.26E-17	3.87E-17	3.60E-17	3.24E-17	3.17E-17
Re-189	6.51E-17	6.15E-17	5.92E-17	5.73E-17	5.40E-17	5.35E-17
Re-190	1.18E-15	1.10E-15	1.05E-15	9.99E-16	9.26E-16	9.15E-16
Re-190m	8.05E-16	7.46E-16	7.09E-16	6.76E-16	6.25E-16	6.17E-16
Osmium						
Os-180	9.34E-17	8.38E-17	7.80E-17	7.32E-17	6.68E-17	6.56E-17
Os-181	1.10E-15	1.02E-15	9.63E-16	9.17E-16	8.52E-16	8.41E-16
Os-182	3.50E-16	3.21E-16	3.04E-16	2.88E-16	2.64E-16	2.60E-16
Os-183	5.06E-16	4.64E-16	4.38E-16	4.15E-16	3.80E-16	3.74E-16
Os-183m	8.08E-16	7.44E-16	7.03E-16	6.70E-16	6.23E-16	6.16E-16
Os-185	5.71E-16	5.25E-16	4.97E-16	4.71E-16	4.35E-16	4.29E-16
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	4.09E-23	3.25E-23	2.50E-23	2.31E-23	1.58E-23	1.49E-23
Os-190m	1.32E-15	1.22E-15	1.16E-15	1.11E-15	1.02E-15	1.00E-15
Os-191	5.96E-17	5.38E-17	4.95E-17	4.65E-17	4.23E-17	4.14E-17
Os-191m	3.98E-18	3.43E-18	3.09E-18	2.85E-18	2.58E-18	2.52E-18
Os-193	8.19E-17	7.74E-17	7.46E-17	7.21E-17	6.83E-17	6.77E-17
Os-194	1.53E-18	1.22E-18	1.05E-18	9.36E-19	7.53E-19	7.32E-19
Os-196	9.58E-17	9.04E-17	8.70E-17	8.41E-17	7.95E-17	7.87E-17
Iridium						
Ir-180	1.43E-15	1.33E-15	1.26E-15	1.21E-15	1.12E-15	1.11E-15
Ir-182	1.25E-15	1.16E-15	1.11E-15	1.06E-15	9.81E-16	9.69E-16
Ir-183	9.39E-16	8.68E-16	8.21E-16	7.84E-16	7.30E-16	7.21E-16
Ir-184	1.60E-15	1.48E-15	1.40E-15	1.34E-15	1.24E-15	1.23E-15
Ir-185	6.56E-16	6.06E-16	5.72E-16	5.46E-16	5.10E-16	5.04E-16
Ir-186	1.33E-15	1.23E-15	1.17E-15	1.11E-15	1.03E-15	1.02E-15
Ir-186m	9.99E-16	9.24E-16	8.76E-16	8.36E-16	7.78E-16	7.69E-16
Ir-187	2.64E-16	2.41E-16	2.27E-16	2.15E-16	1.98E-16	1.95E-16
Ir-188	1.58E-15	1.47E-15	1.39E-15	1.34E-15	1.25E-15	1.24E-15
Ir-189	5.55E-17	4.89E-17	4.49E-17	4.18E-17	3.80E-17	3.71E-17
Ir-190	1.22E-15	1.13E-15	1.07E-15	1.02E-15	9.34E-16	9.21E-16
Ir-190m	1.55E-23	1.74E-23	1.25E-23	1.22E-23	5.93E-24	5.27E-24
Ir-190n	3.92E-17	3.41E-17	3.09E-17	2.86E-17	2.59E-17	2.52E-17
Ir-191m	5.37E-17	4.84E-17	4.46E-17	4.19E-17	3.80E-17	3.73E-17
Ir-192	6.83E-16	6.31E-16	6.00E-16	5.70E-16	5.23E-16	5.16E-16
Ir-192m	5.32E-20	4.86E-20	4.58E-20	4.35E-20	4.01E-20	3.95E-20
Ir-192n	4.31E-19	3.82E-19	3.49E-19	3.25E-19	2.97E-19	2.90E-19
Ir-193m	2.13E-19	1.84E-19	1.66E-19	1.54E-19	1.40E-19	1.36E-19
Ir-194	1.70E-16	1.64E-16	1.61E-16	1.57E-16	1.52E-16	1.51E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-194m	1.95E-15	1.80E-15	1.71E-15	1.63E-15	1.50E-15	1.48E-15
Ir-195	6.48E-17	6.02E-17	5.71E-17	5.49E-17	5.21E-17	5.15E-17
Ir-195m	3.16E-16	2.91E-16	2.76E-16	2.63E-16	2.42E-16	2.38E-16
Ir-196	3.20E-16	3.05E-16	2.96E-16	2.87E-16	2.74E-16	2.73E-16
Ir-196m	2.08E-15	1.92E-15	1.83E-15	1.74E-15	1.60E-15	1.58E-15
Platinum						
Pt-184	5.79E-16	5.30E-16	4.99E-16	4.72E-16	4.33E-16	4.27E-16
Pt-186	5.60E-16	5.14E-16	4.86E-16	4.61E-16	4.25E-16	4.19E-16
Pt-187	5.01E-16	4.60E-16	4.34E-16	4.12E-16	3.80E-16	3.74E-16
Pt-188	1.58E-16	1.43E-16	1.34E-16	1.26E-16	1.15E-16	1.13E-16
Pt-189	3.87E-16	3.54E-16	3.34E-16	3.16E-16	2.91E-16	2.87E-16
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	2.31E-16	2.10E-16	1.97E-16	1.85E-16	1.70E-16	1.67E-16
Pt-193	5.68E-23	7.66E-23	5.42E-23	5.46E-23	2.14E-23	1.83E-23
Pt-193m	7.20E-18	6.28E-18	5.68E-18	5.26E-18	4.83E-18	4.70E-18
Pt-195m	5.04E-17	4.45E-17	4.06E-17	3.78E-17	3.45E-17	3.37E-17
Pt-197	2.07E-17	1.90E-17	1.78E-17	1.69E-17	1.58E-17	1.55E-17
Pt-197m	6.16E-17	5.57E-17	5.20E-17	4.90E-17	4.49E-17	4.41E-17
Pt-199	2.23E-16	2.10E-16	2.02E-16	1.95E-16	1.84E-16	1.82E-16
Pt-200	4.59E-17	4.17E-17	3.89E-17	3.67E-17	3.37E-17	3.31E-17
Pt-202	7.76E-17	7.74E-17	7.73E-17	7.72E-17	7.70E-17	7.70E-17
Gold						
Au-186	1.32E-15	1.22E-15	1.16E-15	1.11E-15	1.03E-15	1.02E-15
Au-187	8.40E-16	7.77E-16	7.36E-16	7.03E-16	6.56E-16	6.49E-16
Au-190	1.80E-15	1.67E-15	1.59E-15	1.52E-15	1.43E-15	1.41E-15
Au-191	4.82E-16	4.43E-16	4.19E-16	3.97E-16	3.65E-16	3.60E-16
Au-192	1.48E-15	1.37E-15	1.30E-15	1.25E-15	1.17E-15	1.16E-15
Au-193	1.26E-16	1.14E-16	1.06E-16	1.00E-16	9.16E-17	8.99E-17
Au-193m	1.59E-16	1.46E-16	1.38E-16	1.31E-16	1.20E-16	1.18E-16
Au-194	8.14E-16	7.53E-16	7.13E-16	6.81E-16	6.34E-16	6.26E-16
Au-195	5.62E-17	4.94E-17	4.50E-17	4.18E-17	3.82E-17	3.73E-17
Au-195m	1.61E-16	1.48E-16	1.41E-16	1.34E-16	1.22E-16	1.20E-16
Au-196	3.87E-16	3.55E-16	3.37E-16	3.19E-16	2.92E-16	2.88E-16
Au-196m	1.86E-16	1.71E-16	1.60E-16	1.51E-16	1.38E-16	1.36E-16
Au-198	3.58E-16	3.33E-16	3.18E-16	3.03E-16	2.79E-16	2.76E-16
Au-198m	4.22E-16	3.89E-16	3.66E-16	3.48E-16	3.17E-16	3.12E-16
Au-199	7.52E-17	6.97E-17	6.54E-17	6.21E-17	5.67E-17	5.58E-17
Au-200	3.03E-16	2.87E-16	2.76E-16	2.67E-16	2.54E-16	2.52E-16
Au-200m	1.65E-15	1.53E-15	1.45E-15	1.38E-15	1.27E-15	1.25E-15
Au-201	6.89E-17	6.66E-17	6.52E-17	6.39E-17	6.20E-17	6.16E-17
Au-202	2.60E-16	2.49E-16	2.42E-16	2.36E-16	2.27E-16	2.26E-16
Mercury						
Hg-190	1.51E-16	1.38E-16	1.29E-16	1.22E-16	1.11E-16	1.09E-16
Hg-191m	1.20E-15	1.11E-15	1.05E-15	1.00E-15	9.28E-16	9.16E-16
Hg-192	2.13E-16	1.95E-16	1.83E-16	1.73E-16	1.58E-16	1.56E-16
Hg-193	6.61E-16	6.10E-16	5.76E-16	5.49E-16	5.11E-16	5.04E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-193m	8.22E-16	7.59E-16	7.18E-16	6.84E-16	6.35E-16	6.27E-16
Hg-194	3.33E-22	3.37E-22	2.58E-22	2.50E-22	9.41E-23	8.23E-23
Hg-195	1.55E-16	1.41E-16	1.32E-16	1.25E-16	1.15E-16	1.13E-16
Hg-195m	1.59E-16	1.45E-16	1.37E-16	1.30E-16	1.19E-16	1.18E-16
Hg-197	4.91E-17	4.32E-17	3.93E-17	3.65E-17	3.37E-17	3.28E-17
Hg-197m	7.19E-17	6.60E-17	6.15E-17	5.82E-17	5.31E-17	5.22E-17
Hg-199m	1.42E-16	1.31E-16	1.22E-16	1.16E-16	1.06E-16	1.04E-16
Hg-203	1.96E-16	1.80E-16	1.71E-16	1.63E-16	1.49E-16	1.47E-16
Hg-205	6.48E-17	6.43E-17	6.40E-17	6.37E-17	6.33E-17	6.33E-17
Hg-206	1.35E-16	1.27E-16	1.22E-16	1.18E-16	1.11E-16	1.10E-16
Hg-207	2.16E-15	2.01E-15	1.91E-15	1.83E-15	1.72E-15	1.70E-15
Thallium						
Tl-190	1.20E-15	1.12E-15	1.07E-15	1.02E-15	9.49E-16	9.38E-16
Tl-190m	2.11E-15	1.96E-15	1.86E-15	1.77E-15	1.64E-15	1.62E-15
Tl-194	8.16E-16	7.57E-16	7.21E-16	6.87E-16	6.37E-16	6.29E-16
Tl-194m	2.11E-15	1.95E-15	1.85E-15	1.76E-15	1.63E-15	1.60E-15
Tl-195	9.50E-16	8.80E-16	8.33E-16	7.96E-16	7.44E-16	7.35E-16
Tl-196	1.49E-15	1.38E-15	1.31E-15	1.25E-15	1.17E-15	1.15E-15
Tl-197	3.64E-16	3.35E-16	3.16E-16	3.00E-16	2.78E-16	2.74E-16
Tl-198	1.56E-15	1.45E-15	1.37E-15	1.31E-15	1.23E-15	1.21E-15
Tl-198m	1.01E-15	9.29E-16	8.81E-16	8.37E-16	7.70E-16	7.59E-16
Tl-199	1.98E-16	1.81E-16	1.70E-16	1.61E-16	1.48E-16	1.45E-16
Tl-200	1.06E-15	9.75E-16	9.23E-16	8.80E-16	8.16E-16	8.06E-16
Tl-201	6.54E-17	5.84E-17	5.36E-17	5.01E-17	4.61E-17	4.51E-17
Tl-202	3.81E-16	3.51E-16	3.32E-16	3.15E-16	2.89E-16	2.85E-16
Tl-204	1.07E-17	1.05E-17	1.04E-17	1.04E-17	1.03E-17	1.03E-17
Tl-206	6.09E-17	6.08E-17	6.07E-17	6.06E-17	6.05E-17	6.05E-17
Tl-206m	2.01E-15	1.85E-15	1.76E-15	1.67E-15	1.55E-15	1.53E-15
Tl-207	5.56E-17	5.53E-17	5.52E-17	5.50E-17	5.48E-17	5.48E-17
Tl-208	2.50E-15	2.34E-15	2.23E-15	2.15E-15	2.03E-15	2.01E-15
Tl-209	1.75E-15	1.63E-15	1.55E-15	1.49E-15	1.39E-15	1.38E-15
Tl-210	2.30E-15	2.14E-15	2.03E-15	1.95E-15	1.83E-15	1.81E-15
Lead						
Pb-194	8.60E-16	7.94E-16	7.52E-16	7.16E-16	6.66E-16	6.58E-16
Pb-195m	1.38E-15	1.27E-15	1.21E-15	1.15E-15	1.06E-15	1.05E-15
Pb-196	3.99E-16	3.66E-16	3.46E-16	3.28E-16	3.02E-16	2.97E-16
Pb-197	1.21E-15	1.12E-15	1.06E-15	1.02E-15	9.47E-16	9.35E-16
Pb-197m	9.60E-16	8.85E-16	8.39E-16	7.98E-16	7.36E-16	7.27E-16
Pb-198	3.52E-16	3.23E-16	3.05E-16	2.90E-16	2.66E-16	2.62E-16
Pb-199	8.25E-16	7.62E-16	7.22E-16	6.88E-16	6.41E-16	6.33E-16
Pb-200	1.58E-16	1.44E-16	1.35E-16	1.27E-16	1.17E-16	1.15E-16
Pb-201	6.15E-16	5.66E-16	5.36E-16	5.09E-16	4.70E-16	4.64E-16
Pb-201m	3.35E-16	3.12E-16	2.97E-16	2.84E-16	2.64E-16	2.61E-16
Pb-202	9.21E-23	1.09E-22	8.07E-23	7.85E-23	3.13E-23	2.72E-23
Pb-202m	1.66E-15	1.53E-15	1.45E-15	1.38E-15	1.28E-15	1.26E-15
Pb-203	2.50E-16	2.29E-16	2.16E-16	2.05E-16	1.88E-16	1.85E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-204m	1.72E-15	1.58E-15	1.50E-15	1.43E-15	1.33E-15	1.31E-15
Pb-205	9.49E-23	1.12E-22	8.28E-23	8.05E-23	3.21E-23	2.79E-23
Pb-209	3.12E-18	3.10E-18	3.08E-18	3.07E-18	3.06E-18	3.05E-18
Pb-210	1.33E-18	1.08E-18	9.41E-19	8.44E-19	6.85E-19	6.67E-19
Pb-211	1.00E-16	9.58E-17	9.32E-17	9.08E-17	8.73E-17	8.68E-17
Pb-212	1.16E-16	1.06E-16	1.00E-16	9.51E-17	8.70E-17	8.57E-17
Pb-214	2.14E-16	1.98E-16	1.88E-16	1.79E-16	1.64E-16	1.62E-16
Bismuth						
Bi-197	1.39E-15	1.29E-15	1.22E-15	1.17E-15	1.09E-15	1.07E-15
Bi-200	2.02E-15	1.87E-15	1.77E-15	1.69E-15	1.56E-15	1.54E-15
Bi-201	1.37E-15	1.27E-15	1.20E-15	1.14E-15	1.07E-15	1.06E-15
Bi-202	2.26E-15	2.08E-15	1.97E-15	1.88E-15	1.74E-15	1.72E-15
Bi-203	1.87E-15	1.73E-15	1.64E-15	1.57E-15	1.47E-15	1.45E-15
Bi-204	2.36E-15	2.18E-15	2.06E-15	1.97E-15	1.83E-15	1.81E-15
Bi-205	1.32E-15	1.22E-15	1.16E-15	1.11E-15	1.04E-15	1.02E-15
Bi-206	2.66E-15	2.46E-15	2.33E-15	2.22E-15	2.06E-15	2.03E-15
Bi-207	1.26E-15	1.16E-15	1.10E-15	1.05E-15	9.77E-16	9.65E-16
Bi-208	1.83E-15	1.72E-15	1.64E-15	1.58E-15	1.50E-15	1.48E-15
Bi-210	3.50E-17	3.49E-17	3.49E-17	3.48E-17	3.48E-17	3.48E-17
Bi-210m	2.15E-16	1.98E-16	1.88E-16	1.79E-16	1.64E-16	1.62E-16
Bi-211	3.92E-17	3.61E-17	3.43E-17	3.26E-17	2.99E-17	2.95E-17
Bi-212	1.41E-16	1.34E-16	1.30E-16	1.27E-16	1.22E-16	1.21E-16
Bi-212n	6.01E-17	5.99E-17	5.99E-17	5.98E-17	5.97E-17	5.97E-17
Bi-213	1.49E-16	1.40E-16	1.35E-16	1.31E-16	1.23E-16	1.22E-16
Bi-214	1.23E-15	1.14E-15	1.09E-15	1.04E-15	9.81E-16	9.71E-16
Bi-215	2.77E-16	2.61E-16	2.51E-16	2.42E-16	2.29E-16	2.27E-16
Bi-216	7.59E-16	7.11E-16	6.83E-16	6.55E-16	6.13E-16	6.06E-16
Polonium						
Po-203	1.32E-15	1.22E-15	1.15E-15	1.10E-15	1.03E-15	1.01E-15
Po-204	9.40E-16	8.65E-16	8.18E-16	7.77E-16	7.19E-16	7.10E-16
Po-205	1.28E-15	1.18E-15	1.12E-15	1.06E-15	9.90E-16	9.78E-16
Po-206	9.73E-16	8.97E-16	8.49E-16	8.07E-16	7.47E-16	7.37E-16
Po-207	1.05E-15	9.64E-16	9.12E-16	8.68E-16	8.06E-16	7.96E-16
Po-208	1.75E-20	1.61E-20	1.53E-20	1.45E-20	1.34E-20	1.32E-20
Po-209	5.05E-18	4.64E-18	4.39E-18	4.18E-18	3.86E-18	3.81E-18
Po-210	8.09E-21	7.47E-21	7.07E-21	6.73E-21	6.23E-21	6.16E-21
Po-211	6.80E-18	6.28E-18	5.96E-18	5.67E-18	5.25E-18	5.18E-18
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	5.66E-17	5.30E-17	5.04E-17	4.85E-17	4.58E-17	4.54E-17
Po-213	3.14E-20	2.89E-20	2.74E-20	2.61E-20	2.42E-20	2.39E-20
Po-214	6.91E-20	6.37E-20	6.04E-20	5.74E-20	5.32E-20	5.26E-20
Po-215	1.48E-19	1.37E-19	1.30E-19	1.24E-19	1.13E-19	1.12E-19
Po-216	1.27E-20	1.17E-20	1.11E-20	1.06E-20	9.81E-21	9.69E-21
Po-218	3.94E-24	3.23E-24	2.85E-24	2.62E-24	2.22E-24	2.16E-24
Astatine						
At-204	1.98E-15	1.83E-15	1.74E-15	1.65E-15	1.53E-15	1.51E-15

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
At-205	9.47E-16	8.76E-16	8.31E-16	7.92E-16	7.36E-16	7.27E-16
At-206	2.07E-15	1.91E-15	1.82E-15	1.73E-15	1.60E-15	1.58E-15
At-207	1.61E-15	1.49E-15	1.41E-15	1.34E-15	1.25E-15	1.24E-15
At-208	2.47E-15	2.28E-15	2.16E-15	2.06E-15	1.91E-15	1.89E-15
At-209	1.88E-15	1.73E-15	1.64E-15	1.56E-15	1.44E-15	1.42E-15
At-210	2.33E-15	2.16E-15	2.04E-15	1.95E-15	1.82E-15	1.80E-15
At-211	2.53E-17	2.28E-17	2.10E-17	1.97E-17	1.81E-17	1.77E-17
At-215	1.43E-19	1.32E-19	1.25E-19	1.19E-19	1.09E-19	1.08E-19
At-216	1.86E-18	1.69E-18	1.57E-18	1.48E-18	1.36E-18	1.33E-18
At-217	1.99E-19	1.83E-19	1.74E-19	1.65E-19	1.51E-19	1.49E-19
At-218	1.24E-19	1.23E-19	1.23E-19	1.23E-19	1.22E-19	1.22E-19
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	4.98E-16	4.68E-16	4.51E-16	4.35E-16	4.08E-16	4.04E-16
Radon						
Rn-207	8.31E-16	7.68E-16	7.30E-16	6.95E-16	6.42E-16	6.34E-16
Rn-209	9.68E-16	8.96E-16	8.50E-16	8.10E-16	7.51E-16	7.42E-16
Rn-210	4.99E-17	4.60E-17	4.36E-17	4.15E-17	3.83E-17	3.78E-17
Rn-211	1.52E-15	1.40E-15	1.33E-15	1.27E-15	1.18E-15	1.16E-15
Rn-212	2.83E-19	2.62E-19	2.48E-19	2.36E-19	2.18E-19	2.15E-19
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	6.35E-19	5.87E-19	5.58E-19	5.30E-19	4.89E-19	4.82E-19
Rn-219	4.86E-17	4.48E-17	4.26E-17	4.05E-17	3.71E-17	3.65E-17
Rn-220	5.28E-19	4.88E-19	4.64E-19	4.40E-19	4.06E-19	4.00E-19
Rn-222	3.26E-19	3.02E-19	2.87E-19	2.73E-19	2.51E-19	2.47E-19
Rn-223	3.39E-16	3.17E-16	3.04E-16	2.92E-16	2.74E-16	2.71E-16
Francium						
Fr-212	9.15E-16	8.46E-16	8.01E-16	7.64E-16	7.12E-16	7.03E-16
Fr-219	2.97E-18	2.74E-18	2.60E-18	2.47E-18	2.27E-18	2.23E-18
Fr-220	7.03E-18	6.41E-18	5.96E-18	5.64E-18	5.15E-18	5.05E-18
Fr-221	2.37E-17	2.19E-17	2.07E-17	1.97E-17	1.80E-17	1.77E-17
Fr-222	2.15E-16	2.04E-16	1.97E-16	1.91E-16	1.81E-16	1.79E-16
Fr-223	6.82E-17	6.36E-17	6.08E-17	5.86E-17	5.52E-17	5.47E-17
Fr-224	5.33E-16	5.00E-16	4.78E-16	4.61E-16	4.35E-16	4.31E-16
Fr-227	4.48E-16	4.20E-16	4.01E-16	3.86E-16	3.61E-16	3.57E-16
Radium						
Ra-219	1.39E-16	1.29E-16	1.22E-16	1.16E-16	1.06E-16	1.05E-16
Ra-220	3.92E-18	3.63E-18	3.45E-18	3.28E-18	3.01E-18	2.97E-18
Ra-221	2.80E-17	2.60E-17	2.43E-17	2.31E-17	2.10E-17	2.07E-17
Ra-222	7.64E-18	7.05E-18	6.71E-18	6.38E-18	5.84E-18	5.76E-18
Ra-223	1.10E-16	1.01E-16	9.52E-17	9.03E-17	8.26E-17	8.12E-17
Ra-224	8.50E-18	7.84E-18	7.44E-18	7.09E-18	6.47E-18	6.38E-18
Ra-225	7.17E-18	5.51E-18	4.65E-18	4.16E-18	3.28E-18	3.18E-18
Ra-226	5.89E-18	5.45E-18	5.15E-18	4.90E-18	4.47E-18	4.40E-18
Ra-227	1.50E-16	1.41E-16	1.35E-16	1.30E-16	1.22E-16	1.21E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-228	2.73E-20	1.95E-20	1.70E-20	1.54E-20	6.61E-21	6.05E-21
Ra-230	6.57E-17	6.06E-17	5.73E-17	5.45E-17	5.01E-17	4.94E-17
Actinium						
Ac-223	1.39E-17	1.28E-17	1.21E-17	1.15E-17	1.05E-17	1.03E-17
Ac-224	1.79E-16	1.65E-16	1.55E-16	1.48E-16	1.34E-16	1.32E-16
Ac-225	1.09E-17	1.01E-17	9.44E-18	8.97E-18	8.15E-18	8.02E-18
Ac-226	1.22E-16	1.14E-16	1.09E-16	1.05E-16	9.69E-17	9.57E-17
Ac-227	7.23E-20	6.22E-20	5.65E-20	5.30E-20	4.54E-20	4.44E-20
Ac-228	7.35E-16	6.82E-16	6.47E-16	6.19E-16	5.77E-16	5.71E-16
Ac-230	5.21E-16	4.91E-16	4.70E-16	4.54E-16	4.31E-16	4.27E-16
Ac-231	4.02E-16	3.76E-16	3.60E-16	3.45E-16	3.20E-16	3.16E-16
Ac-232	9.86E-16	9.23E-16	8.81E-16	8.48E-16	8.02E-16	7.95E-16
Ac-233	5.15E-16	4.83E-16	4.64E-16	4.46E-16	4.17E-16	4.13E-16
Thorium						
Th-223	5.41E-17	4.98E-17	4.64E-17	4.41E-17	4.00E-17	3.93E-17
Th-224	1.85E-17	1.71E-17	1.62E-17	1.54E-17	1.40E-17	1.38E-17
Th-226	6.13E-18	5.69E-18	5.35E-18	5.10E-18	4.61E-18	4.54E-18
Th-227	9.99E-17	9.18E-17	8.69E-17	8.25E-17	7.52E-17	7.41E-17
Th-228	1.58E-18	1.45E-18	1.35E-18	1.28E-18	1.17E-18	1.15E-18
Th-229	6.47E-17	5.94E-17	5.54E-17	5.26E-17	4.78E-17	4.69E-17
Th-230	2.95E-19	2.61E-19	2.40E-19	2.24E-19	2.02E-19	1.98E-19
Th-231	9.12E-18	8.05E-18	7.37E-18	6.94E-18	6.20E-18	6.07E-18
Th-232	1.56E-19	1.35E-19	1.22E-19	1.13E-19	1.00E-19	9.74E-20
Th-233	6.50E-17	6.27E-17	6.12E-17	5.99E-17	5.79E-17	5.76E-17
Th-234	6.53E-18	5.87E-18	5.40E-18	5.07E-18	4.58E-18	4.48E-18
Th-235	1.23E-16	1.19E-16	1.17E-16	1.15E-16	1.12E-16	1.12E-16
Th-236	5.55E-17	5.34E-17	5.19E-17	5.07E-17	4.87E-17	4.84E-17
Protactinium						
Pa-227	1.45E-17	1.31E-17	1.21E-17	1.15E-17	1.03E-17	1.01E-17
Pa-228	1.10E-15	1.01E-15	9.60E-16	9.16E-16	8.49E-16	8.39E-16
Pa-229	4.60E-17	4.24E-17	3.95E-17	3.75E-17	3.38E-17	3.33E-17
Pa-230	5.42E-16	5.01E-16	4.73E-16	4.51E-16	4.17E-16	4.12E-16
Pa-231	2.79E-17	2.55E-17	2.41E-17	2.29E-17	2.08E-17	2.05E-17
Pa-232	7.70E-16	7.10E-16	6.73E-16	6.41E-16	5.94E-16	5.86E-16
Pa-233	1.76E-16	1.62E-16	1.54E-16	1.46E-16	1.33E-16	1.32E-16
Pa-234	1.20E-15	1.11E-15	1.05E-15	1.00E-15	9.29E-16	9.17E-16
Pa-234m	1.10E-16	1.08E-16	1.07E-16	1.07E-16	1.06E-16	1.06E-16
Pa-235	5.03E-17	5.02E-17	5.02E-17	5.01E-17	5.00E-17	5.00E-17
Pa-236	8.05E-16	7.53E-16	7.18E-16	6.90E-16	6.49E-16	6.42E-16
Pa-237	5.68E-16	5.29E-16	5.05E-16	4.83E-16	4.52E-16	4.47E-16
Uranium						
U-227	9.23E-17	8.52E-17	8.04E-17	7.65E-17	6.96E-17	6.86E-17
U-228	3.06E-18	2.82E-18	2.64E-18	2.51E-18	2.27E-18	2.24E-18
U-230	8.70E-19	7.87E-19	7.31E-19	6.90E-19	6.26E-19	6.14E-19
U-231	5.27E-17	4.83E-17	4.49E-17	4.27E-17	3.84E-17	3.77E-17
U-232	2.06E-19	1.79E-19	1.64E-19	1.53E-19	1.31E-19	1.28E-19

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-233	2.06E-19	1.83E-19	1.70E-19	1.60E-19	1.41E-19	1.38E-19
U-234	1.15E-19	9.75E-20	8.83E-20	8.20E-20	6.69E-20	6.52E-20
U-235	1.31E-16	1.21E-16	1.14E-16	1.09E-16	9.92E-17	9.78E-17
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	6.76E-20	5.52E-20	4.95E-20	4.56E-20	3.49E-20	3.39E-20
U-237	1.04E-16	9.49E-17	8.87E-17	8.41E-17	7.59E-17	7.46E-17
U-238	5.66E-20	4.64E-20	4.17E-20	3.86E-20	3.00E-20	2.92E-20
U-239	7.28E-17	6.87E-17	6.61E-17	6.41E-17	6.19E-17	6.13E-17
U-240	3.60E-18	3.26E-18	3.03E-18	2.87E-18	2.55E-18	2.50E-18
U-242	6.66E-17	6.36E-17	6.18E-17	6.02E-17	5.79E-17	5.75E-17
Neptunium						
Np-232	9.77E-16	9.02E-16	8.54E-16	8.13E-16	7.51E-16	7.42E-16
Np-233	6.61E-17	6.12E-17	5.72E-17	5.45E-17	4.91E-17	4.83E-17
Np-234	8.59E-16	7.97E-16	7.55E-16	7.23E-16	6.76E-16	6.69E-16
Np-235	5.22E-19	4.56E-19	4.20E-19	3.97E-19	3.34E-19	3.27E-19
Np-236	1.07E-16	9.96E-17	9.32E-17	8.89E-17	8.02E-17	7.90E-17
Np-236m	3.67E-17	3.40E-17	3.19E-17	3.04E-17	2.74E-17	2.70E-17
Np-237	1.76E-17	1.57E-17	1.44E-17	1.37E-17	1.22E-17	1.20E-17
Np-238	4.93E-16	4.56E-16	4.32E-16	4.13E-16	3.85E-16	3.81E-16
Np-239	1.40E-16	1.30E-16	1.22E-16	1.17E-16	1.06E-16	1.04E-16
Np-240	8.78E-16	8.13E-16	7.71E-16	7.35E-16	6.81E-16	6.73E-16
Np-240m	3.35E-16	3.15E-16	3.03E-16	2.92E-16	2.75E-16	2.73E-16
Np-241	6.78E-17	6.56E-17	6.39E-17	6.27E-17	6.03E-17	5.99E-17
Np-242	3.10E-16	2.95E-16	2.84E-16	2.76E-16	2.64E-16	2.63E-16
Np-242m	8.09E-16	7.51E-16	7.15E-16	6.83E-16	6.37E-16	6.30E-16
Plutonium						
Pu-232	4.53E-17	4.21E-17	3.93E-17	3.75E-17	3.36E-17	3.31E-17
Pu-234	4.90E-17	4.55E-17	4.25E-17	4.05E-17	3.64E-17	3.58E-17
Pu-235	6.75E-17	6.26E-17	5.84E-17	5.57E-17	5.01E-17	4.94E-17
Pu-236	7.70E-20	5.91E-20	5.23E-20	4.81E-20	3.35E-20	3.22E-20
Pu-237	3.53E-17	3.26E-17	3.04E-17	2.90E-17	2.60E-17	2.56E-17
Pu-238	5.62E-20	4.15E-20	3.64E-20	3.34E-20	2.13E-20	2.03E-20
Pu-239	7.11E-20	6.07E-20	5.57E-20	5.22E-20	4.34E-20	4.24E-20
Pu-240	5.63E-20	4.19E-20	3.68E-20	3.38E-20	2.20E-20	2.10E-20
Pu-241	1.20E-21	1.11E-21	1.04E-21	9.89E-22	8.90E-22	8.76E-22
Pu-242	1.08E-19	9.21E-20	8.51E-20	8.05E-20	6.75E-20	6.62E-20
Pu-243	1.86E-17	1.69E-17	1.57E-17	1.48E-17	1.36E-17	1.34E-17
Pu-244	1.63E-17	1.53E-17	1.45E-17	1.40E-17	1.31E-17	1.30E-17
Pu-245	3.44E-16	3.19E-16	3.03E-16	2.89E-16	2.67E-16	2.64E-16
Pu-246	1.06E-16	9.76E-17	9.15E-17	8.70E-17	7.84E-17	7.72E-17
Americium						
Am-237	2.95E-16	2.73E-16	2.58E-16	2.46E-16	2.24E-16	2.21E-16
Am-238	7.26E-16	6.71E-16	6.35E-16	6.05E-16	5.61E-16	5.54E-16
Am-239	1.80E-16	1.67E-16	1.57E-16	1.50E-16	1.35E-16	1.33E-16
Am-240	8.36E-16	7.72E-16	7.30E-16	6.95E-16	6.45E-16	6.38E-16
Am-241	1.56E-17	1.32E-17	1.19E-17	1.08E-17	9.55E-18	9.30E-18

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-242	1.28E-17	1.20E-17	1.13E-17	1.09E-17	9.99E-18	9.86E-18
Am-242m	3.95E-19	3.14E-19	2.81E-19	2.62E-19	2.01E-19	1.95E-19
Am-243	3.94E-17	3.47E-17	3.15E-17	2.93E-17	2.70E-17	2.64E-17
Am-244	6.57E-16	6.07E-16	5.75E-16	5.47E-16	5.07E-16	5.01E-16
Am-244m	6.73E-17	6.62E-17	6.55E-17	6.50E-17	6.42E-17	6.41E-17
Am-245	3.71E-17	3.52E-17	3.39E-17	3.29E-17	3.09E-17	3.07E-17
Am-246	6.36E-16	5.90E-16	5.61E-16	5.35E-16	4.96E-16	4.89E-16
Am-246m	8.42E-16	7.81E-16	7.42E-16	7.09E-16	6.63E-16	6.56E-16
Am-247	1.53E-16	1.45E-16	1.40E-16	1.36E-16	1.27E-16	1.26E-16
Curium						
Cm-238	5.95E-17	5.54E-17	5.18E-17	4.94E-17	4.44E-17	4.37E-17
Cm-239	2.00E-16	1.86E-16	1.75E-16	1.67E-16	1.52E-16	1.49E-16
Cm-240	8.51E-20	6.15E-20	5.36E-20	4.94E-20	3.17E-20	3.01E-20
Cm-241	4.03E-16	3.74E-16	3.54E-16	3.37E-16	3.08E-16	3.04E-16
Cm-242	7.27E-20	5.18E-20	4.50E-20	4.14E-20	2.58E-20	2.44E-20
Cm-243	1.02E-16	9.40E-17	8.87E-17	8.46E-17	7.67E-17	7.55E-17
Cm-244	7.26E-20	5.42E-20	4.80E-20	4.46E-20	3.08E-20	2.96E-20
Cm-245	7.77E-17	7.22E-17	6.76E-17	6.45E-17	5.80E-17	5.72E-17
Cm-246	2.99E-18	2.79E-18	2.65E-18	2.55E-18	2.38E-18	2.36E-18
Cm-247	2.62E-16	2.43E-16	2.31E-16	2.19E-16	2.01E-16	1.98E-16
Cm-248	1.08E-15	1.01E-15	9.59E-16	9.21E-16	8.66E-16	8.57E-16
Cm-249	3.07E-17	2.94E-17	2.87E-17	2.79E-17	2.69E-17	2.67E-17
Cm-250	1.10E-14	1.03E-14	9.78E-15	9.40E-15	8.84E-15	8.75E-15
Cm-251	1.33E-16	1.26E-16	1.22E-16	1.18E-16	1.12E-16	1.11E-16
Berkelium						
Bk-245	1.78E-16	1.65E-16	1.56E-16	1.48E-16	1.34E-16	1.32E-16
Bk-246	6.90E-16	6.37E-16	6.03E-16	5.74E-16	5.31E-16	5.25E-16
Bk-247	1.15E-16	1.06E-16	9.94E-17	9.45E-17	8.61E-17	8.47E-17
Bk-248m	5.00E-17	4.69E-17	4.47E-17	4.30E-17	3.99E-17	3.94E-17
Bk-249	2.68E-21	2.13E-21	1.85E-21	1.70E-21	1.40E-21	1.36E-21
Bk-250	7.45E-16	6.88E-16	6.52E-16	6.22E-16	5.80E-16	5.73E-16
Bk-251	8.20E-17	7.76E-17	7.37E-17	7.11E-17	6.57E-17	6.49E-17
Californium						
Cf-244	8.88E-20	5.96E-20	5.07E-20	4.66E-20	2.71E-20	2.53E-20
Cf-246	9.59E-20	7.31E-20	6.50E-20	6.08E-20	4.51E-20	4.35E-20
Cf-247	6.93E-17	6.45E-17	6.04E-17	5.76E-17	5.18E-17	5.10E-17
Cf-248	3.50E-19	3.07E-19	2.87E-19	2.73E-19	2.42E-19	2.38E-19
Cf-249	2.71E-16	2.50E-16	2.38E-16	2.26E-16	2.07E-16	2.04E-16
Cf-250	8.05E-18	7.51E-18	7.15E-18	6.86E-18	6.44E-18	6.37E-18
Cf-251	9.21E-17	8.55E-17	8.04E-17	7.67E-17	6.94E-17	6.84E-17
Cf-252	3.73E-16	3.48E-16	3.32E-16	3.19E-16	3.00E-16	2.97E-16
Cf-253	4.78E-19	3.43E-19	2.91E-19	2.65E-19	1.87E-19	1.79E-19
Cf-254	1.38E-14	1.29E-14	1.23E-14	1.18E-14	1.11E-14	1.10E-14
Cf-255	5.70E-18	5.68E-18	5.66E-18	5.65E-18	5.63E-18	5.62E-18
Einsteinium						
Es-249	3.31E-16	3.06E-16	2.90E-16	2.76E-16	2.53E-16	2.49E-16

Table 4-1. Reference person effective dose rate coefficients for ground surface. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^2)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Es-250	9.68E-16	8.94E-16	8.45E-16	8.05E-16	7.41E-16	7.31E-16
Es-250m	4.40E-16	4.07E-16	3.85E-16	3.67E-16	3.40E-16	3.36E-16
Es-251	6.92E-17	6.45E-17	6.04E-17	5.76E-17	5.18E-17	5.11E-17
Es-253	2.92E-19	2.62E-19	2.46E-19	2.33E-19	2.08E-19	2.05E-19
Es-254	3.12E-18	2.59E-18	2.35E-18	2.18E-18	1.85E-18	1.80E-18
Es-254m	4.02E-16	3.71E-16	3.53E-16	3.36E-16	3.11E-16	3.07E-16
Es-255	5.81E-19	5.40E-19	5.13E-19	4.93E-19	4.62E-19	4.57E-19
Es-256	6.52E-17	6.49E-17	6.48E-17	6.47E-17	6.45E-17	6.45E-17
Fermium						
Fm-251	1.20E-16	1.11E-16	1.05E-16	1.00E-16	9.11E-17	8.98E-17
Fm-252	3.14E-19	2.68E-19	2.47E-19	2.35E-19	2.03E-19	2.00E-19
Fm-253	4.47E-17	4.15E-17	3.89E-17	3.71E-17	3.34E-17	3.29E-17
Fm-254	5.79E-18	5.38E-18	5.12E-18	4.91E-18	4.60E-18	4.55E-18
Fm-255	2.00E-18	1.61E-18	1.44E-18	1.34E-18	1.10E-18	1.07E-18
Fm-256	1.01E-14	9.47E-15	9.02E-15	8.66E-15	8.14E-15	8.06E-15
Fm-257	1.12E-16	1.04E-16	9.78E-17	9.34E-17	8.52E-17	8.40E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm.

Explanation of entries

For each radionuclide, values for the age-dependent effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. Reference person organ equivalent dose coefficients h_T are provided electronically.[12]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^3), that is, the effective dose per unit time-integrated exposure to a radionuclide

w_T: The tissue weighting factor

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^3) for tissue *T*.

The dose rate coefficients provided in Table 4-2 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

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

To convert from SI units (Sv Bq^{-1} s^{-1} m^3) to conventional units (mrem μCi^{-1} y^{-1} cm^3), multiply table entries by 1.168×10^{23}.

To convert from SI units for a source per unit volume (Sv Bq^{-1} s^{-1} m^3) to conventional units for a source per unit mass basis (mrem μCi^{-1} y^{-1} g), multiply table entries by 1.868×10^{23}.

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

[12] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	1.80E-27	1.18E-27	9.56E-28	8.44E-28	2.72E-28	2.49E-28
Beryllium						
Be-7	3.90E-19	3.62E-19	3.44E-19	3.27E-19	3.00E-19	2.95E-19
Be-10	2.76E-21	2.44E-21	2.24E-21	2.12E-21	1.89E-21	1.86E-21
Carbon						
C-10	1.37E-17	1.27E-17	1.20E-17	1.15E-17	1.06E-17	1.04E-17
C-11	7.99E-18	7.42E-18	7.03E-18	6.70E-18	6.14E-18	6.06E-18
C-14	6.31E-23	4.89E-23	4.19E-23	3.82E-23	3.03E-23	2.95E-23
Nitrogen						
N-13	8.01E-18	7.43E-18	7.05E-18	6.72E-18	6.16E-18	6.07E-18
N-16	2.48E-17	2.37E-17	2.29E-17	2.22E-17	2.12E-17	2.11E-17
Oxygen						
O-14	2.35E-17	2.20E-17	2.09E-17	2.01E-17	1.88E-17	1.86E-17
O-15	8.07E-18	7.49E-18	7.10E-18	6.77E-18	6.21E-18	6.12E-18
O-19	7.34E-18	6.84E-18	6.48E-18	6.23E-18	5.81E-18	5.74E-18
Fluorine						
F-17	8.07E-18	7.49E-18	7.10E-18	6.77E-18	6.21E-18	6.12E-18
F-18	7.74E-18	7.18E-18	6.81E-18	6.49E-18	5.95E-18	5.86E-18
Neon						
Ne-19	8.13E-18	7.55E-18	7.16E-18	6.83E-18	6.27E-18	6.18E-18
Ne-24	4.33E-18	4.02E-18	3.82E-18	3.64E-18	3.34E-18	3.30E-18
Sodium						
Na-22	1.66E-17	1.54E-17	1.46E-17	1.40E-17	1.29E-17	1.28E-17
Na-24	2.79E-17	2.62E-17	2.48E-17	2.40E-17	2.26E-17	2.24E-17
Magnesium						
Mg-27	6.93E-18	6.41E-18	6.06E-18	5.80E-18	5.37E-18	5.31E-18
Mg-28	1.02E-17	9.42E-18	8.90E-18	8.53E-18	7.93E-18	7.84E-18
Aluminum						
Al-26	1.95E-17	1.82E-17	1.72E-17	1.65E-17	1.54E-17	1.52E-17
Al-28	1.27E-17	1.19E-17	1.13E-17	1.09E-17	1.02E-17	1.01E-17
Al-29	1.02E-17	9.50E-18	9.00E-18	8.65E-18	8.09E-18	8.01E-18
Silicon						
Si-31	5.70E-20	5.50E-20	5.37E-20	5.28E-20	5.12E-20	5.09E-20
Si-32	1.59E-22	1.29E-22	1.12E-22	1.03E-22	8.50E-23	8.31E-23
Phosphorus						
P-30	8.28E-18	7.69E-18	7.30E-18	6.97E-18	6.40E-18	6.31E-18
P-32	7.18E-20	6.98E-20	6.85E-20	6.76E-20	6.59E-20	6.57E-20
P-33	2.08E-22	1.70E-22	1.49E-22	1.37E-22	1.14E-22	1.12E-22
Sulfur						
S-35	6.68E-23	5.21E-23	4.47E-23	4.09E-23	3.26E-23	3.18E-23
S-37	1.86E-17	1.76E-17	1.68E-17	1.62E-17	1.54E-17	1.53E-17
S-38	1.18E-17	1.10E-17	1.04E-17	1.01E-17	9.50E-18	9.41E-18
Chlorine						
Cl-34	8.48E-18	7.89E-18	7.50E-18	7.16E-18	6.59E-18	6.50E-18
Cl-34m	1.49E-17	1.39E-17	1.32E-17	1.27E-17	1.19E-17	1.18E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	6.01E-21	5.55E-21	5.25E-21	5.05E-21	4.67E-21	4.62E-21
Cl-38	1.03E-17	9.67E-18	9.18E-18	8.87E-18	8.37E-18	8.29E-18
Cl-39	1.08E-17	1.00E-17	9.49E-18	9.13E-18	8.51E-18	8.42E-18
Cl-40	2.75E-17	2.58E-17	2.45E-17	2.37E-17	2.24E-17	2.21E-17
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	2.21E-21	1.95E-21	1.79E-21	1.69E-21	1.50E-21	1.48E-21
Ar-41	9.52E-18	8.83E-18	8.36E-18	8.03E-18	7.49E-18	7.41E-18
Ar-42	2.68E-21	2.39E-21	2.21E-21	2.10E-21	1.88E-21	1.86E-21
Ar-43	1.14E-17	1.06E-17	1.00E-17	9.66E-18	9.03E-18	8.94E-18
Ar-44	1.38E-17	1.29E-17	1.22E-17	1.18E-17	1.10E-17	1.09E-17
Potassium						
K-38	2.29E-17	2.14E-17	2.03E-17	1.95E-17	1.83E-17	1.81E-17
K-40	1.18E-18	1.10E-18	1.04E-18	1.00E-18	9.41E-19	9.32E-19
K-42	2.30E-18	2.15E-18	2.05E-18	1.98E-18	1.86E-18	1.84E-18
K-43	7.54E-18	6.99E-18	6.62E-18	6.32E-18	5.79E-18	5.71E-18
K-44	1.70E-17	1.59E-17	1.51E-17	1.45E-17	1.36E-17	1.35E-17
K-45	1.31E-17	1.23E-17	1.16E-17	1.12E-17	1.05E-17	1.04E-17
K-46	2.01E-17	1.88E-17	1.79E-17	1.73E-17	1.63E-17	1.61E-17
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	2.18E-22	1.78E-22	1.57E-22	1.45E-22	1.20E-22	1.18E-22
Ca-47	7.83E-18	7.27E-18	6.88E-18	6.60E-18	6.15E-18	6.09E-18
Ca-49	2.00E-17	1.89E-17	1.81E-17	1.75E-17	1.66E-17	1.65E-17
Scandium						
Sc-42m	3.17E-17	2.95E-17	2.79E-17	2.68E-17	2.48E-17	2.46E-17
Sc-43	7.72E-18	7.17E-18	6.80E-18	6.48E-18	5.94E-18	5.85E-18
Sc-44	1.64E-17	1.52E-17	1.44E-17	1.38E-17	1.27E-17	1.26E-17
Sc-44m	2.12E-18	1.97E-18	1.86E-18	1.78E-18	1.62E-18	1.60E-18
Sc-46	1.53E-17	1.41E-17	1.34E-17	1.28E-17	1.19E-17	1.17E-17
Sc-47	8.26E-19	7.73E-19	7.25E-19	6.92E-19	6.29E-19	6.19E-19
Sc-48	2.52E-17	2.34E-17	2.21E-17	2.12E-17	1.97E-17	1.95E-17
Sc-49	1.09E-19	1.06E-19	1.04E-19	1.02E-19	9.97E-20	9.93E-20
Sc-50	2.40E-17	2.23E-17	2.12E-17	2.03E-17	1.89E-17	1.87E-17
Titanium						
Ti-44	9.44E-19	8.31E-19	7.61E-19	7.11E-19	6.28E-19	6.20E-19
Ti-45	6.83E-18	6.33E-18	6.01E-18	5.73E-18	5.25E-18	5.17E-18
Ti-51	2.98E-18	2.78E-18	2.63E-18	2.52E-18	2.30E-18	2.27E-18
Ti-52	1.01E-18	9.51E-19	8.94E-19	8.57E-19	7.80E-19	7.68E-19
Vanadium						
V-47	7.88E-18	7.31E-18	6.94E-18	6.62E-18	6.07E-18	5.98E-18
V-48	2.20E-17	2.04E-17	1.93E-17	1.85E-17	1.71E-17	1.69E-17
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	1.03E-17	9.59E-18	9.08E-18	8.74E-18	8.18E-18	8.09E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
V-52	1.07E-17	9.95E-18	9.42E-18	9.07E-18	8.49E-18	8.40E-18
V-53	8.04E-18	7.44E-18	7.04E-18	6.75E-18	6.27E-18	6.20E-18
Chromium						
Cr-48	3.34E-18	3.11E-18	2.94E-18	2.81E-18	2.55E-18	2.51E-18
Cr-49	8.24E-18	7.64E-18	7.24E-18	6.90E-18	6.31E-18	6.22E-18
Cr-51	2.48E-19	2.30E-19	2.18E-19	2.08E-19	1.89E-19	1.86E-19
Cr-55	1.83E-19	1.78E-19	1.75E-19	1.73E-19	1.68E-19	1.68E-19
Cr-56	6.32E-19	5.67E-19	5.25E-19	4.96E-19	4.43E-19	4.37E-19
Manganese						
Mn-50m	3.53E-17	3.28E-17	3.11E-17	2.97E-17	2.76E-17	2.73E-17
Mn-51	7.94E-18	7.37E-18	6.99E-18	6.67E-18	6.12E-18	6.03E-18
Mn-52	2.61E-17	2.42E-17	2.29E-17	2.19E-17	2.03E-17	2.01E-17
Mn-52m	1.83E-17	1.70E-17	1.61E-17	1.54E-17	1.43E-17	1.41E-17
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	6.45E-18	5.96E-18	5.64E-18	5.39E-18	4.98E-18	4.92E-18
Mn-56	1.25E-17	1.16E-17	1.10E-17	1.06E-17	9.87E-18	9.77E-18
Mn-57	9.09E-19	8.52E-19	8.12E-19	7.81E-19	7.28E-19	7.20E-19
Mn-58m	1.81E-17	1.68E-17	1.59E-17	1.53E-17	1.43E-17	1.41E-17
Iron						
Fe-52	5.75E-18	5.35E-18	5.06E-18	4.83E-18	4.41E-18	4.35E-18
Fe-53	9.37E-18	8.70E-18	8.26E-18	7.88E-18	7.23E-18	7.13E-18
Fe-53m	2.28E-17	2.11E-17	2.00E-17	1.92E-17	1.79E-17	1.77E-17
Fe-55	1.20E-27	1.13E-27	1.06E-27	1.01E-27	9.12E-28	8.97E-28
Fe-59	8.89E-18	8.24E-18	7.79E-18	7.47E-18	6.96E-18	6.88E-18
Fe-60	1.21E-22	9.60E-23	8.30E-23	7.60E-23	6.16E-23	6.02E-23
Fe-61	1.05E-17	9.76E-18	9.24E-18	8.87E-18	8.27E-18	8.17E-18
Fe-62	4.06E-18	3.78E-18	3.58E-18	3.42E-18	3.14E-18	3.09E-18
Cobalt						
Co-54m	3.02E-17	2.80E-17	2.66E-17	2.54E-17	2.36E-17	2.33E-17
Co-55	1.53E-17	1.42E-17	1.35E-17	1.29E-17	1.19E-17	1.17E-17
Co-56	2.61E-17	2.43E-17	2.31E-17	2.22E-17	2.07E-17	2.05E-17
Co-57	8.94E-19	8.39E-19	7.86E-19	7.51E-19	6.79E-19	6.68E-19
Co-58	7.54E-18	6.98E-18	6.60E-18	6.31E-18	5.82E-18	5.75E-18
Co-58m	2.30E-23	1.53E-23	1.24E-23	1.10E-23	7.72E-24	7.33E-24
Co-60	1.86E-17	1.72E-17	1.63E-17	1.57E-17	1.46E-17	1.44E-17
Co-60m	3.23E-20	2.94E-20	2.74E-20	2.61E-20	2.39E-20	2.37E-20
Co-61	7.14E-19	6.40E-19	5.93E-19	5.59E-19	5.05E-19	4.99E-19
Co-62	1.20E-17	1.11E-17	1.06E-17	1.02E-17	9.52E-18	9.42E-18
Co-62m	1.99E-17	1.85E-17	1.75E-17	1.68E-17	1.57E-17	1.56E-17
Nickel						
Ni-56	1.32E-17	1.22E-17	1.16E-17	1.10E-17	1.02E-17	1.01E-17
Ni-57	1.43E-17	1.33E-17	1.26E-17	1.21E-17	1.13E-17	1.11E-17
Ni-59	1.22E-22	1.13E-22	1.07E-22	1.02E-22	9.34E-23	9.21E-23
Ni-63	2.37E-24	1.65E-24	1.35E-24	1.22E-24	8.13E-25	7.75E-25
Ni-65	4.18E-18	3.88E-18	3.68E-18	3.54E-18	3.30E-18	3.27E-18
Ni-66	1.97E-22	1.61E-22	1.41E-22	1.30E-22	1.08E-22	1.06E-22

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Copper						
Cu-57	9.97E-18	9.29E-18	8.84E-18	8.46E-18	7.81E-18	7.71E-18
Cu-59	1.15E-17	1.07E-17	1.01E-17	9.66E-18	8.90E-18	8.78E-18
Cu-60	2.87E-17	2.67E-17	2.53E-17	2.43E-17	2.26E-17	2.24E-17
Cu-61	6.43E-18	5.96E-18	5.65E-18	5.39E-18	4.94E-18	4.87E-18
Cu-62	8.11E-18	7.53E-18	7.15E-18	6.82E-18	6.27E-18	6.18E-18
Cu-64	1.44E-18	1.34E-18	1.27E-18	1.21E-18	1.11E-18	1.09E-18
Cu-66	9.14E-19	8.53E-19	8.13E-19	7.84E-19	7.35E-19	7.28E-19
Cu-67	8.68E-19	8.08E-19	7.58E-19	7.26E-19	6.56E-19	6.46E-19
Cu-69	4.15E-18	3.85E-18	3.64E-18	3.49E-18	3.24E-18	3.20E-18
Zinc						
Zn-60	1.21E-17	1.12E-17	1.06E-17	1.02E-17	9.32E-18	9.19E-18
Zn-61	1.21E-17	1.12E-17	1.07E-17	1.02E-17	9.44E-18	9.31E-18
Zn-62	3.41E-18	3.15E-18	2.99E-18	2.85E-18	2.61E-18	2.57E-18
Zn-63	8.68E-18	8.06E-18	7.64E-18	7.29E-18	6.70E-18	6.61E-18
Zn-65	4.37E-18	4.04E-18	3.82E-18	3.66E-18	3.41E-18	3.37E-18
Zn-69	9.49E-21	8.97E-21	8.63E-21	8.42E-21	8.00E-21	7.94E-21
Zn-69m	3.26E-18	3.02E-18	2.87E-18	2.73E-18	2.50E-18	2.46E-18
Zn-71	2.60E-18	2.42E-18	2.30E-18	2.20E-18	2.03E-18	2.01E-18
Zn-71m	1.22E-17	1.13E-17	1.07E-17	1.02E-17	9.38E-18	9.25E-18
Zn-72	1.10E-18	1.03E-18	9.65E-19	9.21E-19	8.36E-19	8.22E-19
Gallium						
Ga-64	2.46E-17	2.30E-17	2.18E-17	2.09E-17	1.95E-17	1.93E-17
Ga-65	9.12E-18	8.47E-18	8.02E-18	7.65E-18	7.02E-18	6.92E-18
Ga-66	1.75E-17	1.63E-17	1.55E-17	1.49E-17	1.40E-17	1.39E-17
Ga-67	1.17E-18	1.09E-18	1.02E-18	9.80E-19	8.87E-19	8.73E-19
Ga-68	7.50E-18	6.96E-18	6.60E-18	6.30E-18	5.78E-18	5.70E-18
Ga-70	1.18E-19	1.12E-19	1.08E-19	1.05E-19	1.00E-19	9.95E-20
Ga-72	1.96E-17	1.82E-17	1.73E-17	1.66E-17	1.55E-17	1.54E-17
Ga-73	2.71E-18	2.52E-18	2.38E-18	2.28E-18	2.07E-18	2.04E-18
Ga-74	2.25E-17	2.10E-17	1.99E-17	1.92E-17	1.79E-17	1.78E-17
Germanium						
Ge-66	5.20E-18	4.81E-18	4.55E-18	4.34E-18	3.97E-18	3.91E-18
Ge-67	1.12E-17	1.04E-17	9.83E-18	9.40E-18	8.65E-18	8.53E-18
Ge-68	4.26E-23	2.63E-23	2.03E-23	1.71E-23	5.27E-24	4.85E-24
Ge-69	7.23E-18	6.70E-18	6.35E-18	6.07E-18	5.62E-18	5.55E-18
Ge-71	4.32E-23	2.67E-23	2.06E-23	1.73E-23	5.35E-24	4.92E-24
Ge-75	2.95E-19	2.75E-19	2.60E-19	2.50E-19	2.28E-19	2.24E-19
Ge-77	8.31E-18	7.72E-18	7.30E-18	7.00E-18	6.44E-18	6.35E-18
Ge-78	2.16E-18	2.01E-18	1.90E-18	1.82E-18	1.65E-18	1.63E-18
Arsenic						
As-68	2.82E-17	2.62E-17	2.49E-17	2.38E-17	2.21E-17	2.19E-17
As-69	9.07E-18	8.43E-18	7.99E-18	7.64E-18	7.02E-18	6.93E-18
As-70	3.20E-17	2.97E-17	2.82E-17	2.70E-17	2.50E-17	2.47E-17
As-71	4.43E-18	4.11E-18	3.89E-18	3.72E-18	3.40E-18	3.35E-18
As-72	1.39E-17	1.29E-17	1.22E-17	1.17E-17	1.08E-17	1.06E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-73	3.68E-20	3.09E-20	2.71E-20	2.49E-20	2.10E-20	2.06E-20
As-74	5.93E-18	5.49E-18	5.21E-18	4.97E-18	4.56E-18	4.50E-18
As-76	3.38E-18	3.14E-18	2.98E-18	2.85E-18	2.64E-18	2.61E-18
As-77	6.73E-20	6.25E-20	5.90E-20	5.65E-20	5.14E-20	5.06E-20
As-78	9.97E-18	9.27E-18	8.79E-18	8.44E-18	7.85E-18	7.76E-18
As-79	3.81E-19	3.58E-19	3.43E-19	3.32E-19	3.11E-19	3.08E-19
Selenium						
Se-70	5.54E-18	5.13E-18	4.86E-18	4.63E-18	4.23E-18	4.17E-18
Se-71	1.26E-17	1.17E-17	1.11E-17	1.06E-17	9.80E-18	9.67E-18
Se-72	1.63E-19	1.32E-19	1.13E-19	1.03E-19	8.40E-20	8.24E-20
Se-73	8.49E-18	7.86E-18	7.44E-18	7.09E-18	6.48E-18	6.39E-18
Se-73m	2.06E-18	1.91E-18	1.81E-18	1.72E-18	1.58E-18	1.56E-18
Se-75	2.94E-18	2.74E-18	2.58E-18	2.47E-18	2.24E-18	2.21E-18
Se-77m	6.54E-19	6.12E-19	5.74E-19	5.48E-19	4.98E-19	4.90E-19
Se-79	7.23E-23	5.61E-23	4.80E-23	4.38E-23	3.49E-23	3.40E-23
Se-79m	6.59E-20	6.09E-20	5.67E-20	5.41E-20	4.82E-20	4.74E-20
Se-81	1.18E-19	1.11E-19	1.07E-19	1.04E-19	9.84E-20	9.76E-20
Se-81m	1.00E-19	9.34E-20	8.73E-20	8.34E-20	7.47E-20	7.35E-20
Se-83	1.96E-17	1.82E-17	1.72E-17	1.65E-17	1.53E-17	1.51E-17
Se-83m	7.54E-18	7.01E-18	6.65E-18	6.38E-18	5.95E-18	5.88E-18
Se-84	3.33E-18	3.10E-18	2.93E-18	2.80E-18	2.56E-18	2.52E-18
Bromine						
Br-72	2.32E-17	2.15E-17	2.04E-17	1.96E-17	1.81E-17	1.79E-17
Br-73	1.14E-17	1.06E-17	1.00E-17	9.55E-18	8.78E-18	8.66E-18
Br-74	3.18E-17	2.98E-17	2.83E-17	2.73E-17	2.55E-17	2.53E-17
Br-74m	3.02E-17	2.82E-17	2.67E-17	2.57E-17	2.39E-17	2.36E-17
Br-75	9.38E-18	8.71E-18	8.25E-18	7.88E-18	7.21E-18	7.11E-18
Br-76	2.03E-17	1.89E-17	1.80E-17	1.72E-17	1.61E-17	1.59E-17
Br-76m	2.24E-19	1.89E-19	1.67E-19	1.54E-19	1.31E-19	1.29E-19
Br-77	2.45E-18	2.27E-18	2.15E-18	2.06E-18	1.88E-18	1.85E-18
Br-77m	1.08E-19	1.00E-19	9.39E-20	8.97E-20	8.04E-20	7.91E-20
Br-78	8.24E-18	7.65E-18	7.26E-18	6.93E-18	6.36E-18	6.27E-18
Br-80	6.78E-19	6.32E-19	6.02E-19	5.77E-19	5.35E-19	5.28E-19
Br-80m	7.31E-20	5.43E-20	4.46E-20	3.99E-20	3.09E-20	2.99E-20
Br-82	2.02E-17	1.87E-17	1.77E-17	1.69E-17	1.57E-17	1.55E-17
Br-82m	2.82E-20	2.61E-20	2.48E-20	2.38E-20	2.20E-20	2.17E-20
Br-83	6.39E-20	5.95E-20	5.66E-20	5.42E-20	5.00E-20	4.93E-20
Br-84	1.24E-17	1.16E-17	1.10E-17	1.06E-17	9.97E-18	9.87E-18
Br-84m	2.09E-17	1.94E-17	1.83E-17	1.76E-17	1.63E-17	1.61E-17
Br-85	6.64E-19	6.23E-19	5.95E-19	5.75E-19	5.40E-19	5.35E-19
Krypton						
Kr-74	8.26E-18	7.66E-18	7.25E-18	6.92E-18	6.33E-18	6.24E-18
Kr-75	1.02E-17	9.50E-18	9.01E-18	8.60E-18	7.91E-18	7.80E-18
Kr-76	3.25E-18	3.01E-18	2.84E-18	2.72E-18	2.47E-18	2.44E-18
Kr-77	8.13E-18	7.56E-18	7.16E-18	6.83E-18	6.25E-18	6.16E-18
Kr-79	1.94E-18	1.80E-18	1.70E-18	1.62E-18	1.49E-18	1.46E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-81	7.48E-21	6.66E-21	6.19E-21	5.89E-21	5.02E-21	4.94E-21
Kr-81m	9.84E-19	9.18E-19	8.63E-19	8.27E-19	7.49E-19	7.38E-19
Kr-83m	5.08E-22	3.47E-22	2.86E-22	2.57E-22	9.73E-23	9.00E-23
Kr-85	2.14E-20	1.98E-20	1.88E-20	1.79E-20	1.64E-20	1.62E-20
Kr-85m	1.20E-18	1.12E-18	1.05E-18	1.00E-18	9.13E-19	8.98E-19
Kr-87	5.87E-18	5.50E-18	5.23E-18	5.03E-18	4.71E-18	4.66E-18
Kr-88	1.35E-17	1.27E-17	1.20E-17	1.16E-17	1.09E-17	1.08E-17
Kr-89	1.39E-17	1.30E-17	1.24E-17	1.19E-17	1.11E-17	1.10E-17
Rubidium						
Rb-77	1.23E-17	1.14E-17	1.08E-17	1.03E-17	9.48E-18	9.35E-18
Rb-78	2.84E-17	2.66E-17	2.53E-17	2.43E-17	2.28E-17	2.25E-17
Rb-78m	2.43E-17	2.26E-17	2.15E-17	2.06E-17	1.91E-17	1.88E-17
Rb-79	1.13E-17	1.05E-17	9.96E-18	9.51E-18	8.73E-18	8.60E-18
Rb-80	9.80E-18	9.11E-18	8.65E-18	8.26E-18	7.60E-18	7.50E-18
Rb-81	3.93E-18	3.65E-18	3.46E-18	3.30E-18	3.02E-18	2.98E-18
Rb-81m	1.84E-19	1.70E-19	1.60E-19	1.53E-19	1.39E-19	1.37E-19
Rb-82	8.93E-18	8.30E-18	7.88E-18	7.52E-18	6.91E-18	6.82E-18
Rb-82m	2.23E-17	2.07E-17	1.96E-17	1.87E-17	1.73E-17	1.71E-17
Rb-83	3.79E-18	3.51E-18	3.33E-18	3.17E-18	2.91E-18	2.87E-18
Rb-84	6.99E-18	6.47E-18	6.12E-18	5.85E-18	5.40E-18	5.33E-18
Rb-84m	2.96E-18	2.75E-18	2.60E-18	2.48E-18	2.26E-18	2.23E-18
Rb-86	7.77E-19	7.22E-19	6.86E-19	6.59E-19	6.15E-19	6.09E-19
Rb-86m	4.27E-18	3.96E-18	3.75E-18	3.58E-18	3.28E-18	3.24E-18
Rb-87	4.83E-22	4.03E-22	3.58E-22	3.32E-22	2.81E-22	2.75E-22
Rb-88	5.01E-18	4.70E-18	4.47E-18	4.31E-18	4.06E-18	4.02E-18
Rb-89	1.64E-17	1.52E-17	1.44E-17	1.39E-17	1.30E-17	1.28E-17
Rb-90	1.35E-17	1.27E-17	1.21E-17	1.17E-17	1.11E-17	1.10E-17
Rb-90m	2.26E-17	2.12E-17	2.01E-17	1.94E-17	1.82E-17	1.80E-17
Strontium						
Sr-79	9.58E-18	8.90E-18	8.44E-18	8.06E-18	7.40E-18	7.29E-18
Sr-80	3.36E-18	3.11E-18	2.95E-18	2.81E-18	2.58E-18	2.54E-18
Sr-81	1.09E-17	1.01E-17	9.61E-18	9.17E-18	8.42E-18	8.30E-18
Sr-82	2.21E-21	1.52E-21	1.28E-21	1.16E-21	4.00E-22	3.65E-22
Sr-83	6.25E-18	5.80E-18	5.49E-18	5.25E-18	4.83E-18	4.77E-18
Sr-85	3.85E-18	3.57E-18	3.39E-18	3.23E-18	2.96E-18	2.92E-18
Sr-85m	1.66E-18	1.55E-18	1.46E-18	1.40E-18	1.27E-18	1.25E-18
Sr-87m	2.49E-18	2.32E-18	2.19E-18	2.09E-18	1.91E-18	1.88E-18
Sr-89	5.26E-20	5.11E-20	5.01E-20	4.94E-20	4.80E-20	4.79E-20
Sr-90	1.79E-21	1.57E-21	1.43E-21	1.35E-21	1.19E-21	1.17E-21
Sr-91	5.50E-18	5.09E-18	4.82E-18	4.61E-18	4.27E-18	4.22E-18
Sr-92	9.83E-18	9.13E-18	8.64E-18	8.30E-18	7.75E-18	7.67E-18
Sr-93	1.70E-17	1.58E-17	1.49E-17	1.43E-17	1.33E-17	1.31E-17
Sr-94	1.05E-17	9.80E-18	9.28E-18	8.92E-18	8.34E-18	8.26E-18
Yttrium						
Y-81	9.51E-18	8.85E-18	8.39E-18	8.01E-18	7.36E-18	7.25E-18
Y-83	1.06E-17	9.82E-18	9.31E-18	8.90E-18	8.19E-18	8.08E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-83m	6.66E-18	6.19E-18	5.87E-18	5.60E-18	5.13E-18	5.06E-18
Y-84m	3.06E-17	2.84E-17	2.69E-17	2.57E-17	2.38E-17	2.35E-17
Y-85	8.46E-18	7.85E-18	7.44E-18	7.10E-18	6.51E-18	6.42E-18
Y-85m	9.98E-18	9.29E-18	8.80E-18	8.43E-18	7.81E-18	7.71E-18
Y-86	2.67E-17	2.48E-17	2.34E-17	2.25E-17	2.09E-17	2.06E-17
Y-86m	1.69E-18	1.57E-18	1.48E-18	1.42E-18	1.29E-18	1.27E-18
Y-87	3.43E-18	3.18E-18	3.02E-18	2.87E-18	2.63E-18	2.59E-18
Y-87m	2.39E-18	2.22E-18	2.10E-18	2.01E-18	1.83E-18	1.80E-18
Y-88	1.94E-17	1.80E-17	1.71E-17	1.64E-17	1.54E-17	1.52E-17
Y-89m	6.93E-18	6.40E-18	6.06E-18	5.79E-18	5.36E-18	5.30E-18
Y-90	1.36E-19	1.32E-19	1.30E-19	1.28E-19	1.25E-19	1.25E-19
Y-90m	4.94E-18	4.59E-18	4.34E-18	4.14E-18	3.78E-18	3.72E-18
Y-91	7.94E-20	7.61E-20	7.39E-20	7.23E-20	6.96E-20	6.92E-20
Y-91m	4.13E-18	3.83E-18	3.63E-18	3.46E-18	3.17E-18	3.13E-18
Y-92	2.20E-18	2.05E-18	1.95E-18	1.88E-18	1.76E-18	1.74E-18
Y-93	9.11E-19	8.57E-19	8.18E-19	7.91E-19	7.44E-19	7.37E-19
Y-94	6.23E-18	5.79E-18	5.50E-18	5.28E-18	4.92E-18	4.86E-18
Y-95	7.85E-18	7.36E-18	7.00E-18	6.76E-18	6.37E-18	6.31E-18
Zirconium						
Zr-85	1.17E-17	1.08E-17	1.03E-17	9.82E-18	9.03E-18	8.91E-18
Zr-86	2.13E-18	1.97E-18	1.86E-18	1.78E-18	1.61E-18	1.59E-18
Zr-87	7.32E-18	6.80E-18	6.45E-18	6.15E-18	5.66E-18	5.58E-18
Zr-88	2.99E-18	2.78E-18	2.63E-18	2.51E-18	2.29E-18	2.26E-18
Zr-89	8.88E-18	8.21E-18	7.77E-18	7.43E-18	6.86E-18	6.77E-18
Zr-89m	4.90E-18	4.54E-18	4.31E-18	4.11E-18	3.79E-18	3.73E-18
Zr-93	2.76E-24	1.91E-24	1.58E-24	1.42E-24	9.43E-25	8.98E-25
Zr-95	5.69E-18	5.26E-18	4.98E-18	4.76E-18	4.39E-18	4.33E-18
Zr-97	6.87E-18	6.36E-18	6.02E-18	5.76E-18	5.32E-18	5.25E-18
Niobium						
Nb-87	9.82E-18	9.13E-18	8.66E-18	8.27E-18	7.59E-18	7.48E-18
Nb-88	3.26E-17	3.02E-17	2.86E-17	2.74E-17	2.53E-17	2.50E-17
Nb-88m	3.15E-17	2.92E-17	2.77E-17	2.65E-17	2.45E-17	2.42E-17
Nb-89	1.03E-17	9.60E-18	9.11E-18	8.74E-18	8.10E-18	8.00E-18
Nb-89m	1.03E-17	9.56E-18	9.07E-18	8.65E-18	7.94E-18	7.83E-18
Nb-90	2.99E-17	2.79E-17	2.65E-17	2.55E-17	2.38E-17	2.36E-17
Nb-91	1.78E-20	1.53E-20	1.41E-20	1.34E-20	1.09E-20	1.07E-20
Nb-91m	1.92E-19	1.76E-19	1.66E-19	1.60E-19	1.47E-19	1.45E-19
Nb-92	1.16E-17	1.07E-17	1.01E-17	9.68E-18	8.93E-18	8.81E-18
Nb-92m	7.35E-18	6.79E-18	6.42E-18	6.15E-18	5.69E-18	5.63E-18
Nb-93m	1.19E-21	8.11E-22	6.94E-22	6.43E-22	3.07E-22	2.81E-22
Nb-94	1.21E-17	1.12E-17	1.06E-17	1.01E-17	9.31E-18	9.20E-18
Nb-94m	3.86E-20	3.45E-20	3.24E-20	3.09E-20	2.75E-20	2.70E-20
Nb-95	5.93E-18	5.49E-18	5.19E-18	4.96E-18	4.58E-18	4.52E-18
Nb-95m	4.88E-19	4.53E-19	4.26E-19	4.09E-19	3.70E-19	3.64E-19
Nb-96	1.89E-17	1.75E-17	1.66E-17	1.58E-17	1.46E-17	1.45E-17
Nb-97	5.21E-18	4.82E-18	4.57E-18	4.36E-18	4.02E-18	3.96E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-98m	2.14E-17	1.98E-17	1.88E-17	1.80E-17	1.67E-17	1.65E-17
Nb-99	1.53E-18	1.44E-18	1.36E-18	1.31E-18	1.20E-18	1.19E-18
Nb-99m	5.55E-18	5.20E-18	4.94E-18	4.77E-18	4.48E-18	4.43E-18
Molybdenum						
Mo-89	9.89E-18	9.20E-18	8.73E-18	8.35E-18	7.70E-18	7.59E-18
Mo-90	6.30E-18	5.85E-18	5.53E-18	5.29E-18	4.84E-18	4.77E-18
Mo-91	7.92E-18	7.36E-18	6.99E-18	6.67E-18	6.13E-18	6.05E-18
Mo-91m	1.06E-17	9.85E-18	9.33E-18	8.93E-18	8.27E-18	8.16E-18
Mo-93	6.65E-21	4.54E-21	3.89E-21	3.60E-21	1.72E-21	1.58E-21
Mo-93m	1.72E-17	1.60E-17	1.51E-17	1.45E-17	1.35E-17	1.34E-17
Mo-99	1.17E-18	1.08E-18	1.02E-18	9.76E-19	8.98E-19	8.87E-19
Mo-101	1.10E-17	1.02E-17	9.64E-18	9.25E-18	8.60E-18	8.50E-18
Mo-102	1.54E-19	1.44E-19	1.36E-19	1.30E-19	1.19E-19	1.17E-19
Technetium						
Tc-91	1.84E-17	1.72E-17	1.63E-17	1.57E-17	1.46E-17	1.44E-17
Tc-91m	1.15E-17	1.07E-17	1.01E-17	9.69E-18	8.92E-18	8.80E-18
Tc-92	2.91E-17	2.71E-17	2.57E-17	2.46E-17	2.28E-17	2.25E-17
Tc-93	1.14E-17	1.06E-17	1.00E-17	9.65E-18	9.02E-18	8.92E-18
Tc-93m	6.59E-18	6.17E-18	5.86E-18	5.64E-18	5.27E-18	5.22E-18
Tc-94	2.05E-17	1.89E-17	1.79E-17	1.71E-17	1.58E-17	1.56E-17
Tc-94m	1.49E-17	1.38E-17	1.31E-17	1.25E-17	1.16E-17	1.15E-17
Tc-95	6.09E-18	5.63E-18	5.33E-18	5.09E-18	4.69E-18	4.64E-18
Tc-95m	5.25E-18	4.86E-18	4.59E-18	4.39E-18	4.03E-18	3.98E-18
Tc-96	1.93E-17	1.78E-17	1.68E-17	1.61E-17	1.49E-17	1.47E-17
Tc-96m	3.22E-19	2.96E-19	2.80E-19	2.68E-19	2.47E-19	2.44E-19
Tc-97	8.57E-21	5.80E-21	4.94E-21	4.56E-21	2.36E-21	2.18E-21
Tc-97m	1.06E-20	7.67E-21	6.66E-21	6.19E-21	4.05E-21	3.85E-21
Tc-98	1.10E-17	1.02E-17	9.64E-18	9.20E-18	8.47E-18	8.36E-18
Tc-99	3.99E-22	3.32E-22	2.95E-22	2.73E-22	2.31E-22	2.26E-22
Tc-99m	9.41E-19	8.82E-19	8.26E-19	7.88E-19	7.15E-19	7.03E-19
Tc-101	2.65E-18	2.46E-18	2.33E-18	2.23E-18	2.03E-18	2.00E-18
Tc-102	1.07E-18	1.01E-18	9.75E-19	9.45E-19	8.94E-19	8.86E-19
Tc-102m	1.82E-17	1.70E-17	1.61E-17	1.54E-17	1.44E-17	1.42E-17
Tc-104	1.65E-17	1.54E-17	1.46E-17	1.40E-17	1.31E-17	1.30E-17
Tc-105	6.19E-18	5.76E-18	5.45E-18	5.23E-18	4.84E-18	4.78E-18
Ruthenium						
Ru-92	1.57E-17	1.46E-17	1.38E-17	1.32E-17	1.22E-17	1.20E-17
Ru-94	3.95E-18	3.66E-18	3.46E-18	3.31E-18	3.03E-18	2.99E-18
Ru-95	9.36E-18	8.68E-18	8.22E-18	7.87E-18	7.27E-18	7.18E-18
Ru-97	1.77E-18	1.64E-18	1.55E-18	1.48E-18	1.34E-18	1.32E-18
Ru-103	3.88E-18	3.60E-18	3.41E-18	3.25E-18	2.98E-18	2.94E-18
Ru-105	5.82E-18	5.39E-18	5.10E-18	4.87E-18	4.48E-18	4.42E-18
Ru-106	1.81E-25	1.22E-25	1.01E-25	9.20E-26	4.83E-26	4.51E-26
Ru-107	2.80E-18	2.60E-18	2.47E-18	2.37E-18	2.20E-18	2.17E-18
Ru-108	4.92E-19	4.60E-19	4.33E-19	4.14E-19	3.77E-19	3.71E-19

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rhodium						
Rh-94	2.89E-17	2.69E-17	2.55E-17	2.44E-17	2.27E-17	2.24E-17
Rh-95	1.92E-17	1.78E-17	1.69E-17	1.62E-17	1.50E-17	1.49E-17
Rh-95m	6.49E-18	6.06E-18	5.76E-18	5.52E-18	5.12E-18	5.06E-18
Rh-96	3.01E-17	2.79E-17	2.64E-17	2.53E-17	2.33E-17	2.31E-17
Rh-96m	9.66E-18	8.98E-18	8.51E-18	8.15E-18	7.56E-18	7.47E-18
Rh-97	1.11E-17	1.03E-17	9.76E-18	9.33E-18	8.60E-18	8.48E-18
Rh-97m	1.56E-17	1.46E-17	1.38E-17	1.33E-17	1.24E-17	1.23E-17
Rh-98	1.42E-17	1.32E-17	1.25E-17	1.20E-17	1.10E-17	1.09E-17
Rh-99	4.22E-18	3.91E-18	3.70E-18	3.53E-18	3.23E-18	3.18E-18
Rh-99m	4.93E-18	4.57E-18	4.33E-18	4.14E-18	3.80E-18	3.75E-18
Rh-100	1.97E-17	1.84E-17	1.74E-17	1.67E-17	1.56E-17	1.54E-17
Rh-100m	3.54E-19	3.18E-19	2.97E-19	2.83E-19	2.56E-19	2.52E-19
Rh-101	2.09E-18	1.95E-18	1.83E-18	1.75E-18	1.58E-18	1.56E-18
Rh-101m	2.15E-18	1.99E-18	1.88E-18	1.80E-18	1.64E-18	1.61E-18
Rh-102	3.89E-18	3.61E-18	3.42E-18	3.26E-18	2.99E-18	2.95E-18
Rh-102m	1.66E-17	1.53E-17	1.45E-17	1.39E-17	1.28E-17	1.26E-17
Rh-103m	2.14E-21	1.44E-21	1.20E-21	1.09E-21	6.87E-22	6.46E-22
Rh-104	2.43E-19	2.33E-19	2.26E-19	2.20E-19	2.10E-19	2.09E-19
Rh-104m	2.18E-19	1.82E-19	1.60E-19	1.48E-19	1.24E-19	1.22E-19
Rh-105	6.03E-19	5.60E-19	5.29E-19	5.07E-19	4.60E-19	4.54E-19
Rh-106	1.88E-18	1.75E-18	1.67E-18	1.60E-18	1.49E-18	1.47E-18
Rh-106m	2.18E-17	2.02E-17	1.91E-17	1.83E-17	1.69E-17	1.67E-17
Rh-107	2.46E-18	2.29E-18	2.17E-18	2.07E-18	1.89E-18	1.86E-18
Rh-108	2.89E-18	2.70E-18	2.57E-18	2.47E-18	2.28E-18	2.25E-18
Rh-109	2.44E-18	2.27E-18	2.15E-18	2.06E-18	1.89E-18	1.86E-18
Palladium						
Pd-96	1.10E-17	1.02E-17	9.67E-18	9.24E-18	8.51E-18	8.40E-18
Pd-97	1.77E-17	1.65E-17	1.56E-17	1.50E-17	1.39E-17	1.37E-17
Pd-98	3.06E-18	2.83E-18	2.67E-18	2.55E-18	2.34E-18	2.30E-18
Pd-99	9.68E-18	9.00E-18	8.52E-18	8.16E-18	7.53E-18	7.43E-18
Pd-100	7.05E-19	6.25E-19	5.74E-19	5.40E-19	4.76E-19	4.68E-19
Pd-101	2.54E-18	2.35E-18	2.22E-18	2.12E-18	1.95E-18	1.92E-18
Pd-103	1.96E-20	1.33E-20	1.11E-20	1.01E-20	6.50E-21	6.12E-21
Pd-107	1.12E-25	7.55E-26	6.30E-26	5.72E-26	2.77E-26	2.57E-26
Pd-109	5.53E-20	4.78E-20	4.40E-20	4.18E-20	3.68E-20	3.62E-20
Pd-109m	8.15E-19	7.58E-19	7.12E-19	6.82E-19	6.17E-19	6.07E-19
Pd-111	4.71E-19	4.42E-19	4.22E-19	4.07E-19	3.82E-19	3.78E-19
Pd-112	4.55E-21	3.09E-21	2.62E-21	2.42E-21	1.36E-21	1.27E-21
Pd-114	2.37E-19	2.23E-19	2.11E-19	2.03E-19	1.87E-19	1.84E-19
Silver						
Ag-99	1.77E-17	1.64E-17	1.56E-17	1.49E-17	1.38E-17	1.36E-17
Ag-100m	2.18E-17	2.02E-17	1.92E-17	1.84E-17	1.70E-17	1.68E-17
Ag-101	1.21E-17	1.13E-17	1.07E-17	1.02E-17	9.41E-18	9.29E-18
Ag-102	2.56E-17	2.38E-17	2.25E-17	2.16E-17	2.00E-17	1.98E-17
Ag-102m	1.42E-17	1.32E-17	1.26E-17	1.21E-17	1.13E-17	1.12E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-103	6.37E-18	5.91E-18	5.59E-18	5.35E-18	4.92E-18	4.86E-18
Ag-104	2.06E-17	1.91E-17	1.80E-17	1.73E-17	1.60E-17	1.58E-17
Ag-104m	1.35E-17	1.26E-17	1.20E-17	1.15E-17	1.06E-17	1.05E-17
Ag-105	3.88E-18	3.59E-18	3.39E-18	3.24E-18	2.96E-18	2.91E-18
Ag-105m	7.74E-21	7.16E-21	6.77E-21	6.47E-21	5.90E-21	5.82E-21
Ag-106	5.49E-18	5.10E-18	4.83E-18	4.61E-18	4.23E-18	4.17E-18
Ag-106m	2.13E-17	1.98E-17	1.87E-17	1.79E-17	1.66E-17	1.63E-17
Ag-108	2.00E-19	1.87E-19	1.79E-19	1.73E-19	1.62E-19	1.60E-19
Ag-108m	1.26E-17	1.16E-17	1.10E-17	1.05E-17	9.64E-18	9.51E-18
Ag-109m	3.60E-20	2.95E-20	2.64E-20	2.47E-20	2.05E-20	2.00E-20
Ag-110	4.43E-19	4.20E-19	4.05E-19	3.93E-19	3.73E-19	3.69E-19
Ag-110m	2.11E-17	1.95E-17	1.85E-17	1.77E-17	1.64E-17	1.62E-17
Ag-111	2.20E-19	2.05E-19	1.94E-19	1.86E-19	1.69E-19	1.67E-19
Ag-111m	3.38E-20	2.93E-20	2.70E-20	2.55E-20	2.23E-20	2.19E-20
Ag-112	5.39E-18	5.02E-18	4.77E-18	4.58E-18	4.27E-18	4.22E-18
Ag-113	6.47E-19	6.04E-19	5.75E-19	5.53E-19	5.11E-19	5.04E-19
Ag-113m	1.67E-18	1.55E-18	1.47E-18	1.40E-18	1.28E-18	1.26E-18
Ag-114	2.44E-18	2.29E-18	2.19E-18	2.11E-18	1.98E-18	1.96E-18
Ag-115	3.69E-18	3.45E-18	3.27E-18	3.15E-18	2.94E-18	2.91E-18
Ag-116	1.56E-17	1.46E-17	1.38E-17	1.33E-17	1.25E-17	1.23E-17
Ag-117	9.36E-18	8.76E-18	8.31E-18	8.01E-18	7.52E-18	7.44E-18
Cadmium						
Cd-101	1.86E-17	1.73E-17	1.64E-17	1.57E-17	1.46E-17	1.44E-17
Cd-102	6.37E-18	5.90E-18	5.59E-18	5.34E-18	4.91E-18	4.84E-18
Cd-103	1.51E-17	1.40E-17	1.33E-17	1.28E-17	1.19E-17	1.18E-17
Cd-104	1.79E-18	1.64E-18	1.54E-18	1.47E-18	1.34E-18	1.32E-18
Cd-105	9.49E-18	8.83E-18	8.36E-18	8.03E-18	7.47E-18	7.38E-18
Cd-107	1.10E-19	9.03E-20	8.15E-20	7.64E-20	6.42E-20	6.27E-20
Cd-109	6.28E-20	4.73E-20	4.10E-20	3.78E-20	2.93E-20	2.83E-20
Cd-111m	2.13E-18	1.98E-18	1.87E-18	1.79E-18	1.62E-18	1.59E-18
Cd-113	3.48E-22	2.90E-22	2.57E-22	2.39E-22	2.01E-22	1.97E-22
Cd-113m	2.16E-21	1.92E-21	1.77E-21	1.68E-21	1.49E-21	1.46E-21
Cd-115	1.51E-18	1.40E-18	1.33E-18	1.27E-18	1.16E-18	1.15E-18
Cd-115m	3.05E-19	2.85E-19	2.72E-19	2.62E-19	2.45E-19	2.43E-19
Cd-117	8.07E-18	7.49E-18	7.09E-18	6.81E-18	6.32E-18	6.25E-18
Cd-117m	1.48E-17	1.37E-17	1.30E-17	1.25E-17	1.17E-17	1.16E-17
Cd-118	1.19E-21	1.03E-21	9.33E-22	8.76E-22	7.61E-22	7.47E-22
Cd-119	1.19E-17	1.11E-17	1.05E-17	1.01E-17	9.45E-18	9.35E-18
Cd-119m	1.68E-17	1.56E-17	1.48E-17	1.42E-17	1.33E-17	1.31E-17
Indium						
In-103	2.07E-17	1.93E-17	1.83E-17	1.76E-17	1.63E-17	1.61E-17
In-105	1.47E-17	1.37E-17	1.30E-17	1.24E-17	1.15E-17	1.13E-17
In-106	2.76E-17	2.56E-17	2.42E-17	2.32E-17	2.14E-17	2.11E-17
In-106m	2.11E-17	1.97E-17	1.87E-17	1.79E-17	1.66E-17	1.64E-17
In-107	1.13E-17	1.05E-17	9.93E-18	9.53E-18	8.84E-18	8.73E-18
In-108	2.96E-17	2.75E-17	2.60E-17	2.49E-17	2.30E-17	2.28E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-108m	1.96E-17	1.83E-17	1.74E-17	1.67E-17	1.56E-17	1.55E-17
In-109	4.79E-18	4.44E-18	4.19E-18	4.02E-18	3.69E-18	3.64E-18
In-109m	4.74E-18	4.39E-18	4.16E-18	3.97E-18	3.65E-18	3.60E-18
In-110	2.38E-17	2.20E-17	2.08E-17	1.99E-17	1.84E-17	1.81E-17
In-110m	1.21E-17	1.12E-17	1.06E-17	1.02E-17	9.38E-18	9.26E-18
In-111	3.00E-18	2.79E-18	2.62E-18	2.51E-18	2.27E-18	2.24E-18
In-111m	3.67E-18	3.40E-18	3.23E-18	3.07E-18	2.82E-18	2.78E-18
In-112	2.07E-18	1.92E-18	1.82E-18	1.73E-18	1.59E-18	1.57E-18
In-112m	1.87E-19	1.66E-19	1.53E-19	1.45E-19	1.29E-19	1.26E-19
In-113m	2.00E-18	1.86E-18	1.76E-18	1.68E-18	1.53E-18	1.51E-18
In-114	1.10E-19	1.07E-19	1.04E-19	1.03E-19	9.94E-20	9.89E-20
In-114m	5.71E-19	5.25E-19	4.94E-19	4.72E-19	4.29E-19	4.23E-19
In-115	1.05E-21	9.04E-22	8.16E-22	7.64E-22	6.61E-22	6.49E-22
In-115m	1.22E-18	1.13E-18	1.07E-18	1.02E-18	9.27E-19	9.13E-19
In-116m	1.82E-17	1.69E-17	1.60E-17	1.54E-17	1.43E-17	1.42E-17
In-117	5.38E-18	5.00E-18	4.73E-18	4.51E-18	4.13E-18	4.07E-18
In-117m	7.09E-19	6.59E-19	6.22E-19	5.95E-19	5.42E-19	5.34E-19
In-118	1.01E-18	9.60E-19	9.23E-19	8.96E-19	8.52E-19	8.45E-19
In-118m	2.10E-17	1.94E-17	1.84E-17	1.76E-17	1.64E-17	1.62E-17
In-119	6.01E-18	5.55E-18	5.26E-18	5.02E-18	4.64E-18	4.58E-18
In-119m	6.48E-19	6.07E-19	5.80E-19	5.60E-19	5.27E-19	5.22E-19
In-121	7.27E-18	6.73E-18	6.37E-18	6.09E-18	5.65E-18	5.58E-18
In-121m	7.19E-19	6.69E-19	6.38E-19	6.17E-19	5.81E-19	5.76E-19
Tin						
Sn-106	9.22E-18	8.53E-18	8.07E-18	7.71E-18	7.09E-18	7.00E-18
Sn-108	5.20E-18	4.81E-18	4.55E-18	4.34E-18	3.96E-18	3.91E-18
Sn-109	1.60E-17	1.49E-17	1.41E-17	1.35E-17	1.26E-17	1.25E-17
Sn-110	2.16E-18	2.00E-18	1.89E-18	1.80E-18	1.63E-18	1.61E-18
Sn-111	3.68E-18	3.41E-18	3.23E-18	3.09E-18	2.85E-18	2.81E-18
Sn-113	8.26E-20	6.60E-20	5.87E-20	5.48E-20	4.56E-20	4.44E-20
Sn-113m	3.51E-20	2.40E-20	1.97E-20	1.76E-20	1.28E-20	1.23E-20
Sn-117m	1.11E-18	1.02E-18	9.57E-19	9.12E-19	8.25E-19	8.10E-19
Sn-119m	3.44E-20	2.30E-20	1.86E-20	1.66E-20	1.17E-20	1.11E-20
Sn-121	5.73E-22	4.85E-22	4.34E-22	4.04E-22	3.45E-22	3.38E-22
Sn-121m	1.52E-20	1.05E-20	8.47E-21	7.54E-21	5.57E-21	5.34E-21
Sn-123	9.32E-20	8.81E-20	8.47E-20	8.22E-20	7.81E-20	7.75E-20
Sn-123m	1.08E-18	1.01E-18	9.47E-19	9.05E-19	8.24E-19	8.10E-19
Sn-125	2.63E-18	2.44E-18	2.31E-18	2.22E-18	2.07E-18	2.05E-18
Sn-125m	2.79E-18	2.60E-18	2.46E-18	2.36E-18	2.15E-18	2.12E-18
Sn-126	3.52E-19	3.12E-19	2.87E-19	2.70E-19	2.38E-19	2.35E-19
Sn-127	1.43E-17	1.32E-17	1.25E-17	1.20E-17	1.12E-17	1.10E-17
Sn-127m	4.56E-18	4.24E-18	4.03E-18	3.85E-18	3.56E-18	3.51E-18
Sn-128	4.49E-18	4.13E-18	3.89E-18	3.70E-18	3.38E-18	3.33E-18
Sn-129	7.93E-18	7.36E-18	6.98E-18	6.68E-18	6.19E-18	6.11E-18
Sn-130	7.18E-18	6.64E-18	6.27E-18	5.99E-18	5.49E-18	5.42E-18
Sn-130m	6.89E-18	6.39E-18	6.05E-18	5.80E-18	5.38E-18	5.32E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Antimony						
Sb-111	1.18E-17	1.09E-17	1.04E-17	9.90E-18	9.10E-18	8.97E-18
Sb-113	9.94E-18	9.22E-18	8.74E-18	8.34E-18	7.66E-18	7.55E-18
Sb-114	2.04E-17	1.90E-17	1.80E-17	1.72E-17	1.60E-17	1.58E-17
Sb-115	6.89E-18	6.39E-18	6.05E-18	5.77E-18	5.29E-18	5.21E-18
Sb-116	1.69E-17	1.57E-17	1.49E-17	1.43E-17	1.33E-17	1.31E-17
Sb-116m	2.33E-17	2.16E-17	2.05E-17	1.96E-17	1.81E-17	1.79E-17
Sb-117	1.31E-18	1.21E-18	1.13E-18	1.08E-18	9.75E-19	9.58E-19
Sb-118	6.39E-18	5.93E-18	5.63E-18	5.37E-18	4.93E-18	4.86E-18
Sb-118m	1.95E-17	1.80E-17	1.70E-17	1.63E-17	1.51E-17	1.50E-17
Sb-119	5.59E-20	3.73E-20	3.02E-20	2.69E-20	1.90E-20	1.80E-20
Sb-120	3.50E-18	3.24E-18	3.07E-18	2.93E-18	2.69E-18	2.65E-18
Sb-120m	1.85E-17	1.71E-17	1.61E-17	1.55E-17	1.43E-17	1.42E-17
Sb-122	3.52E-18	3.27E-18	3.10E-18	2.96E-18	2.72E-18	2.68E-18
Sb-122m	3.89E-19	3.25E-19	2.90E-19	2.68E-19	2.29E-19	2.25E-19
Sb-124	1.37E-17	1.28E-17	1.21E-17	1.16E-17	1.08E-17	1.07E-17
Sb-124m	3.44E-18	3.19E-18	3.02E-18	2.88E-18	2.65E-18	2.61E-18
Sb-124n	2.08E-24	1.39E-24	1.12E-24	9.96E-25	7.09E-25	6.74E-25
Sb-125	3.34E-18	3.09E-18	2.92E-18	2.78E-18	2.55E-18	2.51E-18
Sb-126	2.15E-17	1.99E-17	1.88E-17	1.80E-17	1.65E-17	1.63E-17
Sb-126m	1.21E-17	1.12E-17	1.07E-17	1.02E-17	9.35E-18	9.22E-18
Sb-127	5.40E-18	5.00E-18	4.74E-18	4.52E-18	4.16E-18	4.10E-18
Sb-128	2.40E-17	2.22E-17	2.11E-17	2.01E-17	1.85E-17	1.83E-17
Sb-128m	1.49E-17	1.38E-17	1.31E-17	1.25E-17	1.15E-17	1.14E-17
Sb-129	1.11E-17	1.03E-17	9.71E-18	9.30E-18	8.63E-18	8.53E-18
Sb-130	2.52E-17	2.33E-17	2.21E-17	2.11E-17	1.95E-17	1.92E-17
Sb-130m	2.09E-17	1.93E-17	1.83E-17	1.75E-17	1.62E-17	1.60E-17
Sb-131	1.55E-17	1.44E-17	1.36E-17	1.30E-17	1.21E-17	1.20E-17
Sb-133	1.99E-17	1.85E-17	1.76E-17	1.69E-17	1.58E-17	1.56E-17
Tellurium						
Te-113	1.71E-17	1.59E-17	1.50E-17	1.44E-17	1.34E-17	1.32E-17
Te-114	9.39E-18	8.71E-18	8.24E-18	7.90E-18	7.33E-18	7.24E-18
Te-115	1.71E-17	1.58E-17	1.50E-17	1.44E-17	1.33E-17	1.31E-17
Te-115m	1.95E-17	1.81E-17	1.72E-17	1.65E-17	1.53E-17	1.51E-17
Te-116	6.91E-19	6.17E-19	5.73E-19	5.43E-19	4.87E-19	4.79E-19
Te-117	1.15E-17	1.06E-17	1.01E-17	9.67E-18	8.97E-18	8.87E-18
Te-118	5.48E-20	3.68E-20	2.96E-20	2.63E-20	1.90E-20	1.81E-20
Te-119	5.82E-18	5.38E-18	5.09E-18	4.86E-18	4.48E-18	4.42E-18
Te-119m	1.12E-17	1.03E-17	9.76E-18	9.36E-18	8.69E-18	8.58E-18
Te-121	4.41E-18	4.07E-18	3.86E-18	3.67E-18	3.37E-18	3.32E-18
Te-121m	1.60E-18	1.47E-18	1.38E-18	1.33E-18	1.20E-18	1.18E-18
Te-123	9.52E-23	6.39E-23	5.14E-23	4.57E-23	3.30E-23	3.14E-23
Te-123m	1.05E-18	9.76E-19	9.11E-19	8.69E-19	7.86E-19	7.72E-19
Te-125m	1.13E-19	7.73E-20	6.25E-20	5.56E-20	4.13E-20	3.95E-20
Te-127	4.11E-20	3.81E-20	3.60E-20	3.44E-20	3.13E-20	3.09E-20
Te-127m	3.55E-20	2.47E-20	2.01E-20	1.80E-20	1.35E-20	1.30E-20

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-129	5.01E-19	4.63E-19	4.39E-19	4.19E-19	3.85E-19	3.80E-19
Te-129m	2.73E-19	2.48E-19	2.33E-19	2.22E-19	2.03E-19	2.01E-19
Te-131	3.28E-18	3.04E-18	2.88E-18	2.75E-18	2.53E-18	2.50E-18
Te-131m	1.11E-17	1.02E-17	9.68E-18	9.26E-18	8.57E-18	8.46E-18
Te-132	1.70E-18	1.56E-18	1.46E-18	1.39E-18	1.26E-18	1.24E-18
Te-133	9.03E-18	8.40E-18	7.95E-18	7.63E-18	7.07E-18	6.99E-18
Te-133m	1.41E-17	1.30E-17	1.23E-17	1.18E-17	1.09E-17	1.08E-17
Te-134	6.72E-18	6.21E-18	5.87E-18	5.61E-18	5.14E-18	5.07E-18
Iodine						
I-118	1.60E-17	1.49E-17	1.41E-17	1.35E-17	1.24E-17	1.23E-17
I-118m	2.91E-17	2.70E-17	2.56E-17	2.45E-17	2.25E-17	2.22E-17
I-119	7.09E-18	6.58E-18	6.23E-18	5.95E-18	5.44E-18	5.36E-18
I-120	1.96E-17	1.82E-17	1.73E-17	1.66E-17	1.55E-17	1.53E-17
I-120m	2.69E-17	2.49E-17	2.36E-17	2.26E-17	2.09E-17	2.06E-17
I-121	2.99E-18	2.76E-18	2.60E-18	2.49E-18	2.27E-18	2.23E-18
I-122	7.69E-18	7.14E-18	6.77E-18	6.46E-18	5.94E-18	5.86E-18
I-123	1.20E-18	1.10E-18	1.03E-18	9.80E-19	8.85E-19	8.70E-19
I-124	8.35E-18	7.75E-18	7.34E-18	7.02E-18	6.49E-18	6.41E-18
I-125	1.32E-19	9.01E-20	7.25E-20	6.43E-20	4.73E-20	4.52E-20
I-126	3.35E-18	3.09E-18	2.93E-18	2.79E-18	2.56E-18	2.52E-18
I-128	6.15E-19	5.74E-19	5.47E-19	5.24E-19	4.85E-19	4.78E-19
I-129	9.37E-20	6.58E-20	5.32E-20	4.73E-20	3.58E-20	3.45E-20
I-130	1.66E-17	1.54E-17	1.46E-17	1.39E-17	1.28E-17	1.26E-17
I-130m	8.45E-19	7.81E-19	7.39E-19	7.05E-19	6.49E-19	6.40E-19
I-131	2.98E-18	2.77E-18	2.62E-18	2.50E-18	2.28E-18	2.25E-18
I-132	1.75E-17	1.62E-17	1.53E-17	1.46E-17	1.35E-17	1.33E-17
I-132m	2.60E-18	2.40E-18	2.27E-18	2.17E-18	1.99E-18	1.96E-18
I-133	4.78E-18	4.43E-18	4.20E-18	4.01E-18	3.69E-18	3.64E-18
I-134	1.98E-17	1.84E-17	1.74E-17	1.66E-17	1.54E-17	1.52E-17
I-134m	2.13E-18	1.95E-18	1.83E-18	1.75E-18	1.59E-18	1.56E-18
I-135	1.17E-17	1.08E-17	1.02E-17	9.84E-18	9.18E-18	9.08E-18
Xenon						
Xe-120	2.91E-18	2.67E-18	2.51E-18	2.39E-18	2.18E-18	2.15E-18
Xe-121	1.08E-17	1.00E-17	9.52E-18	9.13E-18	8.48E-18	8.37E-18
Xe-122	4.25E-19	3.76E-19	3.48E-19	3.30E-19	2.94E-19	2.89E-19
Xe-123	4.77E-18	4.42E-18	4.17E-18	3.99E-18	3.67E-18	3.62E-18
Xe-125	1.95E-18	1.79E-18	1.67E-18	1.60E-18	1.44E-18	1.42E-18
Xe-127	2.04E-18	1.88E-18	1.76E-18	1.68E-18	1.52E-18	1.50E-18
Xe-127m	1.20E-18	1.11E-18	1.03E-18	9.84E-19	8.88E-19	8.72E-19
Xe-129m	2.24E-19	1.72E-19	1.48E-19	1.36E-19	1.11E-19	1.08E-19
Xe-131m	8.48E-20	6.44E-20	5.49E-20	5.01E-20	4.08E-20	3.96E-20
Xe-133	2.77E-19	2.37E-19	2.14E-19	1.99E-19	1.73E-19	1.70E-19
Xe-133m	2.41E-19	2.10E-19	1.92E-19	1.82E-19	1.60E-19	1.57E-19
Xe-135	1.92E-18	1.79E-18	1.69E-18	1.62E-18	1.47E-18	1.44E-18
Xe-135m	3.31E-18	3.06E-18	2.90E-18	2.77E-18	2.54E-18	2.50E-18
Xe-137	1.83E-18	1.72E-18	1.64E-18	1.58E-18	1.47E-18	1.45E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Xe-138	8.10E-18	7.56E-18	7.16E-18	6.90E-18	6.45E-18	6.38E-18
Cesium						
Cs-121	9.51E-18	8.84E-18	8.39E-18	8.01E-18	7.37E-18	7.26E-18
Cs-121m	9.44E-18	8.77E-18	8.31E-18	7.94E-18	7.29E-18	7.19E-18
Cs-123	8.54E-18	7.92E-18	7.50E-18	7.16E-18	6.58E-18	6.48E-18
Cs-124	9.48E-18	8.82E-18	8.38E-18	8.01E-18	7.37E-18	7.27E-18
Cs-125	5.81E-18	5.38E-18	5.10E-18	4.87E-18	4.47E-18	4.41E-18
Cs-126	9.23E-18	8.57E-18	8.13E-18	7.77E-18	7.14E-18	7.04E-18
Cs-127	3.27E-18	3.01E-18	2.85E-18	2.71E-18	2.47E-18	2.44E-18
Cs-128	7.07E-18	6.56E-18	6.23E-18	5.94E-18	5.45E-18	5.38E-18
Cs-129	2.05E-18	1.87E-18	1.76E-18	1.68E-18	1.52E-18	1.50E-18
Cs-130	3.91E-18	3.62E-18	3.43E-18	3.27E-18	3.00E-18	2.96E-18
Cs-130m	4.23E-19	3.60E-19	3.24E-19	3.03E-19	2.63E-19	2.58E-19
Cs-131	8.12E-20	5.60E-20	4.50E-20	3.99E-20	2.99E-20	2.87E-20
Cs-132	5.47E-18	5.04E-18	4.77E-18	4.55E-18	4.18E-18	4.12E-18
Cs-134	1.21E-17	1.12E-17	1.06E-17	1.01E-17	9.31E-18	9.19E-18
Cs-134m	1.58E-19	1.39E-19	1.27E-19	1.19E-19	1.05E-19	1.03E-19
Cs-135	3.00E-22	2.48E-22	2.19E-22	2.03E-22	1.70E-22	1.66E-22
Cs-135m	1.24E-17	1.14E-17	1.08E-17	1.03E-17	9.54E-18	9.42E-18
Cs-136	1.63E-17	1.50E-17	1.42E-17	1.36E-17	1.26E-17	1.24E-17
Cs-137	2.69E-21	2.47E-21	2.33E-21	2.25E-21	2.08E-21	2.06E-21
Cs-138	1.73E-17	1.61E-17	1.53E-17	1.47E-17	1.37E-17	1.36E-17
Cs-138m	3.08E-18	2.86E-18	2.70E-18	2.59E-18	2.40E-18	2.37E-18
Cs-139	2.51E-18	2.35E-18	2.24E-18	2.17E-18	2.04E-18	2.03E-18
Cs-140	1.30E-17	1.21E-17	1.15E-17	1.11E-17	1.04E-17	1.03E-17
Barium						
Ba-124	4.32E-18	3.99E-18	3.77E-18	3.60E-18	3.30E-18	3.26E-18
Ba-126	4.35E-18	4.01E-18	3.78E-18	3.61E-18	3.32E-18	3.28E-18
Ba-127	5.63E-18	5.22E-18	4.94E-18	4.72E-18	4.34E-18	4.28E-18
Ba-128	4.17E-19	3.66E-19	3.37E-19	3.19E-19	2.83E-19	2.78E-19
Ba-129	2.48E-18	2.28E-18	2.15E-18	2.06E-18	1.88E-18	1.86E-18
Ba-129m	1.19E-17	1.10E-17	1.04E-17	9.96E-18	9.20E-18	9.09E-18
Ba-131	3.57E-18	3.29E-18	3.10E-18	2.95E-18	2.69E-18	2.65E-18
Ba-131m	5.09E-19	4.62E-19	4.26E-19	4.05E-19	3.60E-19	3.54E-19
Ba-133	2.96E-18	2.71E-18	2.54E-18	2.42E-18	2.19E-18	2.15E-18
Ba-133m	4.55E-19	4.07E-19	3.77E-19	3.59E-19	3.20E-19	3.15E-19
Ba-135m	3.97E-19	3.53E-19	3.27E-19	3.10E-19	2.76E-19	2.71E-19
Ba-137m	4.64E-18	4.30E-18	4.07E-18	3.88E-18	3.57E-18	3.52E-18
Ba-139	4.64E-19	4.37E-19	4.15E-19	4.00E-19	3.72E-19	3.67E-19
Ba-140	1.40E-18	1.30E-18	1.23E-18	1.17E-18	1.07E-18	1.06E-18
Ba-141	7.15E-18	6.64E-18	6.29E-18	6.03E-18	5.56E-18	5.49E-18
Ba-142	7.95E-18	7.36E-18	6.95E-18	6.66E-18	6.16E-18	6.08E-18
Lanthanum						
La-128	2.19E-17	2.03E-17	1.93E-17	1.84E-17	1.70E-17	1.68E-17
La-129	7.19E-18	6.66E-18	6.31E-18	6.02E-18	5.51E-18	5.44E-18
La-130	1.72E-17	1.60E-17	1.51E-17	1.45E-17	1.34E-17	1.32E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-131	5.06E-18	4.67E-18	4.42E-18	4.21E-18	3.85E-18	3.79E-18
La-132	1.49E-17	1.38E-17	1.31E-17	1.26E-17	1.16E-17	1.15E-17
La-132m	5.12E-18	4.73E-18	4.47E-18	4.27E-18	3.91E-18	3.86E-18
La-133	1.15E-18	1.05E-18	9.83E-19	9.34E-19	8.50E-19	8.37E-19
La-134	5.70E-18	5.29E-18	5.01E-18	4.78E-18	4.39E-18	4.33E-18
La-135	1.83E-19	1.47E-19	1.29E-19	1.19E-19	1.01E-19	9.89E-20
La-136	3.15E-18	2.91E-18	2.75E-18	2.62E-18	2.40E-18	2.37E-18
La-137	9.97E-20	7.07E-20	5.73E-20	5.09E-20	3.89E-20	3.74E-20
La-138	9.05E-18	8.39E-18	7.94E-18	7.62E-18	7.10E-18	7.03E-18
La-140	1.69E-17	1.57E-17	1.49E-17	1.43E-17	1.34E-17	1.32E-17
La-141	3.45E-19	3.27E-19	3.15E-19	3.07E-19	2.92E-19	2.90E-19
La-142	1.66E-17	1.55E-17	1.47E-17	1.42E-17	1.33E-17	1.32E-17
La-143	2.15E-18	2.01E-18	1.92E-18	1.85E-18	1.73E-18	1.72E-18
Cerium						
Ce-130	3.71E-18	3.41E-18	3.21E-18	3.06E-18	2.80E-18	2.76E-18
Ce-131	1.24E-17	1.15E-17	1.09E-17	1.04E-17	9.60E-18	9.48E-18
Ce-132	1.99E-18	1.83E-18	1.71E-18	1.63E-18	1.48E-18	1.45E-18
Ce-133	4.10E-18	3.76E-18	3.55E-18	3.37E-18	3.07E-18	3.03E-18
Ce-133m	1.29E-17	1.19E-17	1.13E-17	1.08E-17	1.00E-17	9.88E-18
Ce-134	1.24E-19	9.18E-20	7.60E-20	6.84E-20	5.41E-20	5.23E-20
Ce-135	6.28E-18	5.80E-18	5.47E-18	5.23E-18	4.78E-18	4.72E-18
Ce-137	2.00E-19	1.62E-19	1.42E-19	1.32E-19	1.12E-19	1.09E-19
Ce-137m	3.64E-19	3.20E-19	2.93E-19	2.78E-19	2.46E-19	2.42E-19
Ce-139	1.12E-18	1.02E-18	9.44E-19	8.98E-19	8.07E-19	7.93E-19
Ce-141	5.60E-19	5.19E-19	4.84E-19	4.60E-19	4.16E-19	4.09E-19
Ce-143	2.11E-18	1.94E-18	1.82E-18	1.74E-18	1.58E-18	1.56E-18
Ce-144	1.35E-19	1.23E-19	1.14E-19	1.08E-19	9.68E-20	9.51E-20
Ce-145	6.24E-18	5.75E-18	5.43E-18	5.18E-18	4.76E-18	4.70E-18
Praseodymium						
Pr-134	2.44E-17	2.26E-17	2.14E-17	2.05E-17	1.89E-17	1.86E-17
Pr-134m	1.77E-17	1.65E-17	1.56E-17	1.50E-17	1.38E-17	1.37E-17
Pr-135	6.75E-18	6.24E-18	5.90E-18	5.63E-18	5.17E-18	5.09E-18
Pr-136	1.63E-17	1.51E-17	1.43E-17	1.37E-17	1.27E-17	1.25E-17
Pr-137	2.81E-18	2.59E-18	2.44E-18	2.33E-18	2.14E-18	2.11E-18
Pr-138	6.58E-18	6.11E-18	5.80E-18	5.53E-18	5.08E-18	5.01E-18
Pr-138m	1.90E-17	1.75E-17	1.66E-17	1.59E-17	1.46E-17	1.45E-17
Pr-139	9.21E-19	8.32E-19	7.78E-19	7.38E-19	6.70E-19	6.60E-19
Pr-140	4.31E-18	3.99E-18	3.78E-18	3.60E-18	3.30E-18	3.26E-18
Pr-142	5.25E-19	4.94E-19	4.71E-19	4.56E-19	4.32E-19	4.28E-19
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	9.55E-21	9.04E-21	8.71E-21	8.50E-21	8.09E-21	8.04E-21
Pr-144	4.21E-19	4.02E-19	3.88E-19	3.78E-19	3.62E-19	3.59E-19
Pr-144m	6.55E-20	5.10E-20	4.33E-20	3.95E-20	3.24E-20	3.16E-20
Pr-145	2.13E-19	2.00E-19	1.92E-19	1.85E-19	1.75E-19	1.73E-19
Pr-146	7.70E-18	7.18E-18	6.81E-18	6.54E-18	6.09E-18	6.02E-18
Pr-147	3.73E-18	3.43E-18	3.23E-18	3.08E-18	2.83E-18	2.79E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pr-148	7.71E-18	7.18E-18	6.81E-18	6.54E-18	6.08E-18	6.02E-18
Pr-148m	7.58E-18	7.04E-18	6.68E-18	6.40E-18	5.89E-18	5.81E-18
Neodymium						
Nd-134	4.12E-18	3.80E-18	3.58E-18	3.41E-18	3.11E-18	3.07E-18
Nd-135	9.88E-18	9.16E-18	8.66E-18	8.27E-18	7.58E-18	7.47E-18
Nd-136	2.01E-18	1.82E-18	1.70E-18	1.62E-18	1.47E-18	1.44E-18
Nd-137	8.89E-18	8.22E-18	7.77E-18	7.43E-18	6.84E-18	6.76E-18
Nd-138	2.50E-19	2.07E-19	1.82E-19	1.69E-19	1.44E-19	1.41E-19
Nd-139	3.39E-18	3.12E-18	2.95E-18	2.81E-18	2.58E-18	2.54E-18
Nd-139m	1.20E-17	1.11E-17	1.04E-17	9.98E-18	9.22E-18	9.10E-18
Nd-140	1.35E-19	1.00E-19	8.25E-20	7.39E-20	5.78E-20	5.60E-20
Nd-141	5.02E-19	4.40E-19	4.05E-19	3.82E-19	3.42E-19	3.37E-19
Nd-141m	5.39E-18	4.98E-18	4.72E-18	4.50E-18	4.15E-18	4.10E-18
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.04E-18	9.45E-19	8.84E-19	8.39E-19	7.59E-19	7.47E-19
Nd-149	2.86E-18	2.65E-18	2.50E-18	2.39E-18	2.17E-18	2.14E-18
Nd-151	6.49E-18	6.02E-18	5.69E-18	5.44E-18	5.03E-18	4.96E-18
Nd-152	1.27E-18	1.18E-18	1.11E-18	1.06E-18	9.66E-19	9.52E-19
Promethium						
Pm-136	2.17E-17	2.01E-17	1.91E-17	1.82E-17	1.68E-17	1.65E-17
Pm-137m	1.39E-17	1.29E-17	1.22E-17	1.16E-17	1.07E-17	1.05E-17
Pm-139	7.45E-18	6.92E-18	6.56E-18	6.27E-18	5.76E-18	5.68E-18
Pm-140	8.69E-18	8.08E-18	7.67E-18	7.33E-18	6.76E-18	6.66E-18
Pm-140m	2.35E-17	2.18E-17	2.06E-17	1.97E-17	1.82E-17	1.80E-17
Pm-141	5.70E-18	5.28E-18	5.00E-18	4.78E-18	4.40E-18	4.34E-18
Pm-142	6.92E-18	6.43E-18	6.10E-18	5.83E-18	5.36E-18	5.29E-18
Pm-143	2.37E-18	2.16E-18	2.04E-18	1.94E-18	1.78E-18	1.75E-18
Pm-144	1.21E-17	1.12E-17	1.06E-17	1.01E-17	9.27E-18	9.14E-18
Pm-145	1.58E-19	1.20E-19	1.00E-19	9.05E-20	7.22E-20	7.02E-20
Pm-146	5.80E-18	5.36E-18	5.06E-18	4.83E-18	4.43E-18	4.37E-18
Pm-147	1.64E-22	1.35E-22	1.19E-22	1.10E-22	9.23E-23	9.03E-23
Pm-148	4.38E-18	4.07E-18	3.86E-18	3.70E-18	3.45E-18	3.41E-18
Pm-148m	1.55E-17	1.43E-17	1.36E-17	1.30E-17	1.19E-17	1.18E-17
Pm-149	1.07E-19	9.98E-20	9.46E-20	9.09E-20	8.35E-20	8.24E-20
Pm-150	1.11E-17	1.03E-17	9.75E-18	9.35E-18	8.69E-18	8.58E-18
Pm-151	2.52E-18	2.33E-18	2.20E-18	2.10E-18	1.91E-18	1.88E-18
Pm-152	2.39E-18	2.22E-18	2.11E-18	2.03E-18	1.89E-18	1.87E-18
Pm-152m	1.15E-17	1.07E-17	1.01E-17	9.67E-18	8.94E-18	8.83E-18
Pm-153	6.07E-19	5.59E-19	5.23E-19	4.99E-19	4.53E-19	4.46E-19
Pm-154	1.30E-17	1.21E-17	1.14E-17	1.10E-17	1.03E-17	1.02E-17
Pm-154m	1.34E-17	1.24E-17	1.18E-17	1.13E-17	1.05E-17	1.04E-17
Samarium						
Sm-139	1.14E-17	1.06E-17	1.00E-17	9.57E-18	8.80E-18	8.68E-18
Sm-140	4.27E-18	3.94E-18	3.72E-18	3.55E-18	3.26E-18	3.22E-18
Sm-141	1.08E-17	1.00E-17	9.52E-18	9.10E-18	8.40E-18	8.29E-18
Sm-141m	1.48E-17	1.37E-17	1.30E-17	1.24E-17	1.14E-17	1.13E-17

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-142	7.85E-19	7.04E-19	6.54E-19	6.19E-19	5.57E-19	5.48E-19
Sm-143	4.15E-18	3.84E-18	3.63E-18	3.46E-18	3.18E-18	3.13E-18
Sm-143m	5.31E-18	4.91E-18	4.65E-18	4.44E-18	4.09E-18	4.04E-18
Sm-145	3.41E-19	2.66E-19	2.24E-19	2.03E-19	1.63E-19	1.59E-19
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.42E-23	9.62E-24	7.95E-24	7.18E-24	4.71E-24	4.45E-24
Sm-153	4.21E-19	3.70E-19	3.34E-19	3.14E-19	2.74E-19	2.69E-19
Sm-155	7.87E-19	7.30E-19	6.82E-19	6.52E-19	5.88E-19	5.79E-19
Sm-156	8.45E-19	7.79E-19	7.29E-19	6.96E-19	6.26E-19	6.17E-19
Sm-157	3.25E-18	3.01E-18	2.84E-18	2.73E-18	2.50E-18	2.47E-18
Europium						
Eu-142	1.00E-17	9.32E-18	8.86E-18	8.47E-18	7.83E-18	7.73E-18
Eu-142m	2.69E-17	2.49E-17	2.36E-17	2.26E-17	2.08E-17	2.06E-17
Eu-143	8.85E-18	8.22E-18	7.80E-18	7.46E-18	6.89E-18	6.80E-18
Eu-144	8.93E-18	8.31E-18	7.89E-18	7.55E-18	6.97E-18	6.88E-18
Eu-145	9.46E-18	8.75E-18	8.27E-18	7.93E-18	7.36E-18	7.27E-18
Eu-146	1.81E-17	1.68E-17	1.59E-17	1.52E-17	1.41E-17	1.39E-17
Eu-147	3.51E-18	3.22E-18	3.03E-18	2.89E-18	2.64E-18	2.61E-18
Eu-148	1.71E-17	1.58E-17	1.50E-17	1.43E-17	1.32E-17	1.30E-17
Eu-149	4.26E-19	3.70E-19	3.35E-19	3.14E-19	2.74E-19	2.69E-19
Eu-150	1.20E-17	1.11E-17	1.05E-17	9.99E-18	9.16E-18	9.04E-18
Eu-150m	3.83E-19	3.53E-19	3.33E-19	3.18E-19	2.91E-19	2.87E-19
Eu-152	8.81E-18	8.14E-18	7.69E-18	7.36E-18	6.81E-18	6.73E-18
Eu-152m	2.30E-18	2.12E-18	2.00E-18	1.91E-18	1.77E-18	1.75E-18
Eu-152n	5.05E-19	4.56E-19	4.20E-19	3.98E-19	3.52E-19	3.47E-19
Eu-154	9.44E-18	8.74E-18	8.26E-18	7.91E-18	7.32E-18	7.24E-18
Eu-154m	4.41E-19	3.85E-19	3.49E-19	3.27E-19	2.85E-19	2.81E-19
Eu-155	4.19E-19	3.78E-19	3.48E-19	3.29E-19	2.91E-19	2.87E-19
Eu-156	9.03E-18	8.39E-18	7.95E-18	7.64E-18	7.13E-18	7.05E-18
Eu-157	2.22E-18	2.03E-18	1.91E-18	1.81E-18	1.64E-18	1.62E-18
Eu-158	9.83E-18	9.11E-18	8.62E-18	8.26E-18	7.68E-18	7.59E-18
Eu-159	2.33E-18	2.13E-18	1.99E-18	1.90E-18	1.73E-18	1.71E-18
Gadolinium						
Gd-142	8.08E-18	7.50E-18	7.10E-18	6.79E-18	6.26E-18	6.17E-18
Gd-143m	1.63E-17	1.51E-17	1.43E-17	1.37E-17	1.27E-17	1.25E-17
Gd-144	6.81E-18	6.33E-18	6.00E-18	5.74E-18	5.32E-18	5.25E-18
Gd-145	1.72E-17	1.60E-17	1.52E-17	1.46E-17	1.37E-17	1.35E-17
Gd-145m	5.30E-18	4.90E-18	4.64E-18	4.43E-18	4.08E-18	4.03E-18
Gd-146	1.73E-18	1.55E-18	1.42E-18	1.34E-18	1.19E-18	1.17E-18
Gd-147	1.07E-17	9.88E-18	9.32E-18	8.91E-18	8.19E-18	8.09E-18
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	3.99E-18	3.67E-18	3.45E-18	3.29E-18	2.99E-18	2.95E-18
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	4.54E-19	3.95E-19	3.56E-19	3.34E-19	2.91E-19	2.85E-19

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	6.72E-19	5.83E-19	5.23E-19	4.89E-19	4.23E-19	4.15E-19
Gd-159	4.11E-19	3.75E-19	3.51E-19	3.34E-19	3.01E-19	2.96E-19
Gd-162	3.27E-18	3.03E-18	2.87E-18	2.74E-18	2.50E-18	2.46E-18
Terbium						
Tb-146	2.68E-17	2.50E-17	2.37E-17	2.27E-17	2.12E-17	2.10E-17
Tb-147	1.64E-17	1.52E-17	1.43E-17	1.37E-17	1.27E-17	1.26E-17
Tb-147m	1.39E-17	1.30E-17	1.23E-17	1.18E-17	1.10E-17	1.09E-17
Tb-148	1.77E-17	1.65E-17	1.56E-17	1.49E-17	1.39E-17	1.37E-17
Tb-148m	2.43E-17	2.25E-17	2.13E-17	2.03E-17	1.87E-17	1.85E-17
Tb-149	1.01E-17	9.37E-18	8.86E-18	8.48E-18	7.85E-18	7.75E-18
Tb-149m	1.06E-17	9.81E-18	9.27E-18	8.85E-18	8.15E-18	8.04E-18
Tb-150	1.75E-17	1.63E-17	1.55E-17	1.48E-17	1.38E-17	1.37E-17
Tb-150m	1.96E-17	1.81E-17	1.72E-17	1.64E-17	1.50E-17	1.48E-17
Tb-151	7.55E-18	6.97E-18	6.57E-18	6.27E-18	5.74E-18	5.66E-18
Tb-151m	5.82E-19	5.30E-19	4.96E-19	4.71E-19	4.27E-19	4.21E-19
Tb-152	1.10E-17	1.02E-17	9.67E-18	9.27E-18	8.59E-18	8.48E-18
Tb-152m	5.80E-18	5.35E-18	5.04E-18	4.81E-18	4.38E-18	4.32E-18
Tb-153	2.44E-18	2.23E-18	2.08E-18	1.98E-18	1.80E-18	1.77E-18
Tb-154	1.61E-17	1.50E-17	1.42E-17	1.36E-17	1.28E-17	1.26E-17
Tb-155	1.23E-18	1.11E-18	1.02E-18	9.61E-19	8.52E-19	8.37E-19
Tb-156	1.45E-17	1.34E-17	1.27E-17	1.21E-17	1.12E-17	1.11E-17
Tb-156m	2.33E-19	1.93E-19	1.67E-19	1.53E-19	1.27E-19	1.25E-19
Tb-156n	2.29E-20	1.93E-20	1.69E-20	1.57E-20	1.32E-20	1.30E-20
Tb-157	2.69E-20	2.15E-20	1.82E-20	1.66E-20	1.34E-20	1.31E-20
Tb-158	6.08E-18	5.59E-18	5.27E-18	5.03E-18	4.64E-18	4.58E-18
Tb-160	8.55E-18	7.91E-18	7.47E-18	7.16E-18	6.62E-18	6.54E-18
Tb-161	2.02E-19	1.67E-19	1.47E-19	1.35E-19	1.14E-19	1.12E-19
Tb-162	8.55E-18	7.91E-18	7.47E-18	7.15E-18	6.58E-18	6.49E-18
Tb-163	6.16E-18	5.72E-18	5.41E-18	5.17E-18	4.72E-18	4.65E-18
Tb-164	1.85E-17	1.71E-17	1.62E-17	1.55E-17	1.44E-17	1.42E-17
Tb-165	6.30E-18	5.86E-18	5.55E-18	5.33E-18	4.97E-18	4.91E-18
Dysprosium						
Dy-148	5.52E-18	5.09E-18	4.80E-18	4.58E-18	4.20E-18	4.14E-18
Dy-149	1.20E-17	1.11E-17	1.05E-17	1.00E-17	9.30E-18	9.19E-18
Dy-150	2.13E-18	1.96E-18	1.85E-18	1.76E-18	1.60E-18	1.57E-18
Dy-151	1.03E-17	9.51E-18	8.98E-18	8.60E-18	7.95E-18	7.85E-18
Dy-152	2.15E-18	1.97E-18	1.85E-18	1.76E-18	1.59E-18	1.56E-18
Dy-153	6.46E-18	5.94E-18	5.58E-18	5.33E-18	4.89E-18	4.83E-18
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	4.99E-18	4.60E-18	4.33E-18	4.14E-18	3.80E-18	3.75E-18
Dy-157	2.63E-18	2.41E-18	2.27E-18	2.16E-18	1.95E-18	1.92E-18
Dy-159	2.67E-19	2.16E-19	1.84E-19	1.68E-19	1.38E-19	1.35E-19
Dy-165	2.24E-19	2.06E-19	1.93E-19	1.84E-19	1.68E-19	1.66E-19
Dy-165m	1.32E-19	1.20E-19	1.11E-19	1.05E-19	9.43E-20	9.28E-20
Dy-166	2.78E-19	2.39E-19	2.13E-19	1.98E-19	1.71E-19	1.68E-19

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Dy-167	4.19E-18	3.88E-18	3.67E-18	3.50E-18	3.20E-18	3.16E-18
Dy-168	3.05E-18	2.82E-18	2.66E-18	2.54E-18	2.31E-18	2.28E-18
Holmium						
Ho-150	1.52E-17	1.41E-17	1.33E-17	1.27E-17	1.17E-17	1.16E-17
Ho-153	7.99E-18	7.40E-18	6.99E-18	6.68E-18	6.13E-18	6.04E-18
Ho-153m	8.30E-18	7.68E-18	7.26E-18	6.93E-18	6.35E-18	6.26E-18
Ho-154	1.47E-17	1.36E-17	1.29E-17	1.23E-17	1.13E-17	1.12E-17
Ho-154m	1.90E-17	1.76E-17	1.66E-17	1.59E-17	1.46E-17	1.44E-17
Ho-155	4.61E-18	4.26E-18	4.01E-18	3.83E-18	3.51E-18	3.46E-18
Ho-156	1.58E-17	1.47E-17	1.39E-17	1.33E-17	1.23E-17	1.21E-17
Ho-157	4.37E-18	4.00E-18	3.75E-18	3.58E-18	3.25E-18	3.21E-18
Ho-159	2.82E-18	2.57E-18	2.39E-18	2.27E-18	2.04E-18	2.01E-18
Ho-160	1.30E-17	1.20E-17	1.13E-17	1.08E-17	9.95E-18	9.82E-18
Ho-161	3.28E-19	2.71E-19	2.36E-19	2.18E-19	1.82E-19	1.78E-19
Ho-162	1.16E-18	1.05E-18	9.74E-19	9.24E-19	8.38E-19	8.27E-19
Ho-162m	4.15E-18	3.81E-18	3.58E-18	3.43E-18	3.15E-18	3.11E-18
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	1.83E-19	1.53E-19	1.33E-19	1.22E-19	1.02E-19	1.01E-19
Ho-164m	2.69E-19	2.21E-19	1.91E-19	1.75E-19	1.44E-19	1.42E-19
Ho-166	2.79E-19	2.58E-19	2.43E-19	2.34E-19	2.18E-19	2.16E-19
Ho-166m	1.25E-17	1.16E-17	1.10E-17	1.05E-17	9.63E-18	9.50E-18
Ho-167	2.83E-18	2.63E-18	2.48E-18	2.37E-18	2.15E-18	2.12E-18
Ho-168	6.82E-18	6.31E-18	5.97E-18	5.71E-18	5.28E-18	5.21E-18
Ho-168m	3.82E-20	3.15E-20	2.72E-20	2.49E-20	2.06E-20	2.03E-20
Ho-170	1.31E-17	1.21E-17	1.14E-17	1.09E-17	1.01E-17	9.97E-18
Erbium						
Er-154	4.77E-19	4.13E-19	3.73E-19	3.48E-19	3.03E-19	2.98E-19
Er-156	3.99E-19	3.36E-19	2.96E-19	2.75E-19	2.33E-19	2.29E-19
Er-159	7.24E-18	6.69E-18	6.32E-18	6.04E-18	5.57E-18	5.50E-18
Er-161	7.50E-18	6.91E-18	6.52E-18	6.23E-18	5.74E-18	5.67E-18
Er-163	2.46E-19	2.04E-19	1.76E-19	1.62E-19	1.35E-19	1.32E-19
Er-165	2.30E-19	1.89E-19	1.63E-19	1.50E-19	1.24E-19	1.22E-19
Er-167m	7.23E-19	6.68E-19	6.25E-19	5.98E-19	5.39E-19	5.30E-19
Er-169	4.35E-22	3.65E-22	3.25E-22	3.02E-22	2.57E-22	2.52E-22
Er-171	2.86E-18	2.65E-18	2.49E-18	2.38E-18	2.16E-18	2.12E-18
Er-172	3.98E-18	3.67E-18	3.46E-18	3.30E-18	3.01E-18	2.97E-18
Er-173	6.39E-18	5.91E-18	5.57E-18	5.33E-18	4.89E-18	4.82E-18
Thulium						
Tm-161	9.39E-18	8.67E-18	8.16E-18	7.81E-18	7.22E-18	7.14E-18
Tm-162	1.39E-17	1.30E-17	1.23E-17	1.18E-17	1.10E-17	1.08E-17
Tm-163	9.68E-18	8.94E-18	8.43E-18	8.07E-18	7.47E-18	7.39E-18
Tm-164	5.94E-18	5.50E-18	5.21E-18	4.98E-18	4.59E-18	4.54E-18
Tm-165	4.24E-18	3.89E-18	3.65E-18	3.48E-18	3.17E-18	3.13E-18
Tm-166	1.44E-17	1.34E-17	1.26E-17	1.21E-17	1.13E-17	1.12E-17
Tm-167	1.05E-18	9.50E-19	8.75E-19	8.30E-19	7.37E-19	7.25E-19
Tm-168	9.53E-18	8.79E-18	8.29E-18	7.92E-18	7.27E-18	7.17E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-170	3.63E-20	3.25E-20	3.00E-20	2.84E-20	2.55E-20	2.52E-20
Tm-171	3.90E-21	3.29E-21	2.91E-21	2.68E-21	2.27E-21	2.24E-21
Tm-172	3.51E-18	3.26E-18	3.08E-18	2.96E-18	2.77E-18	2.74E-18
Tm-173	3.04E-18	2.82E-18	2.67E-18	2.55E-18	2.32E-18	2.29E-18
Tm-174	1.36E-17	1.26E-17	1.19E-17	1.14E-17	1.05E-17	1.04E-17
Tm-175	8.37E-18	7.75E-18	7.33E-18	7.01E-18	6.46E-18	6.38E-18
Tm-176	1.45E-17	1.35E-17	1.27E-17	1.22E-17	1.14E-17	1.12E-17
Ytterbium						
Yb-162	1.85E-18	1.70E-18	1.58E-18	1.50E-18	1.35E-18	1.33E-18
Yb-163	5.49E-18	5.07E-18	4.79E-18	4.58E-18	4.22E-18	4.16E-18
Yb-164	3.55E-19	3.05E-19	2.72E-19	2.53E-19	2.18E-19	2.15E-19
Yb-165	2.44E-18	2.22E-18	2.06E-18	1.96E-18	1.78E-18	1.76E-18
Yb-166	5.48E-19	4.64E-19	4.09E-19	3.78E-19	3.20E-19	3.15E-19
Yb-167	1.87E-18	1.68E-18	1.54E-18	1.46E-18	1.29E-18	1.27E-18
Yb-169	2.32E-18	2.09E-18	1.92E-18	1.81E-18	1.60E-18	1.58E-18
Yb-175	3.02E-19	2.79E-19	2.63E-19	2.51E-19	2.28E-19	2.25E-19
Yb-177	1.49E-18	1.38E-18	1.30E-18	1.24E-18	1.15E-18	1.13E-18
Yb-178	2.99E-19	2.77E-19	2.62E-19	2.50E-19	2.28E-19	2.24E-19
Yb-179	7.65E-18	7.09E-18	6.72E-18	6.41E-18	5.88E-18	5.80E-18
Lutetium						
Lu-165	8.31E-18	7.69E-18	7.26E-18	6.94E-18	6.40E-18	6.32E-18
Lu-167	1.22E-17	1.14E-17	1.07E-17	1.03E-17	9.58E-18	9.48E-18
Lu-169	9.71E-18	8.98E-18	8.47E-18	8.11E-18	7.52E-18	7.44E-18
Lu-169m	1.16E-23	7.23E-24	5.59E-24	4.73E-24	1.67E-24	1.55E-24
Lu-170	1.80E-17	1.67E-17	1.59E-17	1.53E-17	1.43E-17	1.42E-17
Lu-171	4.90E-18	4.49E-18	4.23E-18	4.02E-18	3.68E-18	3.64E-18
Lu-171m	2.09E-21	1.79E-21	1.61E-21	1.49E-21	1.29E-21	1.27E-21
Lu-172	1.47E-17	1.36E-17	1.29E-17	1.23E-17	1.14E-17	1.12E-17
Lu-172m	1.27E-23	9.30E-24	7.65E-24	6.82E-24	4.69E-24	4.55E-24
Lu-173	1.28E-18	1.14E-18	1.05E-18	9.87E-19	8.72E-19	8.59E-19
Lu-174	8.03E-19	7.18E-19	6.62E-19	6.26E-19	5.65E-19	5.58E-19
Lu-174m	3.86E-19	3.31E-19	2.96E-19	2.74E-19	2.37E-19	2.33E-19
Lu-176	3.67E-18	3.40E-18	3.20E-18	3.07E-18	2.78E-18	2.73E-18
Lu-176m	1.19E-19	1.08E-19	1.00E-19	9.49E-20	8.56E-20	8.45E-20
Lu-177	2.62E-19	2.43E-19	2.27E-19	2.17E-19	1.96E-19	1.93E-19
Lu-177m	7.61E-18	7.04E-18	6.62E-18	6.32E-18	5.72E-18	5.63E-18
Lu-178	1.00E-18	9.34E-19	8.85E-19	8.52E-19	7.96E-19	7.88E-19
Lu-178m	8.06E-18	7.47E-18	7.05E-18	6.73E-18	6.11E-18	6.02E-18
Lu-179	2.61E-19	2.44E-19	2.31E-19	2.22E-19	2.03E-19	2.01E-19
Lu-180	1.14E-17	1.06E-17	9.99E-18	9.58E-18	8.88E-18	8.78E-18
Lu-181	4.49E-18	4.16E-18	3.93E-18	3.75E-18	3.44E-18	3.39E-18
Hafnium						
Hf-167	4.86E-18	4.50E-18	4.26E-18	4.06E-18	3.71E-18	3.65E-18
Hf-169	4.96E-18	4.58E-18	4.33E-18	4.12E-18	3.76E-18	3.70E-18
Hf-170	3.31E-18	3.04E-18	2.85E-18	2.71E-18	2.46E-18	2.42E-18
Hf-172	6.61E-19	5.73E-19	5.15E-19	4.79E-19	4.15E-19	4.08E-19

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-173	2.95E-18	2.71E-18	2.53E-18	2.41E-18	2.18E-18	2.14E-18
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Hf-175	2.68E-18	2.46E-18	2.31E-18	2.20E-18	1.99E-18	1.96E-18
Hf-177m	1.75E-17	1.62E-17	1.53E-17	1.46E-17	1.33E-17	1.31E-17
Hf-178m	1.73E-17	1.60E-17	1.52E-17	1.45E-17	1.32E-17	1.30E-17
Hf-179m	7.04E-18	6.51E-18	6.13E-18	5.85E-18	5.31E-18	5.23E-18
Hf-180m	7.62E-18	7.05E-18	6.65E-18	6.35E-18	5.77E-18	5.69E-18
Hf-181	4.11E-18	3.81E-18	3.60E-18	3.43E-18	3.13E-18	3.08E-18
Hf-182	1.84E-18	1.71E-18	1.61E-18	1.54E-18	1.40E-18	1.38E-18
Hf-182m	6.98E-18	6.45E-18	6.08E-18	5.80E-18	5.30E-18	5.23E-18
Hf-183	5.97E-18	5.51E-18	5.21E-18	4.97E-18	4.57E-18	4.52E-18
Hf-184	1.76E-18	1.63E-18	1.53E-18	1.46E-18	1.32E-18	1.30E-18
Tantalum						
Ta-170	8.57E-18	7.95E-18	7.53E-18	7.19E-18	6.62E-18	6.53E-18
Ta-172	1.28E-17	1.19E-17	1.12E-17	1.07E-17	9.93E-18	9.81E-18
Ta-173	4.28E-18	3.94E-18	3.70E-18	3.53E-18	3.25E-18	3.21E-18
Ta-174	7.30E-18	6.77E-18	6.39E-18	6.12E-18	5.64E-18	5.57E-18
Ta-175	8.14E-18	7.53E-18	7.10E-18	6.80E-18	6.29E-18	6.22E-18
Ta-176	1.60E-17	1.49E-17	1.41E-17	1.35E-17	1.26E-17	1.25E-17
Ta-177	4.49E-19	3.92E-19	3.55E-19	3.31E-19	2.89E-19	2.85E-19
Ta-178	8.47E-19	7.60E-19	7.03E-19	6.65E-19	6.01E-19	5.93E-19
Ta-178m	8.82E-18	8.15E-18	7.67E-18	7.32E-18	6.64E-18	6.54E-18
Ta-179	1.56E-19	1.33E-19	1.18E-19	1.09E-19	9.27E-20	9.14E-20
Ta-180	3.07E-19	2.64E-19	2.35E-19	2.18E-19	1.88E-19	1.85E-19
Ta-182	9.62E-18	8.89E-18	8.39E-18	8.04E-18	7.46E-18	7.37E-18
Ta-182m	1.92E-18	1.77E-18	1.64E-18	1.56E-18	1.41E-18	1.38E-18
Ta-183	2.17E-18	1.99E-18	1.86E-18	1.77E-18	1.60E-18	1.57E-18
Ta-184	1.21E-17	1.12E-17	1.06E-17	1.01E-17	9.31E-18	9.18E-18
Ta-185	1.19E-18	1.10E-18	1.03E-18	9.82E-19	8.91E-19	8.78E-19
Ta-186	1.11E-17	1.03E-17	9.76E-18	9.33E-18	8.56E-18	8.45E-18
Tungsten						
W-177	6.89E-18	6.34E-18	5.97E-18	5.69E-18	5.21E-18	5.14E-18
W-178	9.49E-20	8.09E-20	7.21E-20	6.65E-20	5.71E-20	5.63E-20
W-179	3.25E-19	2.73E-19	2.43E-19	2.24E-19	1.91E-19	1.88E-19
W-179m	3.80E-19	3.37E-19	3.09E-19	2.90E-19	2.56E-19	2.53E-19
W-181	2.52E-19	2.15E-19	1.92E-19	1.77E-19	1.52E-19	1.50E-19
W-185	1.06E-21	9.24E-22	8.36E-22	7.82E-22	6.79E-22	6.67E-22
W-185m	1.71E-19	1.56E-19	1.44E-19	1.36E-19	1.22E-19	1.20E-19
W-187	3.47E-18	3.21E-18	3.03E-18	2.89E-18	2.65E-18	2.61E-18
W-188	1.48E-20	1.36E-20	1.28E-20	1.22E-20	1.10E-20	1.09E-20
W-190	1.06E-18	9.61E-19	8.86E-19	8.36E-19	7.47E-19	7.35E-19
Rhenium						
Re-178	1.23E-17	1.14E-17	1.08E-17	1.04E-17	9.68E-18	9.57E-18
Re-179	8.09E-18	7.49E-18	7.08E-18	6.77E-18	6.23E-18	6.15E-18
Re-180	9.14E-18	8.43E-18	7.96E-18	7.61E-18	7.02E-18	6.93E-18
Re-181	6.10E-18	5.62E-18	5.30E-18	5.05E-18	4.62E-18	4.56E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-182	1.34E-17	1.23E-17	1.16E-17	1.11E-17	1.03E-17	1.01E-17
Re-182m	9.00E-18	8.30E-18	7.83E-18	7.49E-18	6.94E-18	6.87E-18
Re-183	1.07E-18	9.62E-19	8.84E-19	8.32E-19	7.38E-19	7.27E-19
Re-184	6.79E-18	6.25E-18	5.90E-18	5.63E-18	5.19E-18	5.12E-18
Re-184m	2.86E-18	2.62E-18	2.47E-18	2.35E-18	2.15E-18	2.12E-18
Re-186	1.59E-19	1.46E-19	1.36E-19	1.29E-19	1.17E-19	1.15E-19
Re-186m	9.42E-20	8.00E-20	7.12E-20	6.58E-20	5.63E-20	5.54E-20
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	5.54E-19	5.18E-19	4.91E-19	4.72E-19	4.37E-19	4.32E-19
Re-188m	4.54E-19	3.99E-19	3.63E-19	3.39E-19	2.98E-19	2.94E-19
Re-189	4.30E-19	3.99E-19	3.75E-19	3.59E-19	3.26E-19	3.21E-19
Re-190	1.04E-17	9.66E-18	9.14E-18	8.73E-18	8.01E-18	7.90E-18
Re-190m	7.17E-18	6.64E-18	6.28E-18	6.00E-18	5.49E-18	5.42E-18
Osmium						
Os-180	8.74E-19	7.85E-19	7.29E-19	6.88E-19	6.18E-19	6.09E-19
Os-181	1.03E-17	9.52E-18	8.99E-18	8.60E-18	7.95E-18	7.85E-18
Os-182	3.26E-18	3.01E-18	2.83E-18	2.69E-18	2.45E-18	2.41E-18
Os-183	4.73E-18	4.35E-18	4.09E-18	3.89E-18	3.54E-18	3.49E-18
Os-183m	7.54E-18	6.96E-18	6.57E-18	6.29E-18	5.83E-18	5.76E-18
Os-185	5.31E-18	4.90E-18	4.63E-18	4.41E-18	4.05E-18	3.99E-18
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	5.08E-23	3.22E-23	2.53E-23	2.17E-23	6.72E-24	6.18E-24
Os-190m	1.24E-17	1.15E-17	1.09E-17	1.04E-17	9.47E-18	9.34E-18
Os-191	5.59E-19	5.05E-19	4.65E-19	4.38E-19	3.91E-19	3.85E-19
Os-191m	3.75E-20	3.23E-20	2.92E-20	2.70E-20	2.35E-20	2.32E-20
Os-193	5.18E-19	4.78E-19	4.50E-19	4.28E-19	3.90E-19	3.84E-19
Os-194	1.40E-20	1.11E-20	9.42E-21	8.56E-21	6.90E-21	6.75E-21
Os-196	6.25E-19	5.77E-19	5.44E-19	5.18E-19	4.72E-19	4.65E-19
Iridium						
Ir-180	1.26E-17	1.17E-17	1.10E-17	1.06E-17	9.70E-18	9.57E-18
Ir-182	1.10E-17	1.02E-17	9.67E-18	9.25E-18	8.50E-18	8.39E-18
Ir-183	8.71E-18	8.07E-18	7.62E-18	7.30E-18	6.76E-18	6.68E-18
Ir-184	1.47E-17	1.37E-17	1.29E-17	1.24E-17	1.14E-17	1.13E-17
Ir-185	6.13E-18	5.68E-18	5.35E-18	5.13E-18	4.76E-18	4.71E-18
Ir-186	1.24E-17	1.15E-17	1.09E-17	1.04E-17	9.60E-18	9.48E-18
Ir-186m	9.28E-18	8.60E-18	8.13E-18	7.79E-18	7.22E-18	7.13E-18
Ir-187	2.46E-18	2.25E-18	2.12E-18	2.01E-18	1.84E-18	1.81E-18
Ir-188	1.48E-17	1.38E-17	1.31E-17	1.26E-17	1.18E-17	1.17E-17
Ir-189	5.21E-19	4.60E-19	4.22E-19	3.95E-19	3.49E-19	3.45E-19
Ir-190	1.14E-17	1.06E-17	9.99E-18	9.52E-18	8.71E-18	8.59E-18
Ir-190m	5.76E-23	3.70E-23	2.93E-23	2.53E-23	7.75E-24	7.12E-24
Ir-190n	3.68E-19	3.20E-19	2.90E-19	2.70E-19	2.37E-19	2.33E-19
Ir-191m	5.04E-19	4.54E-19	4.19E-19	3.95E-19	3.52E-19	3.46E-19
Ir-192	6.36E-18	5.90E-18	5.58E-18	5.33E-18	4.86E-18	4.79E-18
Ir-192m	6.27E-22	5.16E-22	4.62E-22	4.30E-22	3.32E-22	3.26E-22
Ir-192n	4.48E-21	3.87E-21	3.51E-21	3.27E-21	2.78E-21	2.74E-21

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-193m	2.07E-21	1.78E-21	1.61E-21	1.49E-21	1.29E-21	1.27E-21
Ir-194	8.04E-19	7.51E-19	7.14E-19	6.87E-19	6.35E-19	6.28E-19
Ir-194m	1.82E-17	1.69E-17	1.60E-17	1.52E-17	1.40E-17	1.38E-17
Ir-195	3.95E-19	3.52E-19	3.23E-19	3.04E-19	2.70E-19	2.66E-19
Ir-195m	2.88E-18	2.66E-18	2.51E-18	2.39E-18	2.18E-18	2.15E-18
Ir-196	1.99E-18	1.86E-18	1.76E-18	1.69E-18	1.57E-18	1.55E-18
Ir-196m	1.92E-17	1.78E-17	1.69E-17	1.61E-17	1.48E-17	1.45E-17
Platinum						
Pt-184	5.41E-18	4.97E-18	4.67E-18	4.44E-18	4.03E-18	3.97E-18
Pt-186	5.22E-18	4.81E-18	4.54E-18	4.32E-18	3.96E-18	3.91E-18
Pt-187	4.63E-18	4.25E-18	4.00E-18	3.81E-18	3.49E-18	3.44E-18
Pt-188	1.48E-18	1.35E-18	1.26E-18	1.19E-18	1.07E-18	1.06E-18
Pt-189	3.61E-18	3.31E-18	3.11E-18	2.96E-18	2.70E-18	2.67E-18
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	2.16E-18	1.97E-18	1.84E-18	1.74E-18	1.57E-18	1.55E-18
Pt-193	1.41E-22	9.19E-23	7.34E-23	6.39E-23	1.99E-23	1.82E-23
Pt-193m	6.80E-20	5.92E-20	5.39E-20	5.01E-20	4.40E-20	4.34E-20
Pt-195m	4.74E-19	4.19E-19	3.83E-19	3.58E-19	3.16E-19	3.12E-19
Pt-197	1.68E-19	1.51E-19	1.40E-19	1.32E-19	1.18E-19	1.17E-19
Pt-197m	5.77E-19	5.22E-19	4.87E-19	4.61E-19	4.14E-19	4.08E-19
Pt-199	1.59E-18	1.47E-18	1.40E-18	1.33E-18	1.22E-18	1.21E-18
Pt-200	4.17E-19	3.79E-19	3.52E-19	3.33E-19	2.99E-19	2.94E-19
Pt-202	6.71E-20	6.53E-20	6.40E-20	6.32E-20	6.16E-20	6.14E-20
Gold						
Au-186	1.16E-17	1.08E-17	1.02E-17	9.78E-18	9.01E-18	8.89E-18
Au-187	7.79E-18	7.22E-18	6.82E-18	6.54E-18	6.07E-18	6.00E-18
Au-190	1.67E-17	1.56E-17	1.48E-17	1.42E-17	1.33E-17	1.32E-17
Au-191	4.51E-18	4.15E-18	3.92E-18	3.73E-18	3.40E-18	3.35E-18
Au-192	1.38E-17	1.29E-17	1.22E-17	1.17E-17	1.09E-17	1.08E-17
Au-193	1.19E-18	1.07E-18	9.99E-19	9.45E-19	8.48E-19	8.36E-19
Au-193m	1.49E-18	1.38E-18	1.29E-18	1.24E-18	1.12E-18	1.11E-18
Au-194	7.61E-18	7.06E-18	6.67E-18	6.40E-18	5.93E-18	5.86E-18
Au-195	5.29E-19	4.65E-19	4.25E-19	3.97E-19	3.49E-19	3.45E-19
Au-195m	1.51E-18	1.40E-18	1.32E-18	1.26E-18	1.14E-18	1.12E-18
Au-196	3.62E-18	3.34E-18	3.15E-18	3.00E-18	2.73E-18	2.69E-18
Au-196m	1.75E-18	1.61E-18	1.50E-18	1.43E-18	1.29E-18	1.27E-18
Au-198	3.16E-18	2.93E-18	2.78E-18	2.65E-18	2.42E-18	2.39E-18
Au-198m	3.96E-18	3.66E-18	3.43E-18	3.28E-18	2.96E-18	2.92E-18
Au-199	7.07E-19	6.56E-19	6.14E-19	5.85E-19	5.30E-19	5.21E-19
Au-200	2.15E-18	2.00E-18	1.89E-18	1.82E-18	1.69E-18	1.67E-18
Au-200m	1.54E-17	1.43E-17	1.35E-17	1.29E-17	1.18E-17	1.17E-17
Au-201	2.89E-19	2.68E-19	2.54E-19	2.43E-19	2.24E-19	2.21E-19
Au-202	1.49E-18	1.39E-18	1.32E-18	1.27E-18	1.18E-18	1.17E-18
Mercury						
Hg-190	1.42E-18	1.30E-18	1.21E-18	1.15E-18	1.03E-18	1.02E-18
Hg-191m	1.12E-17	1.04E-17	9.81E-18	9.38E-18	8.64E-18	8.53E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-192	2.00E-18	1.83E-18	1.72E-18	1.63E-18	1.47E-18	1.45E-18
Hg-193	6.18E-18	5.71E-18	5.39E-18	5.16E-18	4.77E-18	4.71E-18
Hg-193m	7.68E-18	7.10E-18	6.71E-18	6.42E-18	5.93E-18	5.86E-18
Hg-194	2.23E-22	1.49E-22	1.21E-22	1.07E-22	3.41E-23	3.12E-23
Hg-195	1.44E-18	1.31E-18	1.23E-18	1.17E-18	1.07E-18	1.05E-18
Hg-195m	1.49E-18	1.37E-18	1.28E-18	1.22E-18	1.11E-18	1.09E-18
Hg-197	4.64E-19	4.08E-19	3.73E-19	3.48E-19	3.07E-19	3.03E-19
Hg-197m	6.75E-19	6.20E-19	5.78E-19	5.48E-19	4.94E-19	4.86E-19
Hg-199m	1.33E-18	1.23E-18	1.15E-18	1.09E-18	9.87E-19	9.72E-19
Hg-203	1.83E-18	1.70E-18	1.60E-18	1.54E-18	1.39E-18	1.37E-18
Hg-205	8.34E-20	7.92E-20	7.61E-20	7.41E-20	6.98E-20	6.92E-20
Hg-206	9.55E-19	8.86E-19	8.37E-19	8.00E-19	7.29E-19	7.18E-19
Hg-207	1.94E-17	1.81E-17	1.71E-17	1.65E-17	1.54E-17	1.52E-17
Thallium						
Tl-190	1.04E-17	9.66E-18	9.16E-18	8.75E-18	8.05E-18	7.94E-18
Tl-190m	1.92E-17	1.78E-17	1.68E-17	1.61E-17	1.48E-17	1.46E-17
Tl-194	7.20E-18	6.67E-18	6.32E-18	6.03E-18	5.53E-18	5.45E-18
Tl-194m	1.95E-17	1.80E-17	1.71E-17	1.63E-17	1.50E-17	1.48E-17
Tl-195	8.88E-18	8.23E-18	7.79E-18	7.47E-18	6.95E-18	6.87E-18
Tl-196	1.38E-17	1.28E-17	1.21E-17	1.16E-17	1.08E-17	1.07E-17
Tl-197	3.39E-18	3.13E-18	2.95E-18	2.81E-18	2.58E-18	2.55E-18
Tl-198	1.46E-17	1.36E-17	1.29E-17	1.24E-17	1.15E-17	1.14E-17
Tl-198m	9.39E-18	8.69E-18	8.22E-18	7.84E-18	7.17E-18	7.07E-18
Tl-199	1.85E-18	1.70E-18	1.59E-18	1.51E-18	1.37E-18	1.35E-18
Tl-200	9.86E-18	9.13E-18	8.63E-18	8.26E-18	7.62E-18	7.53E-18
Tl-201	6.17E-19	5.51E-19	5.07E-19	4.76E-19	4.23E-19	4.18E-19
Tl-202	3.56E-18	3.29E-18	3.10E-18	2.95E-18	2.69E-18	2.65E-18
Tl-204	1.25E-20	1.12E-20	1.04E-20	9.79E-21	8.83E-21	8.73E-21
Tl-206	4.44E-20	4.30E-20	4.21E-20	4.15E-20	4.03E-20	4.01E-20
Tl-206m	1.87E-17	1.73E-17	1.63E-17	1.56E-17	1.44E-17	1.42E-17
Tl-207	5.36E-20	5.12E-20	4.95E-20	4.83E-20	4.62E-20	4.59E-20
Tl-208	2.30E-17	2.15E-17	2.05E-17	1.97E-17	1.85E-17	1.84E-17
Tl-209	1.58E-17	1.47E-17	1.39E-17	1.33E-17	1.24E-17	1.23E-17
Tl-210	2.06E-17	1.91E-17	1.81E-17	1.74E-17	1.62E-17	1.60E-17
Lead						
Pb-194	8.04E-18	7.44E-18	7.03E-18	6.72E-18	6.21E-18	6.14E-18
Pb-195m	1.27E-17	1.18E-17	1.11E-17	1.06E-17	9.76E-18	9.63E-18
Pb-196	3.72E-18	3.43E-18	3.23E-18	3.08E-18	2.80E-18	2.76E-18
Pb-197	1.13E-17	1.05E-17	9.92E-18	9.51E-18	8.82E-18	8.72E-18
Pb-197m	8.94E-18	8.27E-18	7.82E-18	7.46E-18	6.85E-18	6.76E-18
Pb-198	3.29E-18	3.04E-18	2.86E-18	2.72E-18	2.48E-18	2.44E-18
Pb-199	7.69E-18	7.12E-18	6.73E-18	6.45E-18	5.97E-18	5.90E-18
Pb-200	1.48E-18	1.36E-18	1.27E-18	1.20E-18	1.08E-18	1.07E-18
Pb-201	5.74E-18	5.30E-18	5.01E-18	4.78E-18	4.38E-18	4.32E-18
Pb-201m	2.83E-18	2.61E-18	2.47E-18	2.36E-18	2.16E-18	2.13E-18
Pb-202	2.38E-22	1.52E-22	1.21E-22	1.04E-22	3.25E-23	2.98E-23

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-202m	1.54E-17	1.42E-17	1.35E-17	1.29E-17	1.19E-17	1.17E-17
Pb-203	2.34E-18	2.16E-18	2.03E-18	1.93E-18	1.75E-18	1.72E-18
Pb-204m	1.59E-17	1.47E-17	1.39E-17	1.33E-17	1.23E-17	1.21E-17
Pb-205	2.41E-22	1.54E-22	1.22E-22	1.06E-22	3.29E-23	3.02E-23
Pb-209	2.14E-21	1.91E-21	1.77E-21	1.68E-21	1.51E-21	1.49E-21
Pb-210	1.27E-20	1.03E-20	8.79E-21	8.03E-21	6.43E-21	6.30E-21
Pb-211	5.29E-19	4.91E-19	4.65E-19	4.45E-19	4.11E-19	4.05E-19
Pb-212	1.08E-18	9.99E-19	9.38E-19	8.97E-19	8.10E-19	7.98E-19
Pb-214	1.95E-18	1.80E-18	1.70E-18	1.63E-18	1.48E-18	1.46E-18
Bismuth						
Bi-197	1.28E-17	1.19E-17	1.12E-17	1.07E-17	9.94E-18	9.83E-18
Bi-200	1.87E-17	1.73E-17	1.64E-17	1.57E-17	1.44E-17	1.42E-17
Bi-201	1.28E-17	1.18E-17	1.12E-17	1.07E-17	9.98E-18	9.86E-18
Bi-202	2.10E-17	1.94E-17	1.84E-17	1.76E-17	1.62E-17	1.60E-17
Bi-203	1.75E-17	1.62E-17	1.53E-17	1.47E-17	1.37E-17	1.36E-17
Bi-204	2.20E-17	2.04E-17	1.93E-17	1.84E-17	1.71E-17	1.69E-17
Bi-205	1.23E-17	1.15E-17	1.08E-17	1.04E-17	9.69E-18	9.59E-18
Bi-206	2.48E-17	2.29E-17	2.17E-17	2.08E-17	1.92E-17	1.90E-17
Bi-207	1.17E-17	1.08E-17	1.02E-17	9.75E-18	9.01E-18	8.90E-18
Bi-208	1.73E-17	1.63E-17	1.55E-17	1.50E-17	1.42E-17	1.40E-17
Bi-210	1.88E-20	1.81E-20	1.76E-20	1.73E-20	1.67E-20	1.66E-20
Bi-210m	2.01E-18	1.86E-18	1.76E-18	1.68E-18	1.53E-18	1.51E-18
Bi-211	3.66E-19	3.40E-19	3.21E-19	3.07E-19	2.79E-19	2.75E-19
Bi-212	8.40E-19	7.81E-19	7.41E-19	7.12E-19	6.62E-19	6.55E-19
Bi-212n	4.29E-20	4.16E-20	4.08E-20	4.02E-20	3.91E-20	3.89E-20
Bi-213	1.02E-18	9.47E-19	8.98E-19	8.57E-19	7.85E-19	7.74E-19
Bi-214	1.09E-17	1.02E-17	9.62E-18	9.24E-18	8.62E-18	8.52E-18
Bi-215	1.99E-18	1.85E-18	1.75E-18	1.67E-18	1.54E-18	1.52E-18
Bi-216	6.02E-18	5.59E-18	5.31E-18	5.07E-18	4.66E-18	4.59E-18
Polonium						
Po-203	1.22E-17	1.13E-17	1.07E-17	1.03E-17	9.50E-18	9.39E-18
Po-204	8.77E-18	8.09E-18	7.63E-18	7.29E-18	6.70E-18	6.62E-18
Po-205	1.19E-17	1.10E-17	1.04E-17	9.95E-18	9.22E-18	9.11E-18
Po-206	9.06E-18	8.37E-18	7.91E-18	7.55E-18	6.95E-18	6.86E-18
Po-207	9.73E-18	8.99E-18	8.49E-18	8.12E-18	7.51E-18	7.42E-18
Po-208	1.63E-22	1.50E-22	1.42E-22	1.36E-22	1.24E-22	1.22E-22
Po-209	4.70E-20	4.34E-20	4.10E-20	3.92E-20	3.60E-20	3.55E-20
Po-210	7.53E-23	6.96E-23	6.59E-23	6.30E-23	5.81E-23	5.74E-23
Po-211	6.33E-20	5.85E-20	5.54E-20	5.29E-20	4.88E-20	4.82E-20
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	5.33E-19	5.00E-19	4.76E-19	4.59E-19	4.32E-19	4.28E-19
Po-213	2.91E-22	2.69E-22	2.54E-22	2.43E-22	2.24E-22	2.21E-22
Po-214	6.43E-22	5.94E-22	5.62E-22	5.37E-22	4.96E-22	4.90E-22
Po-215	1.38E-21	1.28E-21	1.21E-21	1.16E-21	1.06E-21	1.04E-21
Po-216	1.19E-22	1.10E-22	1.04E-22	9.91E-23	9.15E-23	9.03E-23
Po-218	3.81E-26	3.11E-26	2.73E-26	2.52E-26	2.09E-26	2.05E-26

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Astatine						
At-204	1.81E-17	1.68E-17	1.59E-17	1.52E-17	1.39E-17	1.37E-17
At-205	8.67E-18	8.03E-18	7.60E-18	7.26E-18	6.70E-18	6.62E-18
At-206	1.91E-17	1.77E-17	1.67E-17	1.60E-17	1.47E-17	1.45E-17
At-207	1.50E-17	1.39E-17	1.31E-17	1.26E-17	1.17E-17	1.15E-17
At-208	2.30E-17	2.13E-17	2.02E-17	1.93E-17	1.78E-17	1.76E-17
At-209	1.75E-17	1.62E-17	1.53E-17	1.46E-17	1.35E-17	1.33E-17
At-210	2.18E-17	2.02E-17	1.91E-17	1.84E-17	1.71E-17	1.69E-17
At-211	2.38E-19	2.14E-19	1.98E-19	1.87E-19	1.66E-19	1.64E-19
At-215	1.33E-21	1.24E-21	1.17E-21	1.12E-21	1.02E-21	1.00E-21
At-216	1.74E-20	1.59E-20	1.48E-20	1.40E-20	1.26E-20	1.24E-20
At-217	1.86E-21	1.72E-21	1.63E-21	1.55E-21	1.41E-21	1.39E-21
At-218	1.82E-22	1.78E-22	1.74E-22	1.72E-22	1.68E-22	1.67E-22
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	3.69E-18	3.44E-18	3.26E-18	3.12E-18	2.86E-18	2.82E-18
Radon						
Rn-207	7.60E-18	7.04E-18	6.66E-18	6.36E-18	5.84E-18	5.76E-18
Rn-209	8.97E-18	8.32E-18	7.87E-18	7.53E-18	6.95E-18	6.86E-18
Rn-210	4.65E-19	4.30E-19	4.06E-19	3.88E-19	3.56E-19	3.51E-19
Rn-211	1.41E-17	1.31E-17	1.24E-17	1.19E-17	1.10E-17	1.08E-17
Rn-212	2.64E-21	2.44E-21	2.31E-21	2.20E-21	2.03E-21	2.00E-21
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	5.91E-21	5.48E-21	5.19E-21	4.95E-21	4.55E-21	4.49E-21
Rn-219	4.54E-19	4.21E-19	3.98E-19	3.81E-19	3.46E-19	3.41E-19
Rn-220	4.91E-21	4.55E-21	4.32E-21	4.12E-21	3.78E-21	3.72E-21
Rn-222	3.04E-21	2.82E-21	2.68E-21	2.55E-21	2.34E-21	2.30E-21
Rn-223	2.65E-18	2.45E-18	2.32E-18	2.22E-18	2.04E-18	2.01E-18
Francium						
Fr-212	8.50E-18	7.88E-18	7.44E-18	7.13E-18	6.61E-18	6.53E-18
Fr-219	2.77E-20	2.57E-20	2.43E-20	2.32E-20	2.12E-20	2.08E-20
Fr-220	6.51E-20	5.94E-20	5.51E-20	5.22E-20	4.67E-20	4.60E-20
Fr-221	2.22E-19	2.06E-19	1.94E-19	1.86E-19	1.68E-19	1.66E-19
Fr-222	1.40E-18	1.30E-18	1.23E-18	1.18E-18	1.08E-18	1.06E-18
Fr-223	3.92E-19	3.50E-19	3.22E-19	3.04E-19	2.70E-19	2.66E-19
Fr-224	4.22E-18	3.92E-18	3.71E-18	3.56E-18	3.30E-18	3.26E-18
Fr-227	3.48E-18	3.22E-18	3.04E-18	2.90E-18	2.66E-18	2.62E-18
Radium						
Ra-219	1.30E-18	1.21E-18	1.14E-18	1.09E-18	9.90E-19	9.75E-19
Ra-220	3.66E-20	3.39E-20	3.22E-20	3.07E-20	2.81E-20	2.77E-20
Ra-221	2.63E-19	2.44E-19	2.28E-19	2.18E-19	1.96E-19	1.93E-19
Ra-222	7.14E-20	6.64E-20	6.28E-20	6.00E-20	5.46E-20	5.38E-20
Ra-223	1.03E-18	9.51E-19	8.92E-19	8.51E-19	7.69E-19	7.57E-19
Ra-224	7.95E-20	7.39E-20	6.97E-20	6.68E-20	6.05E-20	5.96E-20
Ra-225	6.53E-20	5.01E-20	4.17E-20	3.76E-20	2.97E-20	2.89E-20

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-226	5.52E-20	5.14E-20	4.83E-20	4.62E-20	4.19E-20	4.12E-20
Ra-227	1.11E-18	1.02E-18	9.66E-19	9.23E-19	8.40E-19	8.27E-19
Ra-228	1.18E-21	8.12E-22	6.94E-22	6.44E-22	2.73E-22	2.49E-22
Ra-230	5.84E-19	5.39E-19	5.07E-19	4.83E-19	4.38E-19	4.31E-19
Actinium						
Ac-223	1.30E-19	1.21E-19	1.13E-19	1.08E-19	9.80E-20	9.65E-20
Ac-224	1.68E-18	1.55E-18	1.46E-18	1.39E-18	1.26E-18	1.24E-18
Ac-225	1.03E-19	9.50E-20	8.88E-20	8.46E-20	7.61E-20	7.49E-20
Ac-226	9.91E-19	9.22E-19	8.67E-19	8.30E-19	7.52E-19	7.40E-19
Ac-227	8.66E-22	7.10E-22	6.37E-22	5.97E-22	4.67E-22	4.54E-22
Ac-228	6.57E-18	6.08E-18	5.75E-18	5.51E-18	5.10E-18	5.04E-18
Ac-230	4.08E-18	3.80E-18	3.61E-18	3.47E-18	3.24E-18	3.21E-18
Ac-231	3.23E-18	3.01E-18	2.84E-18	2.72E-18	2.47E-18	2.43E-18
Ac-232	8.40E-18	7.83E-18	7.42E-18	7.15E-18	6.69E-18	6.62E-18
Ac-233	4.01E-18	3.72E-18	3.53E-18	3.37E-18	3.10E-18	3.05E-18
Thorium						
Th-223	5.06E-19	4.67E-19	4.36E-19	4.15E-19	3.72E-19	3.66E-19
Th-224	1.73E-19	1.61E-19	1.52E-19	1.45E-19	1.31E-19	1.29E-19
Th-226	5.75E-20	5.35E-20	5.02E-20	4.80E-20	4.32E-20	4.25E-20
Th-227	9.36E-19	8.66E-19	8.14E-19	7.78E-19	7.03E-19	6.92E-19
Th-228	1.53E-20	1.39E-20	1.30E-20	1.23E-20	1.09E-20	1.08E-20
Th-229	6.08E-19	5.60E-19	5.22E-19	4.97E-19	4.45E-19	4.38E-19
Th-230	3.16E-21	2.72E-21	2.48E-21	2.32E-21	1.94E-21	1.91E-21
Th-231	9.06E-20	7.91E-20	7.23E-20	6.81E-20	5.88E-20	5.77E-20
Th-232	1.81E-21	1.50E-21	1.35E-21	1.25E-21	9.91E-22	9.71E-22
Th-233	2.89E-19	2.67E-19	2.53E-19	2.41E-19	2.21E-19	2.18E-19
Th-234	6.15E-20	5.53E-20	5.09E-20	4.80E-20	4.24E-20	4.17E-20
Th-235	4.87E-19	4.55E-19	4.33E-19	4.15E-19	3.85E-19	3.81E-19
Th-236	2.71E-19	2.52E-19	2.38E-19	2.28E-19	2.08E-19	2.05E-19
Protactinium						
Pa-227	1.36E-19	1.24E-19	1.14E-19	1.08E-19	9.59E-20	9.44E-20
Pa-228	1.02E-17	9.48E-18	8.97E-18	8.58E-18	7.93E-18	7.83E-18
Pa-229	4.30E-19	3.97E-19	3.70E-19	3.53E-19	3.15E-19	3.10E-19
Pa-230	5.06E-18	4.67E-18	4.42E-18	4.22E-18	3.89E-18	3.84E-18
Pa-231	2.64E-19	2.42E-19	2.27E-19	2.17E-19	1.95E-19	1.92E-19
Pa-232	7.17E-18	6.63E-18	6.27E-18	6.00E-18	5.54E-18	5.47E-18
Pa-233	1.64E-18	1.53E-18	1.44E-18	1.38E-18	1.25E-18	1.23E-18
Pa-234	1.11E-17	1.03E-17	9.74E-18	9.31E-18	8.60E-18	8.49E-18
Pa-234m	2.28E-19	2.17E-19	2.09E-19	2.03E-19	1.93E-19	1.91E-19
Pa-235	3.26E-20	3.16E-20	3.08E-20	3.04E-20	2.95E-20	2.94E-20
Pa-236	6.82E-18	6.34E-18	6.01E-18	5.77E-18	5.37E-18	5.30E-18
Pa-237	4.76E-18	4.41E-18	4.17E-18	3.99E-18	3.68E-18	3.64E-18
Uranium						
U-227	8.64E-19	8.02E-19	7.53E-19	7.21E-19	6.51E-19	6.40E-19
U-228	2.91E-20	2.68E-20	2.50E-20	2.39E-20	2.13E-20	2.10E-20
U-230	8.85E-21	7.86E-21	7.26E-21	6.87E-21	5.96E-21	5.86E-21

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-231	4.97E-19	4.56E-19	4.24E-19	4.04E-19	3.59E-19	3.53E-19
U-232	2.56E-21	2.11E-21	1.89E-21	1.77E-21	1.37E-21	1.33E-21
U-233	2.22E-21	1.92E-21	1.76E-21	1.66E-21	1.39E-21	1.36E-21
U-234	1.65E-21	1.30E-21	1.15E-21	1.07E-21	7.60E-22	7.35E-22
U-235	1.22E-18	1.14E-18	1.07E-18	1.03E-18	9.30E-19	9.15E-19
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	1.15E-21	8.70E-22	7.57E-22	7.02E-22	4.50E-22	4.31E-22
U-237	9.72E-19	8.92E-19	8.31E-19	7.92E-19	7.09E-19	6.97E-19
U-238	9.45E-22	7.15E-22	6.24E-22	5.79E-22	3.76E-22	3.61E-22
U-239	3.64E-19	3.26E-19	3.01E-19	2.84E-19	2.54E-19	2.51E-19
U-240	3.52E-20	3.17E-20	2.93E-20	2.78E-20	2.42E-20	2.38E-20
U-242	3.26E-19	2.99E-19	2.82E-19	2.68E-19	2.44E-19	2.41E-19
Neptunium						
Np-232	9.10E-18	8.42E-18	7.96E-18	7.61E-18	7.00E-18	6.91E-18
Np-233	6.16E-19	5.72E-19	5.35E-19	5.11E-19	4.59E-19	4.51E-19
Np-234	8.01E-18	7.45E-18	7.05E-18	6.77E-18	6.31E-18	6.25E-18
Np-235	6.90E-21	5.64E-21	5.08E-21	4.78E-21	3.62E-21	3.52E-21
Np-236	1.01E-18	9.37E-19	8.76E-19	8.37E-19	7.52E-19	7.39E-19
Np-236m	3.39E-19	3.15E-19	2.95E-19	2.81E-19	2.53E-19	2.49E-19
Np-237	1.68E-19	1.49E-19	1.37E-19	1.30E-19	1.14E-19	1.12E-19
Np-238	4.45E-18	4.11E-18	3.89E-18	3.72E-18	3.45E-18	3.41E-18
Np-239	1.31E-18	1.22E-18	1.14E-18	1.10E-18	9.88E-19	9.72E-19
Np-240	8.00E-18	7.40E-18	7.00E-18	6.69E-18	6.17E-18	6.09E-18
Np-240m	2.51E-18	2.33E-18	2.21E-18	2.11E-18	1.95E-18	1.93E-18
Np-241	2.94E-19	2.75E-19	2.58E-19	2.48E-19	2.25E-19	2.21E-19
Np-242	2.09E-18	1.94E-18	1.84E-18	1.77E-18	1.66E-18	1.64E-18
Np-242m	7.00E-18	6.48E-18	6.12E-18	5.86E-18	5.40E-18	5.34E-18
Plutonium						
Pu-232	4.22E-19	3.93E-19	3.68E-19	3.51E-19	3.15E-19	3.09E-19
Pu-234	4.57E-19	4.25E-19	3.97E-19	3.80E-19	3.40E-19	3.34E-19
Pu-235	6.30E-19	5.85E-19	5.46E-19	5.22E-19	4.69E-19	4.61E-19
Pu-236	1.46E-21	1.05E-21	9.07E-22	8.38E-22	5.00E-22	4.73E-22
Pu-237	3.30E-19	3.06E-19	2.85E-19	2.72E-19	2.43E-19	2.39E-19
Pu-238	1.21E-21	8.53E-22	7.28E-22	6.72E-22	3.73E-22	3.50E-22
Pu-239	9.51E-22	7.62E-22	6.82E-22	6.39E-22	4.77E-22	4.62E-22
Pu-240	1.17E-21	8.30E-22	7.09E-22	6.54E-22	3.69E-22	3.47E-22
Pu-241	1.12E-23	1.04E-23	9.74E-24	9.29E-24	8.33E-24	8.19E-24
Pu-242	1.53E-21	1.20E-21	1.08E-21	1.01E-21	7.39E-22	7.15E-22
Pu-243	1.68E-19	1.52E-19	1.41E-19	1.33E-19	1.19E-19	1.17E-19
Pu-244	1.44E-19	1.34E-19	1.28E-19	1.23E-19	1.14E-19	1.13E-19
Pu-245	3.09E-18	2.87E-18	2.71E-18	2.59E-18	2.38E-18	2.34E-18
Pu-246	9.95E-19	9.17E-19	8.56E-19	8.17E-19	7.34E-19	7.22E-19
Americium						
Am-237	2.75E-18	2.56E-18	2.41E-18	2.31E-18	2.09E-18	2.06E-18
Am-238	6.76E-18	6.26E-18	5.92E-18	5.66E-18	5.23E-18	5.17E-18
Am-239	1.68E-18	1.57E-18	1.47E-18	1.41E-18	1.27E-18	1.25E-18

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-240	7.79E-18	7.20E-18	6.80E-18	6.51E-18	6.02E-18	5.95E-18
Am-241	1.49E-19	1.26E-19	1.12E-19	1.03E-19	8.81E-20	8.68E-20
Am-242	1.01E-19	9.27E-20	8.64E-20	8.25E-20	7.34E-20	7.21E-20
Am-242m	5.77E-21	4.34E-21	3.78E-21	3.51E-21	2.46E-21	2.36E-21
Am-243	3.73E-19	3.28E-19	3.00E-19	2.80E-19	2.47E-19	2.43E-19
Am-244	6.09E-18	5.63E-18	5.32E-18	5.08E-18	4.69E-18	4.63E-18
Am-244m	1.50E-19	1.40E-19	1.33E-19	1.29E-19	1.20E-19	1.19E-19
Am-245	2.38E-19	2.21E-19	2.08E-19	1.99E-19	1.80E-19	1.77E-19
Am-246	5.63E-18	5.21E-18	4.92E-18	4.70E-18	4.32E-18	4.26E-18
Am-246m	7.45E-18	6.89E-18	6.52E-18	6.24E-18	5.79E-18	5.72E-18
Am-247	1.01E-18	9.45E-19	8.91E-19	8.53E-19	7.73E-19	7.62E-19
Curium						
Cm-238	5.55E-19	5.18E-19	4.85E-19	4.63E-19	4.16E-19	4.09E-19
Cm-239	1.88E-18	1.75E-18	1.64E-18	1.57E-18	1.42E-18	1.40E-18
Cm-240	1.63E-21	1.14E-21	9.69E-22	8.91E-22	5.23E-22	4.92E-22
Cm-241	3.76E-18	3.49E-18	3.30E-18	3.15E-18	2.87E-18	2.83E-18
Cm-242	1.43E-21	9.91E-22	8.40E-22	7.72E-22	4.44E-22	4.17E-22
Cm-243	9.51E-19	8.85E-19	8.31E-19	7.96E-19	7.18E-19	7.07E-19
Cm-244	1.32E-21	9.36E-22	8.04E-22	7.42E-22	4.57E-22	4.33E-22
Cm-245	7.26E-19	6.77E-19	6.33E-19	6.05E-19	5.44E-19	5.35E-19
Cm-246	2.71E-20	2.50E-20	2.37E-20	2.28E-20	2.11E-20	2.08E-20
Cm-247	2.45E-18	2.28E-18	2.16E-18	2.06E-18	1.88E-18	1.85E-18
Cm-248	9.51E-18	8.87E-18	8.42E-18	8.10E-18	7.56E-18	7.48E-18
Cm-249	1.56E-19	1.44E-19	1.37E-19	1.31E-19	1.20E-19	1.18E-19
Cm-250	9.68E-17	9.03E-17	8.57E-17	8.24E-17	7.69E-17	7.61E-17
Cm-251	8.81E-19	8.18E-19	7.76E-19	7.41E-19	6.80E-19	6.71E-19
Berkelium						
Bk-245	1.66E-18	1.55E-18	1.46E-18	1.39E-18	1.26E-18	1.24E-18
Bk-246	6.43E-18	5.95E-18	5.63E-18	5.38E-18	4.96E-18	4.90E-18
Bk-247	1.07E-18	9.93E-19	9.32E-19	8.90E-19	8.03E-19	7.90E-19
Bk-248m	3.94E-19	3.65E-19	3.44E-19	3.29E-19	2.98E-19	2.94E-19
Bk-249	2.72E-23	2.13E-23	1.84E-23	1.69E-23	1.36E-23	1.32E-23
Bk-250	6.82E-18	6.31E-18	5.96E-18	5.71E-18	5.30E-18	5.24E-18
Bk-251	6.19E-19	5.78E-19	5.41E-19	5.17E-19	4.66E-19	4.58E-19
Californium						
Cf-244	1.69E-21	1.14E-21	9.52E-22	8.68E-22	4.99E-22	4.66E-22
Cf-246	1.48E-21	1.08E-21	9.29E-22	8.59E-22	5.84E-22	5.58E-22
Cf-247	6.53E-19	6.07E-19	5.68E-19	5.42E-19	4.87E-19	4.78E-19
Cf-248	3.87E-21	3.25E-21	2.97E-21	2.81E-21	2.36E-21	2.31E-21
Cf-249	2.53E-18	2.35E-18	2.22E-18	2.12E-18	1.93E-18	1.90E-18
Cf-250	7.22E-20	6.71E-20	6.36E-20	6.11E-20	5.68E-20	5.61E-20
Cf-251	8.63E-19	8.05E-19	7.54E-19	7.21E-19	6.51E-19	6.40E-19
Cf-252	3.30E-18	3.08E-18	2.92E-18	2.81E-18	2.62E-18	2.60E-18
Cf-253	6.38E-21	4.51E-21	3.77E-21	3.43E-21	2.32E-21	2.22E-21
Cf-254	1.22E-16	1.14E-16	1.08E-16	1.04E-16	9.71E-17	9.61E-17
Cf-255	3.03E-21	2.76E-21	2.58E-21	2.48E-21	2.27E-21	2.24E-21

Table 4-2. Reference person effective dose rate coefficients for soil to 1 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Einsteinium						
Es-249	3.09E-18	2.87E-18	2.71E-18	2.58E-18	2.36E-18	2.33E-18
Es-250	9.04E-18	8.37E-18	7.90E-18	7.55E-18	6.92E-18	6.83E-18
Es-250m	4.10E-18	3.80E-18	3.59E-18	3.44E-18	3.18E-18	3.14E-18
Es-251	6.50E-19	6.06E-19	5.67E-19	5.42E-19	4.87E-19	4.79E-19
Es-253	2.93E-21	2.60E-21	2.41E-21	2.29E-21	2.00E-21	1.97E-21
Es-254	3.57E-20	2.87E-20	2.56E-20	2.39E-20	1.90E-20	1.85E-20
Es-254m	3.66E-18	3.38E-18	3.21E-18	3.06E-18	2.81E-18	2.78E-18
Es-255	5.16E-21	4.79E-21	4.53E-21	4.35E-21	4.05E-21	4.00E-21
Es-256	5.47E-20	5.20E-20	5.05E-20	4.96E-20	4.77E-20	4.74E-20
Fermium						
Fm-251	1.12E-18	1.04E-18	9.81E-19	9.37E-19	8.52E-19	8.38E-19
Fm-252	3.56E-21	2.90E-21	2.62E-21	2.47E-21	2.04E-21	1.99E-21
Fm-253	4.24E-19	3.93E-19	3.67E-19	3.51E-19	3.15E-19	3.09E-19
Fm-254	5.24E-20	4.85E-20	4.58E-20	4.40E-20	4.08E-20	4.03E-20
Fm-255	2.49E-20	1.93E-20	1.70E-20	1.58E-20	1.20E-20	1.16E-20
Fm-256	9.00E-17	8.39E-17	7.96E-17	7.66E-17	7.15E-17	7.07E-17
Fm-257	1.04E-18	9.65E-19	9.06E-19	8.67E-19	7.88E-19	7.75E-19

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm.

Explanation of entries

For each radionuclide, values for the age-dependent effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. Reference person organ equivalent dose coefficients h_T are provided electronically.[13]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^3), that is, the effective dose per unit time-integrated exposure to a radionuclide:

w_T: The tissue weighting factor:

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^3) for tissue *T*.

The dose rate coefficients provided in Table 4-3 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

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

To convert from SI units (Sv Bq^{-1} s^{-1} m^3) to conventional units (mrem μCi^{-1} y^{-1} cm^3), multiply table entries by 1.168×10^{23}.

To convert from SI units from a source per unit volume (Sv Bq^{-1} s^{-1} m^3) to conventional units for a source per unit mass basis (mrem μCi^{-1} y^{-1} g), multiply table entries by 1.868×10^{23}.

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

[13] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	1.80E-27	1.18E-27	9.56E-28	8.44E-28	2.72E-28	2.49E-28
Beryllium						
Be-7	1.11E-18	1.03E-18	9.73E-19	9.34E-19	8.49E-19	8.37E-19
Be-10	5.86E-21	5.25E-21	4.82E-21	4.57E-21	4.05E-21	3.99E-21
Carbon						
C-10	3.89E-17	3.61E-17	3.40E-17	3.27E-17	2.99E-17	2.95E-17
C-11	2.27E-17	2.11E-17	1.99E-17	1.91E-17	1.74E-17	1.72E-17
C-14	9.54E-23	7.55E-23	6.51E-23	5.99E-23	4.85E-23	4.74E-23
Nitrogen						
N-13	2.28E-17	2.11E-17	1.99E-17	1.92E-17	1.74E-17	1.72E-17
N-16	7.46E-17	7.21E-17	6.96E-17	6.80E-17	6.48E-17	6.45E-17
Oxygen						
O-14	6.84E-17	6.42E-17	6.09E-17	5.89E-17	5.49E-17	5.43E-17
O-15	2.29E-17	2.12E-17	2.00E-17	1.92E-17	1.75E-17	1.73E-17
O-19	2.06E-17	1.92E-17	1.81E-17	1.75E-17	1.62E-17	1.60E-17
Fluorine						
F-17	2.29E-17	2.12E-17	2.00E-17	1.92E-17	1.75E-17	1.73E-17
F-18	2.20E-17	2.04E-17	1.93E-17	1.85E-17	1.69E-17	1.66E-17
Neon						
Ne-19	2.29E-17	2.13E-17	2.01E-17	1.93E-17	1.76E-17	1.73E-17
Ne-24	1.22E-17	1.13E-17	1.07E-17	1.03E-17	9.35E-18	9.22E-18
Sodium						
Na-22	4.77E-17	4.43E-17	4.18E-17	4.03E-17	3.71E-17	3.67E-17
Na-24	8.21E-17	7.74E-17	7.35E-17	7.14E-17	6.70E-17	6.64E-17
Magnesium						
Mg-27	1.97E-17	1.82E-17	1.72E-17	1.66E-17	1.52E-17	1.51E-17
Mg-28	2.92E-17	2.70E-17	2.55E-17	2.47E-17	2.28E-17	2.26E-17
Aluminum						
Al-26	5.64E-17	5.28E-17	4.99E-17	4.83E-17	4.48E-17	4.43E-17
Al-28	3.69E-17	3.46E-17	3.28E-17	3.18E-17	2.98E-17	2.95E-17
Al-29	2.94E-17	2.74E-17	2.59E-17	2.50E-17	2.33E-17	2.31E-17
Silicon						
Si-31	9.23E-20	8.76E-20	8.42E-20	8.21E-20	7.77E-20	7.71E-20
Si-32	2.73E-22	2.26E-22	1.99E-22	1.85E-22	1.55E-22	1.51E-22
Phosphorus						
P-30	2.32E-17	2.15E-17	2.03E-17	1.95E-17	1.78E-17	1.75E-17
P-32	1.04E-19	9.92E-20	9.58E-20	9.38E-20	8.93E-20	8.88E-20
P-33	3.69E-22	3.08E-22	2.73E-22	2.54E-22	2.14E-22	2.10E-22
Sulfur						
S-35	1.03E-22	8.22E-23	7.11E-23	6.55E-23	5.34E-23	5.22E-23
S-37	5.53E-17	5.27E-17	5.02E-17	4.89E-17	4.63E-17	4.59E-17
S-38	3.45E-17	3.24E-17	3.07E-17	2.99E-17	2.80E-17	2.77E-17
Chlorine						
Cl-34	2.35E-17	2.19E-17	2.07E-17	1.99E-17	1.81E-17	1.78E-17
Cl-34m	4.34E-17	4.07E-17	3.86E-17	3.73E-17	3.48E-17	3.44E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	1.23E-20	1.13E-20	1.06E-20	1.02E-20	9.25E-21	9.13E-21
Cl-38	2.99E-17	2.81E-17	2.66E-17	2.59E-17	2.43E-17	2.40E-17
Cl-39	3.10E-17	2.89E-17	2.73E-17	2.64E-17	2.45E-17	2.42E-17
Cl-40	8.06E-17	7.60E-17	7.23E-17	7.02E-17	6.60E-17	6.54E-17
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	4.68E-21	4.19E-21	3.84E-21	3.64E-21	3.22E-21	3.17E-21
Ar-41	2.75E-17	2.55E-17	2.41E-17	2.33E-17	2.17E-17	2.14E-17
Ar-42	5.54E-21	4.99E-21	4.59E-21	4.37E-21	3.88E-21	3.83E-21
Ar-43	3.26E-17	3.04E-17	2.88E-17	2.79E-17	2.59E-17	2.57E-17
Ar-44	4.03E-17	3.77E-17	3.57E-17	3.46E-17	3.22E-17	3.19E-17
Potassium						
K-38	6.63E-17	6.22E-17	5.89E-17	5.71E-17	5.31E-17	5.25E-17
K-40	3.37E-18	3.14E-18	2.97E-18	2.88E-18	2.68E-18	2.65E-18
K-42	6.29E-18	5.88E-18	5.57E-18	5.40E-18	5.05E-18	5.00E-18
K-43	2.14E-17	1.99E-17	1.88E-17	1.80E-17	1.64E-17	1.62E-17
K-44	4.93E-17	4.62E-17	4.38E-17	4.25E-17	3.97E-17	3.93E-17
K-45	3.81E-17	3.57E-17	3.38E-17	3.27E-17	3.05E-17	3.02E-17
K-46	5.82E-17	5.47E-17	5.20E-17	5.05E-17	4.74E-17	4.69E-17
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	3.90E-22	3.26E-22	2.89E-22	2.70E-22	2.28E-22	2.23E-22
Ca-47	2.26E-17	2.10E-17	1.98E-17	1.92E-17	1.78E-17	1.76E-17
Ca-49	5.96E-17	5.68E-17	5.41E-17	5.27E-17	4.99E-17	4.95E-17
Scandium						
Sc-42m	9.10E-17	8.46E-17	8.00E-17	7.72E-17	7.12E-17	7.04E-17
Sc-43	2.20E-17	2.04E-17	1.92E-17	1.85E-17	1.68E-17	1.66E-17
Sc-44	4.69E-17	4.34E-17	4.10E-17	3.95E-17	3.63E-17	3.59E-17
Sc-44m	6.00E-18	5.62E-18	5.27E-18	5.08E-18	4.59E-18	4.53E-18
Sc-46	4.39E-17	4.05E-17	3.82E-17	3.69E-17	3.41E-17	3.37E-17
Sc-47	2.29E-18	2.14E-18	2.00E-18	1.91E-18	1.73E-18	1.70E-18
Sc-48	7.26E-17	6.71E-17	6.34E-17	6.13E-17	5.67E-17	5.61E-17
Sc-49	1.68E-19	1.61E-19	1.55E-19	1.52E-19	1.45E-19	1.44E-19
Sc-50	6.89E-17	6.41E-17	6.06E-17	5.86E-17	5.43E-17	5.38E-17
Titanium						
Ti-44	2.12E-18	1.85E-18	1.68E-18	1.58E-18	1.37E-18	1.35E-18
Ti-45	1.94E-17	1.80E-17	1.70E-17	1.63E-17	1.49E-17	1.46E-17
Ti-51	8.32E-18	7.76E-18	7.30E-18	7.03E-18	6.37E-18	6.29E-18
Ti-52	2.60E-18	2.43E-18	2.28E-18	2.17E-18	1.97E-18	1.93E-18
Vanadium						
V-47	2.23E-17	2.07E-17	1.95E-17	1.88E-17	1.71E-17	1.68E-17
V-48	6.32E-17	5.85E-17	5.53E-17	5.34E-17	4.93E-17	4.87E-17
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	2.99E-17	2.79E-17	2.64E-17	2.56E-17	2.38E-17	2.36E-17
V-52	3.08E-17	2.87E-17	2.71E-17	2.63E-17	2.45E-17	2.42E-17
V-53	2.28E-17	2.11E-17	1.99E-17	1.93E-17	1.78E-17	1.76E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Chromium						
Cr-48	9.30E-18	8.69E-18	8.15E-18	7.83E-18	7.05E-18	6.96E-18
Cr-49	2.32E-17	2.15E-17	2.02E-17	1.94E-17	1.77E-17	1.74E-17
Cr-51	7.02E-19	6.56E-19	6.16E-19	5.93E-19	5.35E-19	5.28E-19
Cr-55	2.76E-19	2.65E-19	2.56E-19	2.50E-19	2.39E-19	2.37E-19
Cr-56	1.42E-18	1.27E-18	1.17E-18	1.11E-18	9.75E-19	9.60E-19
Manganese						
Mn-50m	1.01E-16	9.38E-17	8.86E-17	8.55E-17	7.89E-17	7.80E-17
Mn-51	2.24E-17	2.08E-17	1.96E-17	1.89E-17	1.72E-17	1.69E-17
Mn-52	7.49E-17	6.94E-17	6.56E-17	6.33E-17	5.85E-17	5.78E-17
Mn-52m	5.23E-17	4.86E-17	4.60E-17	4.44E-17	4.09E-17	4.04E-17
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	1.84E-17	1.70E-17	1.60E-17	1.55E-17	1.42E-17	1.40E-17
Mn-56	3.60E-17	3.35E-17	3.17E-17	3.07E-17	2.85E-17	2.82E-17
Mn-57	2.33E-18	2.17E-18	2.05E-18	1.98E-18	1.82E-18	1.80E-18
Mn-58m	5.18E-17	4.81E-17	4.54E-17	4.39E-17	4.07E-17	4.02E-17
Iron						
Fe-52	1.63E-17	1.51E-17	1.43E-17	1.37E-17	1.24E-17	1.23E-17
Fe-53	2.64E-17	2.46E-17	2.32E-17	2.23E-17	2.03E-17	2.00E-17
Fe-53m	6.57E-17	6.09E-17	5.76E-17	5.57E-17	5.15E-17	5.09E-17
Fe-55	3.23E-27	3.01E-27	2.81E-27	2.68E-27	2.42E-27	2.38E-27
Fe-59	2.56E-17	2.37E-17	2.24E-17	2.17E-17	2.01E-17	1.98E-17
Fe-60	1.96E-22	1.59E-22	1.38E-22	1.28E-22	1.06E-22	1.03E-22
Fe-61	3.00E-17	2.79E-17	2.64E-17	2.55E-17	2.36E-17	2.34E-17
Fe-62	1.14E-17	1.06E-17	1.00E-17	9.62E-18	8.76E-18	8.63E-18
Cobalt						
Co-54m	8.61E-17	7.99E-17	7.55E-17	7.29E-17	6.71E-17	6.64E-17
Co-55	4.38E-17	4.06E-17	3.83E-17	3.69E-17	3.39E-17	3.35E-17
Co-56	7.59E-17	7.08E-17	6.71E-17	6.49E-17	6.04E-17	5.98E-17
Co-57	2.40E-18	2.23E-18	2.09E-18	1.99E-18	1.80E-18	1.76E-18
Co-58	2.15E-17	1.99E-17	1.88E-17	1.81E-17	1.66E-17	1.64E-17
Co-58m	2.34E-23	1.56E-23	1.26E-23	1.13E-23	7.88E-24	7.48E-24
Co-60	5.37E-17	4.98E-17	4.70E-17	4.55E-17	4.22E-17	4.18E-17
Co-60m	8.53E-20	7.80E-20	7.29E-20	7.01E-20	6.42E-20	6.35E-20
Co-61	1.73E-18	1.54E-18	1.43E-18	1.36E-18	1.21E-18	1.20E-18
Co-62	3.42E-17	3.19E-17	3.02E-17	2.92E-17	2.72E-17	2.70E-17
Co-62m	5.74E-17	5.34E-17	5.04E-17	4.88E-17	4.54E-17	4.49E-17
Nickel						
Ni-56	3.76E-17	3.48E-17	3.28E-17	3.16E-17	2.90E-17	2.86E-17
Ni-57	4.13E-17	3.84E-17	3.63E-17	3.51E-17	3.25E-17	3.22E-17
Ni-59	3.46E-22	3.21E-22	3.03E-22	2.91E-22	2.65E-22	2.61E-22
Ni-63	2.61E-24	1.82E-24	1.50E-24	1.35E-24	9.16E-25	8.75E-25
Ni-65	1.20E-17	1.12E-17	1.05E-17	1.02E-17	9.48E-18	9.38E-18
Ni-66	3.50E-22	2.92E-22	2.59E-22	2.41E-22	2.03E-22	1.99E-22
Copper						
Cu-57	2.74E-17	2.54E-17	2.40E-17	2.31E-17	2.12E-17	2.09E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cu-59	3.24E-17	3.00E-17	2.84E-17	2.73E-17	2.50E-17	2.46E-17
Cu-60	8.28E-17	7.73E-17	7.31E-17	7.07E-17	6.55E-17	6.48E-17
Cu-61	1.83E-17	1.69E-17	1.60E-17	1.54E-17	1.40E-17	1.38E-17
Cu-62	2.28E-17	2.11E-17	2.00E-17	1.92E-17	1.75E-17	1.72E-17
Cu-64	4.10E-18	3.80E-18	3.59E-18	3.45E-18	3.14E-18	3.10E-18
Cu-66	2.38E-18	2.21E-18	2.09E-18	2.02E-18	1.87E-18	1.86E-18
Cu-67	2.38E-18	2.23E-18	2.08E-18	1.99E-18	1.79E-18	1.76E-18
Cu-69	1.17E-17	1.08E-17	1.02E-17	9.89E-18	9.12E-18	9.02E-18
Zinc						
Zn-60	3.41E-17	3.16E-17	2.99E-17	2.87E-17	2.61E-17	2.58E-17
Zn-61	3.41E-17	3.17E-17	3.00E-17	2.89E-17	2.65E-17	2.61E-17
Zn-62	9.63E-18	8.92E-18	8.41E-18	8.08E-18	7.35E-18	7.25E-18
Zn-63	2.46E-17	2.28E-17	2.15E-17	2.07E-17	1.88E-17	1.86E-17
Zn-65	1.26E-17	1.16E-17	1.10E-17	1.06E-17	9.79E-18	9.69E-18
Zn-69	1.58E-20	1.48E-20	1.40E-20	1.35E-20	1.25E-20	1.24E-20
Zn-69m	9.26E-18	8.60E-18	8.11E-18	7.79E-18	7.07E-18	6.97E-18
Zn-71	7.19E-18	6.67E-18	6.30E-18	6.07E-18	5.56E-18	5.49E-18
Zn-71m	3.47E-17	3.21E-17	3.03E-17	2.92E-17	2.66E-17	2.62E-17
Zn-72	3.02E-18	2.81E-18	2.63E-18	2.50E-18	2.26E-18	2.22E-18
Gallium						
Ga-64	7.09E-17	6.63E-17	6.28E-17	6.07E-17	5.63E-17	5.57E-17
Ga-65	2.57E-17	2.38E-17	2.25E-17	2.16E-17	1.97E-17	1.94E-17
Ga-66	5.07E-17	4.76E-17	4.52E-17	4.38E-17	4.08E-17	4.04E-17
Ga-67	3.22E-18	3.00E-18	2.80E-18	2.69E-18	2.42E-18	2.38E-18
Ga-68	2.12E-17	1.97E-17	1.86E-17	1.79E-17	1.63E-17	1.60E-17
Ga-70	2.49E-19	2.33E-19	2.22E-19	2.15E-19	2.01E-19	1.99E-19
Ga-72	5.68E-17	5.30E-17	5.02E-17	4.86E-17	4.51E-17	4.47E-17
Ga-73	7.62E-18	7.11E-18	6.67E-18	6.42E-18	5.81E-18	5.74E-18
Ga-74	6.53E-17	6.12E-17	5.80E-17	5.62E-17	5.23E-17	5.18E-17
Germanium						
Ge-66	1.46E-17	1.36E-17	1.28E-17	1.23E-17	1.12E-17	1.10E-17
Ge-67	3.15E-17	2.93E-17	2.77E-17	2.66E-17	2.43E-17	2.40E-17
Ge-68	4.26E-23	2.63E-23	2.03E-23	1.71E-23	5.27E-24	4.85E-24
Ge-69	2.07E-17	1.92E-17	1.81E-17	1.75E-17	1.61E-17	1.59E-17
Ge-71	4.32E-23	2.67E-23	2.06E-23	1.73E-23	5.35E-24	4.92E-24
Ge-75	8.04E-19	7.55E-19	7.07E-19	6.81E-19	6.14E-19	6.07E-19
Ge-77	2.36E-17	2.20E-17	2.07E-17	2.00E-17	1.82E-17	1.80E-17
Ge-78	6.11E-18	5.73E-18	5.37E-18	5.17E-18	4.65E-18	4.60E-18
Arsenic						
As-68	8.06E-17	7.49E-17	7.09E-17	6.84E-17	6.31E-17	6.24E-17
As-69	2.56E-17	2.37E-17	2.24E-17	2.16E-17	1.97E-17	1.94E-17
As-70	9.19E-17	8.54E-17	8.07E-17	7.79E-17	7.19E-17	7.11E-17
As-71	1.26E-17	1.17E-17	1.10E-17	1.06E-17	9.61E-18	9.48E-18
As-72	3.95E-17	3.66E-17	3.46E-17	3.33E-17	3.05E-17	3.01E-17
As-73	6.47E-20	5.36E-20	4.67E-20	4.31E-20	3.60E-20	3.55E-20
As-74	1.69E-17	1.56E-17	1.48E-17	1.42E-17	1.29E-17	1.27E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-76	9.42E-18	8.74E-18	8.26E-18	7.96E-18	7.31E-18	7.21E-18
As-77	1.87E-19	1.75E-19	1.64E-19	1.58E-19	1.42E-19	1.41E-19
As-78	2.84E-17	2.64E-17	2.50E-17	2.41E-17	2.23E-17	2.21E-17
As-79	9.19E-19	8.57E-19	8.12E-19	7.85E-19	7.23E-19	7.14E-19
Selenium						
Se-70	1.56E-17	1.45E-17	1.36E-17	1.31E-17	1.19E-17	1.17E-17
Se-71	3.57E-17	3.31E-17	3.13E-17	3.01E-17	2.75E-17	2.72E-17
Se-72	2.51E-19	2.00E-19	1.70E-19	1.56E-19	1.27E-19	1.24E-19
Se-73	2.39E-17	2.21E-17	2.09E-17	2.00E-17	1.82E-17	1.79E-17
Se-73m	5.82E-18	5.40E-18	5.09E-18	4.89E-18	4.45E-18	4.39E-18
Se-75	8.23E-18	7.70E-18	7.21E-18	6.92E-18	6.24E-18	6.15E-18
Se-77m	1.82E-18	1.70E-18	1.59E-18	1.51E-18	1.37E-18	1.35E-18
Se-79	1.10E-22	8.69E-23	7.50E-23	6.90E-23	5.59E-23	5.47E-23
Se-79m	1.64E-19	1.51E-19	1.41E-19	1.34E-19	1.19E-19	1.17E-19
Se-81	2.57E-19	2.41E-19	2.29E-19	2.22E-19	2.04E-19	2.02E-19
Se-81m	2.57E-19	2.38E-19	2.22E-19	2.12E-19	1.89E-19	1.86E-19
Se-83	5.63E-17	5.24E-17	4.95E-17	4.78E-17	4.41E-17	4.36E-17
Se-83m	2.14E-17	1.99E-17	1.88E-17	1.82E-17	1.69E-17	1.67E-17
Se-84	9.41E-18	8.75E-18	8.25E-18	7.93E-18	7.19E-18	7.08E-18
Bromine						
Br-72	6.57E-17	6.10E-17	5.76E-17	5.56E-17	5.12E-17	5.06E-17
Br-73	3.20E-17	2.96E-17	2.79E-17	2.69E-17	2.45E-17	2.42E-17
Br-74	9.28E-17	8.73E-17	8.29E-17	8.04E-17	7.49E-17	7.42E-17
Br-74m	8.71E-17	8.14E-17	7.71E-17	7.46E-17	6.90E-17	6.83E-17
Br-75	2.66E-17	2.47E-17	2.33E-17	2.24E-17	2.04E-17	2.01E-17
Br-76	5.87E-17	5.49E-17	5.19E-17	5.02E-17	4.65E-17	4.60E-17
Br-76m	4.24E-19	3.61E-19	3.21E-19	3.01E-19	2.59E-19	2.55E-19
Br-77	6.96E-18	6.47E-18	6.09E-18	5.86E-18	5.32E-18	5.25E-18
Br-77m	2.77E-19	2.57E-19	2.40E-19	2.29E-19	2.05E-19	2.01E-19
Br-78	2.32E-17	2.16E-17	2.04E-17	1.96E-17	1.78E-17	1.76E-17
Br-80	1.81E-18	1.68E-18	1.59E-18	1.53E-18	1.40E-18	1.38E-18
Br-80m	9.31E-20	6.84E-20	5.61E-20	5.03E-20	3.91E-20	3.79E-20
Br-82	5.79E-17	5.35E-17	5.06E-17	4.87E-17	4.48E-17	4.43E-17
Br-82m	7.05E-20	6.51E-20	6.14E-20	5.93E-20	5.44E-20	5.38E-20
Br-83	1.70E-19	1.58E-19	1.49E-19	1.43E-19	1.31E-19	1.29E-19
Br-84	3.59E-17	3.37E-17	3.20E-17	3.10E-17	2.90E-17	2.87E-17
Br-84m	5.99E-17	5.56E-17	5.25E-17	5.07E-17	4.69E-17	4.63E-17
Br-85	1.68E-18	1.56E-18	1.48E-18	1.43E-18	1.33E-18	1.31E-18
Krypton						
Kr-74	2.32E-17	2.16E-17	2.03E-17	1.95E-17	1.77E-17	1.75E-17
Kr-75	2.86E-17	2.65E-17	2.50E-17	2.41E-17	2.19E-17	2.16E-17
Kr-76	9.13E-18	8.51E-18	7.99E-18	7.68E-18	6.94E-18	6.85E-18
Kr-77	2.29E-17	2.12E-17	2.00E-17	1.92E-17	1.75E-17	1.72E-17
Kr-79	5.50E-18	5.12E-18	4.82E-18	4.63E-18	4.21E-18	4.16E-18
Kr-81	1.91E-20	1.76E-20	1.64E-20	1.58E-20	1.39E-20	1.37E-20
Kr-81m	2.75E-18	2.59E-18	2.41E-18	2.32E-18	2.09E-18	2.06E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-83m	5.16E-22	3.53E-22	2.91E-22	2.61E-22	1.01E-22	9.32E-23
Kr-85	5.73E-20	5.30E-20	5.00E-20	4.80E-20	4.36E-20	4.30E-20
Kr-85m	3.33E-18	3.11E-18	2.91E-18	2.78E-18	2.51E-18	2.47E-18
Kr-87	1.67E-17	1.57E-17	1.49E-17	1.44E-17	1.34E-17	1.33E-17
Kr-88	3.96E-17	3.72E-17	3.53E-17	3.43E-17	3.21E-17	3.17E-17
Kr-89	4.02E-17	3.76E-17	3.57E-17	3.46E-17	3.22E-17	3.18E-17
Rubidium						
Rb-77	3.43E-17	3.18E-17	3.00E-17	2.89E-17	2.64E-17	2.60E-17
Rb-78	8.26E-17	7.78E-17	7.39E-17	7.16E-17	6.67E-17	6.60E-17
Rb-78m	6.96E-17	6.48E-17	6.12E-17	5.91E-17	5.45E-17	5.38E-17
Rb-79	3.21E-17	2.98E-17	2.81E-17	2.70E-17	2.46E-17	2.42E-17
Rb-80	2.73E-17	2.53E-17	2.39E-17	2.30E-17	2.10E-17	2.07E-17
Rb-81	1.12E-17	1.04E-17	9.79E-18	9.41E-18	8.57E-18	8.45E-18
Rb-81m	5.07E-19	4.67E-19	4.39E-19	4.22E-19	3.84E-19	3.79E-19
Rb-82	2.51E-17	2.33E-17	2.20E-17	2.11E-17	1.93E-17	1.90E-17
Rb-82m	6.39E-17	5.92E-17	5.59E-17	5.39E-17	4.95E-17	4.89E-17
Rb-83	1.08E-17	1.00E-17	9.44E-18	9.07E-18	8.26E-18	8.14E-18
Rb-84	1.99E-17	1.84E-17	1.74E-17	1.68E-17	1.54E-17	1.52E-17
Rb-84m	8.36E-18	7.82E-18	7.34E-18	7.06E-18	6.37E-18	6.29E-18
Rb-86	2.13E-18	1.97E-18	1.86E-18	1.80E-18	1.67E-18	1.65E-18
Rb-86m	1.22E-17	1.13E-17	1.06E-17	1.02E-17	9.32E-18	9.19E-18
Rb-87	9.23E-22	7.88E-22	7.06E-22	6.61E-22	5.66E-22	5.56E-22
Rb-88	1.40E-17	1.31E-17	1.24E-17	1.21E-17	1.13E-17	1.12E-17
Rb-89	4.72E-17	4.40E-17	4.17E-17	4.04E-17	3.76E-17	3.72E-17
Rb-90	3.93E-17	3.73E-17	3.56E-17	3.46E-17	3.26E-17	3.23E-17
Rb-90m	6.58E-17	6.18E-17	5.87E-17	5.69E-17	5.32E-17	5.27E-17
Strontium						
Sr-79	2.66E-17	2.47E-17	2.33E-17	2.24E-17	2.04E-17	2.01E-17
Sr-80	9.55E-18	8.86E-18	8.36E-18	8.03E-18	7.31E-18	7.21E-18
Sr-81	3.08E-17	2.86E-17	2.70E-17	2.59E-17	2.36E-17	2.33E-17
Sr-82	2.21E-21	1.52E-21	1.28E-21	1.16E-21	4.00E-22	3.65E-22
Sr-83	1.78E-17	1.65E-17	1.56E-17	1.50E-17	1.38E-17	1.36E-17
Sr-85	1.10E-17	1.02E-17	9.60E-18	9.22E-18	8.39E-18	8.27E-18
Sr-85m	4.68E-18	4.40E-18	4.11E-18	3.95E-18	3.56E-18	3.51E-18
Sr-87m	7.08E-18	6.59E-18	6.21E-18	5.97E-18	5.40E-18	5.33E-18
Sr-89	7.72E-20	7.38E-20	7.11E-20	6.96E-20	6.61E-20	6.57E-20
Sr-90	3.80E-21	3.39E-21	3.10E-21	2.93E-21	2.58E-21	2.54E-21
Sr-91	1.56E-17	1.44E-17	1.36E-17	1.32E-17	1.21E-17	1.20E-17
Sr-92	2.84E-17	2.64E-17	2.50E-17	2.42E-17	2.25E-17	2.22E-17
Sr-93	4.87E-17	4.53E-17	4.28E-17	4.13E-17	3.82E-17	3.77E-17
Sr-94	3.04E-17	2.83E-17	2.67E-17	2.59E-17	2.41E-17	2.38E-17
Yttrium						
Y-81	2.64E-17	2.45E-17	2.31E-17	2.22E-17	2.02E-17	1.99E-17
Y-83	2.98E-17	2.77E-17	2.61E-17	2.51E-17	2.30E-17	2.27E-17
Y-83m	1.87E-17	1.74E-17	1.64E-17	1.58E-17	1.43E-17	1.41E-17
Y-84m	8.74E-17	8.09E-17	7.64E-17	7.37E-17	6.77E-17	6.69E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-85	2.40E-17	2.23E-17	2.10E-17	2.02E-17	1.84E-17	1.82E-17
Y-85m	2.86E-17	2.66E-17	2.52E-17	2.43E-17	2.23E-17	2.21E-17
Y-86	7.68E-17	7.13E-17	6.74E-17	6.51E-17	6.02E-17	5.95E-17
Y-86m	4.74E-18	4.45E-18	4.16E-18	4.00E-18	3.61E-18	3.57E-18
Y-87	9.75E-18	9.04E-18	8.54E-18	8.20E-18	7.45E-18	7.34E-18
Y-87m	6.78E-18	6.32E-18	5.95E-18	5.72E-18	5.17E-18	5.10E-18
Y-88	5.63E-17	5.25E-17	4.97E-17	4.82E-17	4.49E-17	4.44E-17
Y-89m	1.98E-17	1.83E-17	1.73E-17	1.66E-17	1.53E-17	1.52E-17
Y-90	1.98E-19	1.90E-19	1.84E-19	1.80E-19	1.72E-19	1.71E-19
Y-90m	1.40E-17	1.30E-17	1.23E-17	1.18E-17	1.07E-17	1.05E-17
Y-91	1.48E-19	1.40E-19	1.34E-19	1.30E-19	1.23E-19	1.22E-19
Y-91m	1.18E-17	1.09E-17	1.03E-17	9.89E-18	9.01E-18	8.88E-18
Y-92	5.93E-18	5.50E-18	5.21E-18	5.03E-18	4.65E-18	4.61E-18
Y-93	2.34E-18	2.20E-18	2.08E-18	2.02E-18	1.87E-18	1.85E-18
Y-94	1.74E-17	1.61E-17	1.52E-17	1.47E-17	1.36E-17	1.35E-17
Y-95	2.26E-17	2.13E-17	2.02E-17	1.97E-17	1.84E-17	1.83E-17
Zirconium						
Zr-85	3.29E-17	3.06E-17	2.89E-17	2.78E-17	2.53E-17	2.50E-17
Zr-86	5.96E-18	5.59E-18	5.23E-18	5.03E-18	4.53E-18	4.47E-18
Zr-87	2.07E-17	1.92E-17	1.81E-17	1.74E-17	1.59E-17	1.57E-17
Zr-88	8.50E-18	7.91E-18	7.45E-18	7.16E-18	6.48E-18	6.39E-18
Zr-89	2.54E-17	2.34E-17	2.21E-17	2.13E-17	1.96E-17	1.93E-17
Zr-89m	1.40E-17	1.30E-17	1.23E-17	1.18E-17	1.08E-17	1.06E-17
Zr-93	3.03E-24	2.11E-24	1.74E-24	1.57E-24	1.06E-24	1.01E-24
Zr-95	1.62E-17	1.50E-17	1.42E-17	1.36E-17	1.25E-17	1.23E-17
Zr-97	1.95E-17	1.80E-17	1.70E-17	1.64E-17	1.51E-17	1.49E-17
Niobium						
Nb-87	2.74E-17	2.55E-17	2.40E-17	2.31E-17	2.10E-17	2.07E-17
Nb-88	9.28E-17	8.59E-17	8.11E-17	7.82E-17	7.17E-17	7.09E-17
Nb-88m	9.00E-17	8.34E-17	7.88E-17	7.60E-17	6.99E-17	6.91E-17
Nb-89	2.94E-17	2.74E-17	2.60E-17	2.51E-17	2.31E-17	2.28E-17
Nb-89m	2.92E-17	2.71E-17	2.56E-17	2.46E-17	2.24E-17	2.21E-17
Nb-90	8.69E-17	8.14E-17	7.71E-17	7.47E-17	6.95E-17	6.88E-17
Nb-91	4.10E-20	3.67E-20	3.44E-20	3.29E-20	2.86E-20	2.81E-20
Nb-91m	5.41E-19	5.00E-19	4.72E-19	4.56E-19	4.21E-19	4.16E-19
Nb-92	3.30E-17	3.05E-17	2.88E-17	2.77E-17	2.55E-17	2.51E-17
Nb-92m	2.10E-17	1.94E-17	1.83E-17	1.77E-17	1.63E-17	1.61E-17
Nb-93m	1.18E-21	8.08E-22	6.91E-22	6.41E-22	3.05E-22	2.80E-22
Nb-94	3.45E-17	3.18E-17	3.00E-17	2.89E-17	2.65E-17	2.62E-17
Nb-94m	1.01E-19	9.25E-20	8.70E-20	8.38E-20	7.59E-20	7.50E-20
Nb-95	1.69E-17	1.56E-17	1.48E-17	1.42E-17	1.30E-17	1.29E-17
Nb-95m	1.36E-18	1.28E-18	1.20E-18	1.15E-18	1.04E-18	1.02E-18
Nb-96	5.41E-17	5.00E-17	4.72E-17	4.55E-17	4.18E-17	4.13E-17
Nb-97	1.48E-17	1.37E-17	1.29E-17	1.25E-17	1.14E-17	1.12E-17
Nb-98m	6.13E-17	5.68E-17	5.36E-17	5.18E-17	4.78E-17	4.72E-17
Nb-99	3.76E-18	3.51E-18	3.29E-18	3.15E-18	2.86E-18	2.81E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-99m	1.58E-17	1.49E-17	1.41E-17	1.37E-17	1.28E-17	1.26E-17
Molybdenum						
Mo-89	2.77E-17	2.57E-17	2.43E-17	2.33E-17	2.13E-17	2.10E-17
Mo-90	1.78E-17	1.66E-17	1.56E-17	1.50E-17	1.36E-17	1.35E-17
Mo-91	2.22E-17	2.06E-17	1.94E-17	1.87E-17	1.70E-17	1.68E-17
Mo-91m	3.03E-17	2.81E-17	2.66E-17	2.56E-17	2.36E-17	2.33E-17
Mo-93	6.63E-21	4.52E-21	3.87E-21	3.59E-21	1.71E-21	1.57E-21
Mo-93m	4.97E-17	4.62E-17	4.36E-17	4.22E-17	3.90E-17	3.86E-17
Mo-99	3.28E-18	3.03E-18	2.86E-18	2.75E-18	2.52E-18	2.49E-18
Mo-101	3.15E-17	2.93E-17	2.77E-17	2.68E-17	2.47E-17	2.45E-17
Mo-102	4.15E-19	3.89E-19	3.64E-19	3.49E-19	3.15E-19	3.11E-19
Technetium						
Tc-91	5.29E-17	4.94E-17	4.68E-17	4.52E-17	4.19E-17	4.14E-17
Tc-91m	3.22E-17	2.99E-17	2.83E-17	2.72E-17	2.48E-17	2.45E-17
Tc-92	8.31E-17	7.73E-17	7.30E-17	7.04E-17	6.49E-17	6.41E-17
Tc-93	3.31E-17	3.08E-17	2.91E-17	2.82E-17	2.62E-17	2.59E-17
Tc-93m	1.92E-17	1.81E-17	1.72E-17	1.66E-17	1.55E-17	1.53E-17
Tc-94	5.85E-17	5.40E-17	5.10E-17	4.91E-17	4.51E-17	4.46E-17
Tc-94m	4.26E-17	3.95E-17	3.74E-17	3.60E-17	3.31E-17	3.27E-17
Tc-95	1.74E-17	1.60E-17	1.51E-17	1.46E-17	1.34E-17	1.32E-17
Tc-95m	1.49E-17	1.38E-17	1.30E-17	1.25E-17	1.14E-17	1.13E-17
Tc-96	5.50E-17	5.08E-17	4.79E-17	4.62E-17	4.24E-17	4.19E-17
Tc-96m	9.12E-19	8.42E-19	7.95E-19	7.67E-19	7.05E-19	6.97E-19
Tc-97	8.53E-21	5.77E-21	4.91E-21	4.53E-21	2.35E-21	2.17E-21
Tc-97m	1.39E-20	1.07E-20	9.47E-21	8.86E-21	6.43E-21	6.19E-21
Tc-98	3.14E-17	2.90E-17	2.74E-17	2.63E-17	2.41E-17	2.38E-17
Tc-99	7.58E-22	6.46E-22	5.79E-22	5.41E-22	4.63E-22	4.55E-22
Tc-99m	2.57E-18	2.40E-18	2.24E-18	2.13E-18	1.93E-18	1.90E-18
Tc-101	7.46E-18	6.98E-18	6.55E-18	6.31E-18	5.70E-18	5.62E-18
Tc-102	2.50E-18	2.34E-18	2.22E-18	2.15E-18	2.00E-18	1.97E-18
Tc-102m	5.26E-17	4.91E-17	4.64E-17	4.49E-17	4.16E-17	4.11E-17
Tc-104	4.74E-17	4.44E-17	4.20E-17	4.06E-17	3.77E-17	3.73E-17
Tc-105	1.73E-17	1.62E-17	1.52E-17	1.47E-17	1.35E-17	1.33E-17
Ruthenium						
Ru-92	4.45E-17	4.14E-17	3.90E-17	3.76E-17	3.44E-17	3.40E-17
Ru-94	1.12E-17	1.04E-17	9.81E-18	9.44E-18	8.60E-18	8.49E-18
Ru-95	2.68E-17	2.49E-17	2.35E-17	2.27E-17	2.08E-17	2.06E-17
Ru-97	4.95E-18	4.65E-18	4.34E-18	4.18E-18	3.76E-18	3.71E-18
Ru-103	1.10E-17	1.02E-17	9.67E-18	9.29E-18	8.45E-18	8.33E-18
Ru-105	1.65E-17	1.53E-17	1.44E-17	1.39E-17	1.27E-17	1.25E-17
Ru-106	1.83E-25	1.23E-25	1.02E-25	9.27E-26	4.89E-26	4.56E-26
Ru-107	7.76E-18	7.21E-18	6.81E-18	6.57E-18	6.04E-18	5.97E-18
Ru-108	1.32E-18	1.23E-18	1.15E-18	1.10E-18	9.95E-19	9.79E-19
Rhodium						
Rh-94	8.23E-17	7.65E-17	7.24E-17	6.99E-17	6.46E-17	6.38E-17
Rh-95	5.51E-17	5.12E-17	4.84E-17	4.67E-17	4.31E-17	4.26E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rh-95m	1.87E-17	1.75E-17	1.66E-17	1.60E-17	1.48E-17	1.46E-17
Rh-96	8.60E-17	7.97E-17	7.53E-17	7.25E-17	6.67E-17	6.58E-17
Rh-96m	2.76E-17	2.57E-17	2.43E-17	2.34E-17	2.16E-17	2.14E-17
Rh-97	3.16E-17	2.94E-17	2.77E-17	2.67E-17	2.44E-17	2.41E-17
Rh-97m	4.54E-17	4.25E-17	4.02E-17	3.90E-17	3.62E-17	3.58E-17
Rh-98	4.03E-17	3.74E-17	3.53E-17	3.40E-17	3.11E-17	3.07E-17
Rh-99	1.19E-17	1.10E-17	1.04E-17	1.00E-17	9.09E-18	8.97E-18
Rh-99m	1.40E-17	1.30E-17	1.23E-17	1.18E-17	1.08E-17	1.07E-17
Rh-100	5.72E-17	5.34E-17	5.06E-17	4.89E-17	4.55E-17	4.50E-17
Rh-100m	9.28E-19	8.49E-19	7.96E-19	7.65E-19	6.96E-19	6.87E-19
Rh-101	5.77E-18	5.40E-18	5.05E-18	4.84E-18	4.36E-18	4.29E-18
Rh-101m	6.06E-18	5.66E-18	5.31E-18	5.11E-18	4.61E-18	4.55E-18
Rh-102	1.11E-17	1.03E-17	9.68E-18	9.31E-18	8.48E-18	8.36E-18
Rh-102m	4.73E-17	4.37E-17	4.13E-17	3.98E-17	3.64E-17	3.60E-17
Rh-103m	2.19E-21	1.48E-21	1.23E-21	1.12E-21	7.12E-22	6.70E-22
Rh-104	4.90E-19	4.61E-19	4.40E-19	4.27E-19	3.97E-19	3.93E-19
Rh-104m	3.90E-19	3.27E-19	2.88E-19	2.68E-19	2.26E-19	2.22E-19
Rh-105	1.71E-18	1.60E-18	1.50E-18	1.44E-18	1.30E-18	1.28E-18
Rh-106	4.99E-18	4.63E-18	4.38E-18	4.22E-18	3.87E-18	3.82E-18
Rh-106m	6.23E-17	5.78E-17	5.45E-17	5.26E-17	4.84E-17	4.78E-17
Rh-107	6.95E-18	6.49E-18	6.10E-18	5.87E-18	5.30E-18	5.23E-18
Rh-108	7.71E-18	7.18E-18	6.78E-18	6.53E-18	5.96E-18	5.88E-18
Rh-109	6.72E-18	6.28E-18	5.90E-18	5.68E-18	5.13E-18	5.07E-18
Palladium						
Pd-96	3.14E-17	2.90E-17	2.74E-17	2.64E-17	2.42E-17	2.38E-17
Pd-97	5.09E-17	4.75E-17	4.49E-17	4.33E-17	4.00E-17	3.95E-17
Pd-98	8.53E-18	7.89E-18	7.42E-18	7.13E-18	6.50E-18	6.41E-18
Pd-99	2.76E-17	2.57E-17	2.42E-17	2.33E-17	2.14E-17	2.11E-17
Pd-100	1.62E-18	1.44E-18	1.32E-18	1.25E-18	1.09E-18	1.08E-18
Pd-101	7.19E-18	6.67E-18	6.28E-18	6.05E-18	5.52E-18	5.45E-18
Pd-103	2.12E-20	1.48E-20	1.25E-20	1.15E-20	7.69E-21	7.30E-21
Pd-107	1.12E-25	7.57E-26	6.31E-26	5.74E-26	2.78E-26	2.58E-26
Pd-109	1.05E-19	9.33E-20	8.62E-20	8.20E-20	7.23E-20	7.11E-20
Pd-109m	2.27E-18	2.13E-18	1.98E-18	1.90E-18	1.71E-18	1.69E-18
Pd-111	1.19E-18	1.11E-18	1.05E-18	1.02E-18	9.41E-19	9.31E-19
Pd-112	4.70E-21	3.23E-21	2.75E-21	2.53E-21	1.47E-21	1.37E-21
Pd-114	6.09E-19	5.71E-19	5.36E-19	5.15E-19	4.67E-19	4.61E-19
Silver						
Ag-99	5.03E-17	4.68E-17	4.42E-17	4.27E-17	3.92E-17	3.87E-17
Ag-100m	6.20E-17	5.76E-17	5.45E-17	5.26E-17	4.84E-17	4.78E-17
Ag-101	3.45E-17	3.21E-17	3.03E-17	2.91E-17	2.66E-17	2.63E-17
Ag-102	7.34E-17	6.83E-17	6.46E-17	6.23E-17	5.75E-17	5.68E-17
Ag-102m	4.12E-17	3.86E-17	3.66E-17	3.54E-17	3.29E-17	3.26E-17
Ag-103	1.81E-17	1.68E-17	1.58E-17	1.52E-17	1.40E-17	1.38E-17
Ag-104	5.89E-17	5.45E-17	5.15E-17	4.97E-17	4.57E-17	4.51E-17
Ag-104m	3.88E-17	3.62E-17	3.42E-17	3.30E-17	3.04E-17	3.00E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-105	1.09E-17	1.02E-17	9.56E-18	9.19E-18	8.34E-18	8.23E-18
Ag-105m	2.18E-20	2.03E-20	1.91E-20	1.84E-20	1.67E-20	1.65E-20
Ag-106	1.55E-17	1.44E-17	1.36E-17	1.31E-17	1.19E-17	1.17E-17
Ag-106m	6.11E-17	5.66E-17	5.35E-17	5.15E-17	4.74E-17	4.68E-17
Ag-108	4.87E-19	4.54E-19	4.30E-19	4.15E-19	3.81E-19	3.76E-19
Ag-108m	3.57E-17	3.30E-17	3.12E-17	3.00E-17	2.74E-17	2.70E-17
Ag-109m	6.83E-20	5.87E-20	5.34E-20	5.03E-20	4.30E-20	4.21E-20
Ag-110	9.86E-19	9.22E-19	8.77E-19	8.49E-19	7.87E-19	7.78E-19
Ag-110m	6.04E-17	5.59E-17	5.28E-17	5.09E-17	4.69E-17	4.63E-17
Ag-111	6.06E-19	5.66E-19	5.32E-19	5.12E-19	4.63E-19	4.57E-19
Ag-111m	8.05E-20	7.27E-20	6.75E-20	6.46E-20	5.75E-20	5.66E-20
Ag-112	1.52E-17	1.41E-17	1.34E-17	1.29E-17	1.20E-17	1.18E-17
Ag-113	1.71E-18	1.60E-18	1.51E-18	1.45E-18	1.33E-18	1.31E-18
Ag-113m	4.71E-18	4.38E-18	4.12E-18	3.97E-18	3.60E-18	3.55E-18
Ag-114	6.40E-18	5.98E-18	5.67E-18	5.48E-18	5.08E-18	5.02E-18
Ag-115	1.04E-17	9.75E-18	9.22E-18	8.92E-18	8.27E-18	8.18E-18
Ag-116	4.49E-17	4.21E-17	3.99E-17	3.87E-17	3.60E-17	3.56E-17
Ag-117	2.70E-17	2.53E-17	2.40E-17	2.33E-17	2.17E-17	2.15E-17
Cadmium						
Cd-101	5.31E-17	4.95E-17	4.68E-17	4.52E-17	4.17E-17	4.12E-17
Cd-102	1.81E-17	1.68E-17	1.58E-17	1.52E-17	1.39E-17	1.37E-17
Cd-103	4.36E-17	4.07E-17	3.85E-17	3.73E-17	3.46E-17	3.42E-17
Cd-104	4.89E-18	4.49E-18	4.22E-18	4.06E-18	3.68E-18	3.63E-18
Cd-105	2.74E-17	2.55E-17	2.41E-17	2.33E-17	2.16E-17	2.13E-17
Cd-107	2.22E-19	1.94E-19	1.78E-19	1.70E-19	1.48E-19	1.45E-19
Cd-109	9.55E-20	7.68E-20	6.82E-20	6.37E-20	5.18E-20	5.04E-20
Cd-111m	5.97E-18	5.60E-18	5.23E-18	5.03E-18	4.52E-18	4.47E-18
Cd-113	6.61E-22	5.64E-22	5.05E-22	4.72E-22	4.04E-22	3.97E-22
Cd-113m	4.85E-21	4.38E-21	4.04E-21	3.84E-21	3.41E-21	3.36E-21
Cd-115	4.29E-18	3.98E-18	3.75E-18	3.61E-18	3.28E-18	3.23E-18
Cd-115m	7.97E-19	7.40E-19	7.00E-19	6.77E-19	6.27E-19	6.20E-19
Cd-117	2.32E-17	2.16E-17	2.03E-17	1.97E-17	1.82E-17	1.80E-17
Cd-117m	4.28E-17	4.00E-17	3.78E-17	3.66E-17	3.41E-17	3.37E-17
Cd-118	2.52E-21	2.23E-21	2.03E-21	1.91E-21	1.67E-21	1.65E-21
Cd-119	3.44E-17	3.22E-17	3.04E-17	2.95E-17	2.74E-17	2.71E-17
Cd-119m	4.85E-17	4.52E-17	4.28E-17	4.14E-17	3.85E-17	3.81E-17
Indium						
In-103	5.93E-17	5.52E-17	5.22E-17	5.04E-17	4.65E-17	4.59E-17
In-105	4.19E-17	3.90E-17	3.68E-17	3.55E-17	3.26E-17	3.22E-17
In-106	7.86E-17	7.27E-17	6.87E-17	6.62E-17	6.07E-17	5.99E-17
In-106m	6.05E-17	5.64E-17	5.34E-17	5.16E-17	4.76E-17	4.71E-17
In-107	3.24E-17	3.02E-17	2.86E-17	2.76E-17	2.54E-17	2.52E-17
In-108	8.50E-17	7.87E-17	7.43E-17	7.17E-17	6.61E-17	6.53E-17
In-108m	5.69E-17	5.33E-17	5.06E-17	4.90E-17	4.55E-17	4.50E-17
In-109	1.36E-17	1.26E-17	1.19E-17	1.15E-17	1.05E-17	1.04E-17
In-109m	1.35E-17	1.25E-17	1.18E-17	1.14E-17	1.04E-17	1.02E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-110	6.79E-17	6.27E-17	5.92E-17	5.71E-17	5.24E-17	5.18E-17
In-110m	3.44E-17	3.20E-17	3.02E-17	2.91E-17	2.67E-17	2.64E-17
In-111	8.37E-18	7.85E-18	7.33E-18	7.04E-18	6.33E-18	6.25E-18
In-111m	1.04E-17	9.67E-18	9.14E-18	8.78E-18	7.99E-18	7.88E-18
In-112	5.85E-18	5.42E-18	5.12E-18	4.92E-18	4.48E-18	4.42E-18
In-112m	4.62E-19	4.23E-19	3.92E-19	3.73E-19	3.34E-19	3.29E-19
In-113m	5.67E-18	5.27E-18	4.96E-18	4.77E-18	4.32E-18	4.26E-18
In-114	1.84E-19	1.74E-19	1.68E-19	1.64E-19	1.55E-19	1.54E-19
In-114m	1.58E-18	1.47E-18	1.37E-18	1.32E-18	1.20E-18	1.18E-18
In-115	2.21E-21	1.94E-21	1.77E-21	1.67E-21	1.45E-21	1.43E-21
In-115m	3.43E-18	3.20E-18	3.01E-18	2.89E-18	2.61E-18	2.57E-18
In-116m	5.26E-17	4.89E-17	4.62E-17	4.47E-17	4.15E-17	4.11E-17
In-117	1.52E-17	1.41E-17	1.33E-17	1.28E-17	1.16E-17	1.15E-17
In-117m	1.93E-18	1.80E-18	1.69E-18	1.62E-18	1.47E-18	1.45E-18
In-118	2.37E-18	2.22E-18	2.11E-18	2.04E-18	1.91E-18	1.89E-18
In-118m	6.02E-17	5.57E-17	5.27E-17	5.09E-17	4.70E-17	4.65E-17
In-119	1.71E-17	1.57E-17	1.49E-17	1.43E-17	1.31E-17	1.30E-17
In-119m	1.63E-18	1.52E-18	1.44E-18	1.39E-18	1.29E-18	1.28E-18
In-121	2.06E-17	1.90E-17	1.79E-17	1.73E-17	1.59E-17	1.57E-17
In-121m	1.54E-18	1.42E-18	1.34E-18	1.30E-18	1.21E-18	1.19E-18
Tin						
Sn-106	2.62E-17	2.43E-17	2.29E-17	2.20E-17	2.01E-17	1.99E-17
Sn-108	1.46E-17	1.36E-17	1.28E-17	1.23E-17	1.12E-17	1.10E-17
Sn-109	4.62E-17	4.31E-17	4.07E-17	3.94E-17	3.66E-17	3.62E-17
Sn-110	6.05E-18	5.66E-18	5.30E-18	5.10E-18	4.59E-18	4.53E-18
Sn-111	1.05E-17	9.72E-18	9.18E-18	8.84E-18	8.11E-18	8.00E-18
Sn-113	1.60E-19	1.39E-19	1.26E-19	1.20E-19	1.04E-19	1.02E-19
Sn-113m	3.94E-20	2.77E-20	2.30E-20	2.07E-20	1.54E-20	1.48E-20
Sn-117m	2.99E-18	2.79E-18	2.60E-18	2.48E-18	2.24E-18	2.20E-18
Sn-119m	3.53E-20	2.36E-20	1.91E-20	1.71E-20	1.20E-20	1.14E-20
Sn-121	1.15E-21	9.93E-22	8.95E-22	8.41E-22	7.27E-22	7.14E-22
Sn-121m	1.67E-20	1.16E-20	9.38E-21	8.39E-21	6.22E-21	5.96E-21
Sn-123	2.10E-19	1.96E-19	1.86E-19	1.80E-19	1.68E-19	1.66E-19
Sn-123m	2.95E-18	2.76E-18	2.57E-18	2.46E-18	2.22E-18	2.19E-18
Sn-125	7.40E-18	6.86E-18	6.48E-18	6.26E-18	5.79E-18	5.73E-18
Sn-125m	7.78E-18	7.27E-18	6.83E-18	6.58E-18	5.96E-18	5.88E-18
Sn-126	8.04E-19	7.18E-19	6.59E-19	6.24E-19	5.47E-19	5.38E-19
Sn-127	4.10E-17	3.80E-17	3.59E-17	3.47E-17	3.21E-17	3.18E-17
Sn-127m	1.28E-17	1.19E-17	1.12E-17	1.08E-17	9.89E-18	9.75E-18
Sn-128	1.24E-17	1.15E-17	1.08E-17	1.04E-17	9.42E-18	9.29E-18
Sn-129	2.24E-17	2.08E-17	1.96E-17	1.89E-17	1.74E-17	1.72E-17
Sn-130	2.02E-17	1.87E-17	1.76E-17	1.69E-17	1.54E-17	1.52E-17
Sn-130m	1.93E-17	1.79E-17	1.69E-17	1.63E-17	1.50E-17	1.48E-17
Antimony						
Sb-111	3.31E-17	3.07E-17	2.90E-17	2.79E-17	2.54E-17	2.51E-17
Sb-113	2.81E-17	2.61E-17	2.46E-17	2.37E-17	2.16E-17	2.13E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sb-114	5.84E-17	5.42E-17	5.13E-17	4.95E-17	4.57E-17	4.51E-17
Sb-115	1.95E-17	1.81E-17	1.71E-17	1.64E-17	1.50E-17	1.47E-17
Sb-116	4.87E-17	4.53E-17	4.28E-17	4.13E-17	3.82E-17	3.78E-17
Sb-116m	6.68E-17	6.19E-17	5.84E-17	5.64E-17	5.20E-17	5.14E-17
Sb-117	3.55E-18	3.30E-18	3.08E-18	2.94E-18	2.66E-18	2.62E-18
Sb-118	1.80E-17	1.67E-17	1.58E-17	1.51E-17	1.38E-17	1.36E-17
Sb-118m	5.57E-17	5.16E-17	4.87E-17	4.70E-17	4.34E-17	4.29E-17
Sb-119	5.73E-20	3.83E-20	3.10E-20	2.77E-20	1.95E-20	1.86E-20
Sb-120	9.88E-18	9.15E-18	8.64E-18	8.30E-18	7.56E-18	7.45E-18
Sb-120m	5.27E-17	4.87E-17	4.59E-17	4.44E-17	4.09E-17	4.04E-17
Sb-122	9.97E-18	9.23E-18	8.72E-18	8.39E-18	7.65E-18	7.55E-18
Sb-122m	7.48E-19	6.31E-19	5.61E-19	5.22E-19	4.44E-19	4.37E-19
Sb-124	3.96E-17	3.69E-17	3.49E-17	3.37E-17	3.12E-17	3.09E-17
Sb-124m	9.80E-18	9.07E-18	8.56E-18	8.23E-18	7.51E-18	7.41E-18
Sb-124n	2.13E-24	1.42E-24	1.15E-24	1.03E-24	7.29E-25	6.93E-25
Sb-125	9.42E-18	8.73E-18	8.23E-18	7.90E-18	7.19E-18	7.09E-18
Sb-126	6.12E-17	5.66E-17	5.34E-17	5.14E-17	4.70E-17	4.64E-17
Sb-126m	3.45E-17	3.19E-17	3.01E-17	2.90E-17	2.65E-17	2.61E-17
Sb-127	1.54E-17	1.42E-17	1.34E-17	1.29E-17	1.18E-17	1.16E-17
Sb-128	6.85E-17	6.33E-17	5.98E-17	5.76E-17	5.27E-17	5.20E-17
Sb-128m	4.24E-17	3.92E-17	3.70E-17	3.56E-17	3.26E-17	3.22E-17
Sb-129	3.17E-17	2.94E-17	2.78E-17	2.68E-17	2.47E-17	2.45E-17
Sb-130	7.18E-17	6.65E-17	6.27E-17	6.05E-17	5.55E-17	5.48E-17
Sb-130m	5.95E-17	5.50E-17	5.20E-17	5.01E-17	4.61E-17	4.56E-17
Sb-131	4.45E-17	4.13E-17	3.91E-17	3.77E-17	3.49E-17	3.46E-17
Sb-133	5.77E-17	5.38E-17	5.09E-17	4.93E-17	4.58E-17	4.54E-17
Tellurium						
Te-113	4.85E-17	4.51E-17	4.27E-17	4.12E-17	3.79E-17	3.75E-17
Te-114	2.69E-17	2.50E-17	2.36E-17	2.28E-17	2.10E-17	2.08E-17
Te-115	4.88E-17	4.53E-17	4.28E-17	4.13E-17	3.80E-17	3.76E-17
Te-115m	5.61E-17	5.21E-17	4.92E-17	4.76E-17	4.39E-17	4.34E-17
Te-116	1.73E-18	1.57E-18	1.47E-18	1.40E-18	1.26E-18	1.24E-18
Te-117	3.30E-17	3.06E-17	2.90E-17	2.80E-17	2.58E-17	2.55E-17
Te-118	5.69E-20	3.82E-20	3.08E-20	2.75E-20	1.98E-20	1.89E-20
Te-119	1.65E-17	1.53E-17	1.45E-17	1.39E-17	1.27E-17	1.26E-17
Te-119m	3.19E-17	2.96E-17	2.79E-17	2.70E-17	2.49E-17	2.46E-17
Te-121	1.25E-17	1.15E-17	1.09E-17	1.05E-17	9.52E-18	9.39E-18
Te-121m	4.42E-18	4.13E-18	3.86E-18	3.72E-18	3.35E-18	3.31E-18
Te-123	9.89E-23	6.65E-23	5.35E-23	4.77E-23	3.44E-23	3.28E-23
Te-123m	2.85E-18	2.66E-18	2.48E-18	2.36E-18	2.13E-18	2.10E-18
Te-125m	1.24E-19	8.61E-20	7.00E-20	6.27E-20	4.69E-20	4.50E-20
Te-127	1.14E-19	1.06E-19	9.93E-20	9.54E-20	8.64E-20	8.52E-20
Te-127m	4.12E-20	2.94E-20	2.43E-20	2.19E-20	1.68E-20	1.62E-20
Te-129	1.35E-18	1.25E-18	1.18E-18	1.13E-18	1.03E-18	1.02E-18
Te-129m	7.09E-19	6.50E-19	6.12E-19	5.89E-19	5.37E-19	5.30E-19
Te-131	9.16E-18	8.50E-18	8.00E-18	7.69E-18	7.03E-18	6.93E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-131m	3.16E-17	2.92E-17	2.76E-17	2.66E-17	2.45E-17	2.42E-17
Te-132	4.60E-18	4.29E-18	4.00E-18	3.84E-18	3.44E-18	3.40E-18
Te-133	2.59E-17	2.41E-17	2.28E-17	2.20E-17	2.03E-17	2.00E-17
Te-133m	4.03E-17	3.73E-17	3.53E-17	3.40E-17	3.13E-17	3.10E-17
Te-134	1.90E-17	1.76E-17	1.66E-17	1.59E-17	1.45E-17	1.43E-17
Iodine						
I-118	4.52E-17	4.19E-17	3.96E-17	3.81E-17	3.49E-17	3.45E-17
I-118m	8.30E-17	7.68E-17	7.26E-17	6.99E-17	6.40E-17	6.32E-17
I-119	2.00E-17	1.86E-17	1.75E-17	1.69E-17	1.53E-17	1.51E-17
I-120	5.63E-17	5.26E-17	4.98E-17	4.81E-17	4.45E-17	4.40E-17
I-120m	7.68E-17	7.13E-17	6.74E-17	6.50E-17	5.97E-17	5.89E-17
I-121	8.35E-18	7.78E-18	7.30E-18	7.02E-18	6.35E-18	6.27E-18
I-122	2.16E-17	2.00E-17	1.89E-17	1.82E-17	1.66E-17	1.64E-17
I-123	3.21E-18	2.98E-18	2.78E-18	2.65E-18	2.39E-18	2.35E-18
I-124	2.39E-17	2.22E-17	2.10E-17	2.02E-17	1.86E-17	1.84E-17
I-125	1.42E-19	9.64E-20	7.76E-20	6.91E-20	5.08E-20	4.86E-20
I-126	9.46E-18	8.76E-18	8.26E-18	7.95E-18	7.24E-18	7.14E-18
I-128	1.61E-18	1.50E-18	1.42E-18	1.36E-18	1.24E-18	1.23E-18
I-129	1.07E-19	7.51E-20	6.08E-20	5.43E-20	4.12E-20	3.97E-20
I-130	4.74E-17	4.39E-17	4.14E-17	3.98E-17	3.64E-17	3.60E-17
I-130m	2.35E-18	2.18E-18	2.06E-18	1.98E-18	1.81E-18	1.78E-18
I-131	8.45E-18	7.87E-18	7.41E-18	7.12E-18	6.45E-18	6.36E-18
I-132	4.99E-17	4.61E-17	4.36E-17	4.20E-17	3.85E-17	3.81E-17
I-132m	7.35E-18	6.79E-18	6.40E-18	6.16E-18	5.63E-18	5.55E-18
I-133	1.36E-17	1.26E-17	1.19E-17	1.14E-17	1.05E-17	1.03E-17
I-134	5.68E-17	5.25E-17	4.96E-17	4.78E-17	4.40E-17	4.35E-17
I-134m	5.85E-18	5.44E-18	5.09E-18	4.90E-18	4.41E-18	4.36E-18
I-135	3.37E-17	3.13E-17	2.96E-17	2.86E-17	2.66E-17	2.63E-17
Xenon						
Xe-120	8.02E-18	7.39E-18	6.95E-18	6.67E-18	6.08E-18	6.00E-18
Xe-121	3.09E-17	2.89E-17	2.73E-17	2.64E-17	2.43E-17	2.41E-17
Xe-122	1.07E-18	9.73E-19	9.06E-19	8.67E-19	7.77E-19	7.65E-19
Xe-123	1.35E-17	1.25E-17	1.18E-17	1.13E-17	1.04E-17	1.02E-17
Xe-125	5.29E-18	4.92E-18	4.60E-18	4.42E-18	3.98E-18	3.93E-18
Xe-127	5.58E-18	5.21E-18	4.86E-18	4.67E-18	4.20E-18	4.14E-18
Xe-127m	3.17E-18	2.95E-18	2.75E-18	2.62E-18	2.36E-18	2.32E-18
Xe-129m	3.68E-19	3.04E-19	2.68E-19	2.51E-19	2.13E-19	2.09E-19
Xe-131m	1.34E-19	1.09E-19	9.59E-20	8.91E-20	7.55E-20	7.37E-20
Xe-133	5.81E-19	5.04E-19	4.57E-19	4.30E-19	3.72E-19	3.66E-19
Xe-133m	5.75E-19	5.24E-19	4.83E-19	4.62E-19	4.10E-19	4.05E-19
Xe-135	5.41E-18	5.08E-18	4.75E-18	4.58E-18	4.12E-18	4.07E-18
Xe-135m	9.39E-18	8.70E-18	8.21E-18	7.89E-18	7.18E-18	7.08E-18
Xe-137	4.76E-18	4.44E-18	4.21E-18	4.06E-18	3.73E-18	3.68E-18
Xe-138	2.34E-17	2.19E-17	2.08E-17	2.01E-17	1.87E-17	1.85E-17
Cesium						
Cs-121	2.65E-17	2.46E-17	2.33E-17	2.24E-17	2.04E-17	2.01E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cs-121m	2.64E-17	2.46E-17	2.32E-17	2.23E-17	2.03E-17	2.00E-17
Cs-123	2.40E-17	2.22E-17	2.10E-17	2.02E-17	1.84E-17	1.81E-17
Cs-124	2.64E-17	2.46E-17	2.32E-17	2.23E-17	2.04E-17	2.01E-17
Cs-125	1.64E-17	1.52E-17	1.44E-17	1.38E-17	1.26E-17	1.24E-17
Cs-126	2.59E-17	2.41E-17	2.27E-17	2.19E-17	1.99E-17	1.97E-17
Cs-127	9.13E-18	8.46E-18	7.97E-18	7.65E-18	6.94E-18	6.85E-18
Cs-128	1.99E-17	1.85E-17	1.74E-17	1.68E-17	1.53E-17	1.50E-17
Cs-129	5.60E-18	5.18E-18	4.87E-18	4.67E-18	4.22E-18	4.16E-18
Cs-130	1.10E-17	1.02E-17	9.62E-18	9.25E-18	8.42E-18	8.30E-18
Cs-130m	8.91E-19	7.78E-19	7.07E-19	6.66E-19	5.82E-19	5.71E-19
Cs-131	8.95E-20	6.16E-20	4.96E-20	4.41E-20	3.30E-20	3.17E-20
Cs-132	1.55E-17	1.43E-17	1.35E-17	1.30E-17	1.18E-17	1.17E-17
Cs-134	3.45E-17	3.19E-17	3.01E-17	2.90E-17	2.65E-17	2.62E-17
Cs-134m	3.66E-19	3.31E-19	3.05E-19	2.89E-19	2.58E-19	2.53E-19
Cs-135	5.54E-22	4.68E-22	4.17E-22	3.89E-22	3.31E-22	3.25E-22
Cs-135m	3.53E-17	3.26E-17	3.07E-17	2.96E-17	2.72E-17	2.69E-17
Cs-136	4.65E-17	4.30E-17	4.05E-17	3.91E-17	3.60E-17	3.56E-17
Cs-137	4.88E-21	4.46E-21	4.16E-21	3.99E-21	3.62E-21	3.58E-21
Cs-138	4.99E-17	4.66E-17	4.41E-17	4.27E-17	3.97E-17	3.93E-17
Cs-138m	8.71E-18	8.10E-18	7.64E-18	7.38E-18	6.81E-18	6.73E-18
Cs-139	6.83E-18	6.40E-18	6.07E-18	5.89E-18	5.51E-18	5.45E-18
Cs-140	3.72E-17	3.49E-17	3.31E-17	3.20E-17	2.99E-17	2.96E-17
Barium						
Ba-124	1.21E-17	1.12E-17	1.06E-17	1.02E-17	9.30E-18	9.18E-18
Ba-126	1.22E-17	1.13E-17	1.07E-17	1.03E-17	9.40E-18	9.29E-18
Ba-127	1.58E-17	1.47E-17	1.39E-17	1.33E-17	1.22E-17	1.20E-17
Ba-128	1.02E-18	9.35E-19	8.65E-19	8.29E-19	7.39E-19	7.29E-19
Ba-129	6.91E-18	6.41E-18	6.04E-18	5.81E-18	5.30E-18	5.23E-18
Ba-129m	3.39E-17	3.14E-17	2.96E-17	2.86E-17	2.63E-17	2.59E-17
Ba-131	9.89E-18	9.17E-18	8.62E-18	8.27E-18	7.50E-18	7.39E-18
Ba-131m	1.23E-18	1.13E-18	1.05E-18	9.96E-19	8.88E-19	8.71E-19
Ba-133	8.03E-18	7.44E-18	6.96E-18	6.68E-18	6.01E-18	5.93E-18
Ba-133m	1.17E-18	1.07E-18	9.97E-19	9.57E-19	8.55E-19	8.44E-19
Ba-135m	1.00E-18	9.21E-19	8.54E-19	8.19E-19	7.31E-19	7.22E-19
Ba-137m	1.32E-17	1.22E-17	1.15E-17	1.11E-17	1.01E-17	1.00E-17
Ba-139	1.12E-18	1.05E-18	9.86E-19	9.46E-19	8.65E-19	8.54E-19
Ba-140	3.95E-18	3.66E-18	3.45E-18	3.32E-18	3.01E-18	2.97E-18
Ba-141	2.02E-17	1.88E-17	1.77E-17	1.71E-17	1.57E-17	1.55E-17
Ba-142	2.27E-17	2.10E-17	1.98E-17	1.91E-17	1.75E-17	1.74E-17
Lanthanum						
La-128	6.23E-17	5.78E-17	5.46E-17	5.26E-17	4.82E-17	4.76E-17
La-129	2.02E-17	1.87E-17	1.77E-17	1.70E-17	1.55E-17	1.52E-17
La-130	4.89E-17	4.55E-17	4.29E-17	4.14E-17	3.79E-17	3.74E-17
La-131	1.41E-17	1.31E-17	1.24E-17	1.19E-17	1.08E-17	1.06E-17
La-132	4.26E-17	3.97E-17	3.76E-17	3.62E-17	3.34E-17	3.30E-17
La-132m	1.44E-17	1.33E-17	1.26E-17	1.21E-17	1.10E-17	1.09E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-133	3.12E-18	2.87E-18	2.69E-18	2.59E-18	2.35E-18	2.31E-18
La-134	1.60E-17	1.48E-17	1.40E-17	1.35E-17	1.23E-17	1.21E-17
La-135	3.46E-19	2.95E-19	2.66E-19	2.51E-19	2.20E-19	2.16E-19
La-136	8.81E-18	8.15E-18	7.69E-18	7.39E-18	6.72E-18	6.63E-18
La-137	1.16E-19	8.21E-20	6.64E-20	5.92E-20	4.52E-20	4.36E-20
La-138	2.61E-17	2.42E-17	2.29E-17	2.21E-17	2.05E-17	2.03E-17
La-140	4.89E-17	4.56E-17	4.31E-17	4.17E-17	3.87E-17	3.83E-17
La-141	7.85E-19	7.37E-19	7.02E-19	6.82E-19	6.39E-19	6.33E-19
La-142	4.83E-17	4.54E-17	4.31E-17	4.18E-17	3.91E-17	3.87E-17
La-143	5.90E-18	5.51E-18	5.22E-18	5.06E-18	4.71E-18	4.66E-18
Cerium						
Ce-130	1.03E-17	9.49E-18	8.91E-18	8.57E-18	7.81E-18	7.71E-18
Ce-131	3.52E-17	3.27E-17	3.08E-17	2.97E-17	2.73E-17	2.69E-17
Ce-132	5.39E-18	5.02E-18	4.68E-18	4.48E-18	4.04E-18	3.98E-18
Ce-133	1.12E-17	1.03E-17	9.69E-18	9.30E-18	8.43E-18	8.31E-18
Ce-133m	3.67E-17	3.41E-17	3.22E-17	3.10E-17	2.86E-17	2.82E-17
Ce-134	1.68E-19	1.27E-19	1.07E-19	9.75E-20	7.88E-20	7.66E-20
Ce-135	1.77E-17	1.64E-17	1.54E-17	1.48E-17	1.35E-17	1.33E-17
Ce-137	3.81E-19	3.25E-19	2.93E-19	2.76E-19	2.41E-19	2.37E-19
Ce-137m	8.83E-19	8.03E-19	7.42E-19	7.10E-19	6.34E-19	6.25E-19
Ce-139	2.91E-18	2.70E-18	2.50E-18	2.39E-18	2.15E-18	2.11E-18
Ce-141	1.49E-18	1.39E-18	1.29E-18	1.23E-18	1.11E-18	1.09E-18
Ce-143	5.76E-18	5.33E-18	4.99E-18	4.80E-18	4.34E-18	4.29E-18
Ce-144	3.41E-19	3.13E-19	2.90E-19	2.76E-19	2.48E-19	2.43E-19
Ce-145	1.74E-17	1.61E-17	1.52E-17	1.46E-17	1.34E-17	1.32E-17
Praseodymium						
Pr-134	6.93E-17	6.43E-17	6.07E-17	5.85E-17	5.35E-17	5.28E-17
Pr-134m	5.04E-17	4.69E-17	4.43E-17	4.28E-17	3.93E-17	3.88E-17
Pr-135	1.89E-17	1.75E-17	1.65E-17	1.59E-17	1.45E-17	1.43E-17
Pr-136	4.65E-17	4.32E-17	4.09E-17	3.94E-17	3.62E-17	3.57E-17
Pr-137	7.83E-18	7.24E-18	6.83E-18	6.57E-18	5.99E-18	5.91E-18
Pr-138	1.84E-17	1.70E-17	1.61E-17	1.55E-17	1.41E-17	1.39E-17
Pr-138m	5.40E-17	5.00E-17	4.71E-17	4.54E-17	4.17E-17	4.12E-17
Pr-139	2.44E-18	2.24E-18	2.10E-18	2.01E-18	1.83E-18	1.80E-18
Pr-140	1.21E-17	1.12E-17	1.05E-17	1.01E-17	9.22E-18	9.09E-18
Pr-142	1.37E-18	1.29E-18	1.22E-18	1.18E-18	1.11E-18	1.10E-18
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	1.58E-20	1.47E-20	1.39E-20	1.35E-20	1.25E-20	1.24E-20
Pr-144	9.22E-19	8.70E-19	8.29E-19	8.06E-19	7.57E-19	7.50E-19
Pr-144m	1.03E-19	8.30E-20	7.22E-20	6.69E-20	5.67E-20	5.55E-20
Pr-145	5.06E-19	4.70E-19	4.46E-19	4.31E-19	3.99E-19	3.95E-19
Pr-146	2.19E-17	2.04E-17	1.93E-17	1.87E-17	1.73E-17	1.71E-17
Pr-147	1.01E-17	9.37E-18	8.82E-18	8.49E-18	7.76E-18	7.66E-18
Pr-148	2.17E-17	2.03E-17	1.91E-17	1.85E-17	1.71E-17	1.69E-17
Pr-148m	2.11E-17	1.96E-17	1.85E-17	1.78E-17	1.63E-17	1.61E-17
Neodymium						

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nd-134	1.14E-17	1.06E-17	9.93E-18	9.53E-18	8.65E-18	8.53E-18
Nd-135	2.76E-17	2.56E-17	2.42E-17	2.32E-17	2.11E-17	2.08E-17
Nd-136	5.30E-18	4.86E-18	4.55E-18	4.36E-18	3.95E-18	3.89E-18
Nd-137	2.51E-17	2.33E-17	2.19E-17	2.11E-17	1.94E-17	1.91E-17
Nd-138	4.92E-19	4.25E-19	3.83E-19	3.61E-19	3.15E-19	3.09E-19
Nd-139	9.47E-18	8.76E-18	8.25E-18	7.94E-18	7.24E-18	7.14E-18
Nd-139m	3.39E-17	3.13E-17	2.96E-17	2.85E-17	2.62E-17	2.59E-17
Nd-140	1.73E-19	1.27E-19	1.04E-19	9.35E-20	7.33E-20	7.11E-20
Nd-141	1.22E-18	1.10E-18	1.02E-18	9.78E-19	8.85E-19	8.72E-19
Nd-141m	1.54E-17	1.42E-17	1.34E-17	1.29E-17	1.18E-17	1.17E-17
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	2.73E-18	2.51E-18	2.35E-18	2.25E-18	2.03E-18	2.00E-18
Nd-149	7.92E-18	7.37E-18	6.91E-18	6.64E-18	6.01E-18	5.93E-18
Nd-151	1.83E-17	1.70E-17	1.60E-17	1.55E-17	1.42E-17	1.40E-17
Nd-152	3.55E-18	3.32E-18	3.11E-18	3.00E-18	2.70E-18	2.67E-18
Promethium						
Pm-136	6.11E-17	5.66E-17	5.34E-17	5.14E-17	4.70E-17	4.64E-17
Pm-137m	3.90E-17	3.62E-17	3.41E-17	3.28E-17	2.99E-17	2.95E-17
Pm-139	2.09E-17	1.94E-17	1.83E-17	1.76E-17	1.61E-17	1.59E-17
Pm-140	2.41E-17	2.24E-17	2.12E-17	2.03E-17	1.86E-17	1.83E-17
Pm-140m	6.69E-17	6.19E-17	5.84E-17	5.63E-17	5.16E-17	5.10E-17
Pm-141	1.60E-17	1.49E-17	1.41E-17	1.35E-17	1.24E-17	1.22E-17
Pm-142	1.93E-17	1.79E-17	1.69E-17	1.63E-17	1.49E-17	1.46E-17
Pm-143	6.53E-18	5.99E-18	5.64E-18	5.43E-18	4.96E-18	4.90E-18
Pm-144	3.43E-17	3.17E-17	2.99E-17	2.87E-17	2.62E-17	2.59E-17
Pm-145	2.18E-19	1.66E-19	1.39E-19	1.26E-19	1.01E-19	9.80E-20
Pm-146	1.64E-17	1.51E-17	1.43E-17	1.37E-17	1.25E-17	1.24E-17
Pm-147	3.01E-22	2.55E-22	2.28E-22	2.13E-22	1.82E-22	1.78E-22
Pm-148	1.25E-17	1.16E-17	1.10E-17	1.06E-17	9.81E-18	9.70E-18
Pm-148m	4.41E-17	4.08E-17	3.85E-17	3.71E-17	3.39E-17	3.34E-17
Pm-149	2.84E-19	2.65E-19	2.49E-19	2.40E-19	2.18E-19	2.15E-19
Pm-150	3.18E-17	2.95E-17	2.79E-17	2.69E-17	2.49E-17	2.46E-17
Pm-151	7.02E-18	6.52E-18	6.12E-18	5.88E-18	5.33E-18	5.26E-18
Pm-152	6.47E-18	6.00E-18	5.67E-18	5.48E-18	5.06E-18	5.01E-18
Pm-152m	3.27E-17	3.03E-17	2.86E-17	2.76E-17	2.54E-17	2.51E-17
Pm-153	1.48E-18	1.37E-18	1.27E-18	1.22E-18	1.10E-18	1.08E-18
Pm-154	3.74E-17	3.49E-17	3.30E-17	3.20E-17	2.98E-17	2.95E-17
Pm-154m	3.83E-17	3.56E-17	3.36E-17	3.25E-17	3.00E-17	2.97E-17
Samarium						
Sm-139	3.21E-17	2.98E-17	2.82E-17	2.71E-17	2.47E-17	2.44E-17
Sm-140	1.20E-17	1.11E-17	1.04E-17	1.00E-17	9.19E-18	9.08E-18
Sm-141	3.07E-17	2.85E-17	2.70E-17	2.60E-17	2.38E-17	2.35E-17
Sm-141m	4.21E-17	3.90E-17	3.68E-17	3.55E-17	3.26E-17	3.22E-17
Sm-142	2.01E-18	1.83E-18	1.71E-18	1.63E-18	1.48E-18	1.45E-18
Sm-143	1.16E-17	1.07E-17	1.01E-17	9.73E-18	8.86E-18	8.74E-18
Sm-143m	1.51E-17	1.40E-17	1.32E-17	1.27E-17	1.16E-17	1.15E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-145	4.95E-19	3.84E-19	3.23E-19	2.94E-19	2.37E-19	2.32E-19
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.49E-23	1.01E-23	8.35E-24	7.55E-24	5.00E-24	4.74E-24
Sm-153	9.04E-19	8.02E-19	7.32E-19	6.91E-19	6.06E-19	5.94E-19
Sm-155	1.96E-18	1.81E-18	1.69E-18	1.61E-18	1.45E-18	1.42E-18
Sm-156	2.26E-18	2.10E-18	1.95E-18	1.87E-18	1.68E-18	1.65E-18
Sm-157	8.96E-18	8.35E-18	7.84E-18	7.55E-18	6.88E-18	6.80E-18
Europium						
Eu-142	2.77E-17	2.58E-17	2.44E-17	2.35E-17	2.15E-17	2.12E-17
Eu-142m	7.62E-17	7.05E-17	6.66E-17	6.42E-17	5.88E-17	5.81E-17
Eu-143	2.49E-17	2.31E-17	2.18E-17	2.10E-17	1.93E-17	1.90E-17
Eu-144	2.49E-17	2.31E-17	2.18E-17	2.10E-17	1.92E-17	1.90E-17
Eu-145	2.70E-17	2.50E-17	2.36E-17	2.28E-17	2.11E-17	2.09E-17
Eu-146	5.18E-17	4.80E-17	4.53E-17	4.37E-17	4.02E-17	3.97E-17
Eu-147	9.66E-18	8.90E-18	8.35E-18	8.03E-18	7.34E-18	7.25E-18
Eu-148	4.86E-17	4.50E-17	4.24E-17	4.09E-17	3.74E-17	3.70E-17
Eu-149	9.57E-19	8.53E-19	7.81E-19	7.43E-19	6.56E-19	6.47E-19
Eu-150	3.38E-17	3.14E-17	2.96E-17	2.85E-17	2.59E-17	2.56E-17
Eu-150m	1.05E-18	9.75E-19	9.17E-19	8.82E-19	8.03E-19	7.92E-19
Eu-152	2.50E-17	2.31E-17	2.18E-17	2.10E-17	1.94E-17	1.92E-17
Eu-152m	6.40E-18	5.90E-18	5.56E-18	5.36E-18	4.93E-18	4.87E-18
Eu-152n	1.19E-18	1.07E-18	9.85E-19	9.34E-19	8.23E-19	8.09E-19
Eu-154	2.69E-17	2.49E-17	2.35E-17	2.27E-17	2.09E-17	2.07E-17
Eu-154m	9.49E-19	8.34E-19	7.58E-19	7.14E-19	6.22E-19	6.11E-19
Eu-155	9.81E-19	8.86E-19	8.16E-19	7.74E-19	6.83E-19	6.71E-19
Eu-156	2.60E-17	2.42E-17	2.29E-17	2.22E-17	2.06E-17	2.04E-17
Eu-157	5.97E-18	5.50E-18	5.15E-18	4.94E-18	4.47E-18	4.40E-18
Eu-158	2.80E-17	2.59E-17	2.45E-17	2.37E-17	2.19E-17	2.16E-17
Eu-159	6.05E-18	5.53E-18	5.18E-18	4.98E-18	4.54E-18	4.48E-18
Gadolinium						
Gd-142	2.28E-17	2.12E-17	2.00E-17	1.92E-17	1.76E-17	1.74E-17
Gd-143m	4.62E-17	4.29E-17	4.04E-17	3.90E-17	3.57E-17	3.53E-17
Gd-144	1.93E-17	1.80E-17	1.70E-17	1.64E-17	1.51E-17	1.49E-17
Gd-145	4.98E-17	4.66E-17	4.42E-17	4.28E-17	3.99E-17	3.95E-17
Gd-145m	1.50E-17	1.39E-17	1.31E-17	1.26E-17	1.16E-17	1.14E-17
Gd-146	4.09E-18	3.72E-18	3.43E-18	3.25E-18	2.90E-18	2.84E-18
Gd-147	3.02E-17	2.80E-17	2.63E-17	2.54E-17	2.32E-17	2.29E-17
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	1.09E-17	1.01E-17	9.49E-18	9.11E-18	8.26E-18	8.15E-18
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	1.00E-18	8.92E-19	8.12E-19	7.69E-19	6.77E-19	6.67E-19
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	1.38E-18	1.21E-18	1.10E-18	1.03E-18	9.01E-19	8.84E-19
Gd-159	1.08E-18	9.96E-19	9.30E-19	8.91E-19	8.01E-19	7.90E-19

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-162	9.25E-18	8.60E-18	8.10E-18	7.78E-18	7.05E-18	6.95E-18
Terbium						
Tb-146	7.71E-17	7.19E-17	6.80E-17	6.58E-17	6.10E-17	6.03E-17
Tb-147	4.67E-17	4.33E-17	4.09E-17	3.95E-17	3.64E-17	3.60E-17
Tb-147m	4.02E-17	3.74E-17	3.54E-17	3.42E-17	3.18E-17	3.14E-17
Tb-148	5.06E-17	4.71E-17	4.45E-17	4.30E-17	3.96E-17	3.92E-17
Tb-148m	6.91E-17	6.38E-17	6.02E-17	5.80E-17	5.31E-17	5.24E-17
Tb-149	2.88E-17	2.68E-17	2.52E-17	2.44E-17	2.24E-17	2.22E-17
Tb-149m	3.00E-17	2.77E-17	2.62E-17	2.52E-17	2.31E-17	2.28E-17
Tb-150	5.05E-17	4.72E-17	4.47E-17	4.32E-17	4.01E-17	3.97E-17
Tb-150m	5.55E-17	5.14E-17	4.85E-17	4.66E-17	4.25E-17	4.20E-17
Tb-151	2.11E-17	1.95E-17	1.83E-17	1.76E-17	1.61E-17	1.59E-17
Tb-151m	1.55E-18	1.42E-18	1.33E-18	1.27E-18	1.15E-18	1.14E-18
Tb-152	3.14E-17	2.93E-17	2.77E-17	2.67E-17	2.46E-17	2.43E-17
Tb-152m	1.61E-17	1.49E-17	1.40E-17	1.35E-17	1.22E-17	1.20E-17
Tb-153	6.51E-18	5.99E-18	5.59E-18	5.37E-18	4.85E-18	4.79E-18
Tb-154	4.65E-17	4.35E-17	4.12E-17	3.99E-17	3.72E-17	3.68E-17
Tb-155	2.96E-18	2.69E-18	2.48E-18	2.36E-18	2.09E-18	2.06E-18
Tb-156	4.12E-17	3.81E-17	3.60E-17	3.47E-17	3.19E-17	3.16E-17
Tb-156m	3.84E-19	3.14E-19	2.70E-19	2.48E-19	2.06E-19	2.02E-19
Tb-156n	4.18E-20	3.53E-20	3.12E-20	2.90E-20	2.47E-20	2.42E-20
Tb-157	4.00E-20	3.15E-20	2.66E-20	2.43E-20	1.97E-20	1.93E-20
Tb-158	1.70E-17	1.57E-17	1.48E-17	1.42E-17	1.31E-17	1.29E-17
Tb-160	2.44E-17	2.26E-17	2.13E-17	2.05E-17	1.89E-17	1.87E-17
Tb-161	3.60E-19	3.00E-19	2.64E-19	2.45E-19	2.06E-19	2.03E-19
Tb-162	2.42E-17	2.24E-17	2.11E-17	2.04E-17	1.86E-17	1.84E-17
Tb-163	1.75E-17	1.62E-17	1.53E-17	1.47E-17	1.33E-17	1.31E-17
Tb-164	5.28E-17	4.90E-17	4.63E-17	4.46E-17	4.11E-17	4.06E-17
Tb-165	1.80E-17	1.67E-17	1.58E-17	1.53E-17	1.42E-17	1.40E-17
Dysprosium						
Dy-148	1.55E-17	1.43E-17	1.34E-17	1.29E-17	1.18E-17	1.16E-17
Dy-149	3.40E-17	3.16E-17	2.98E-17	2.88E-17	2.66E-17	2.63E-17
Dy-150	5.87E-18	5.44E-18	5.11E-18	4.90E-18	4.43E-18	4.36E-18
Dy-151	2.92E-17	2.71E-17	2.55E-17	2.46E-17	2.27E-17	2.24E-17
Dy-152	5.80E-18	5.40E-18	5.03E-18	4.83E-18	4.33E-18	4.28E-18
Dy-153	1.78E-17	1.65E-17	1.55E-17	1.49E-17	1.36E-17	1.35E-17
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	1.39E-17	1.29E-17	1.21E-17	1.17E-17	1.07E-17	1.05E-17
Dy-157	7.15E-18	6.63E-18	6.20E-18	5.95E-18	5.35E-18	5.28E-18
Dy-159	4.12E-19	3.29E-19	2.80E-19	2.56E-19	2.09E-19	2.05E-19
Dy-165	5.59E-19	5.13E-19	4.81E-19	4.61E-19	4.18E-19	4.12E-19
Dy-165m	3.34E-19	3.05E-19	2.84E-19	2.71E-19	2.43E-19	2.40E-19
Dy-166	5.56E-19	4.79E-19	4.30E-19	4.03E-19	3.47E-19	3.42E-19
Dy-167	1.17E-17	1.09E-17	1.02E-17	9.83E-18	8.92E-18	8.81E-18
Dy-168	8.48E-18	7.86E-18	7.39E-18	7.09E-18	6.43E-18	6.34E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Holmium						
Ho-150	4.26E-17	3.94E-17	3.72E-17	3.58E-17	3.28E-17	3.23E-17
Ho-153	2.24E-17	2.08E-17	1.96E-17	1.88E-17	1.72E-17	1.69E-17
Ho-153m	2.32E-17	2.15E-17	2.02E-17	1.94E-17	1.77E-17	1.74E-17
Ho-154	4.15E-17	3.85E-17	3.63E-17	3.50E-17	3.20E-17	3.16E-17
Ho-154m	5.37E-17	4.98E-17	4.70E-17	4.52E-17	4.12E-17	4.06E-17
Ho-155	1.28E-17	1.19E-17	1.12E-17	1.07E-17	9.80E-18	9.67E-18
Ho-156	4.49E-17	4.18E-17	3.94E-17	3.80E-17	3.50E-17	3.46E-17
Ho-157	1.18E-17	1.09E-17	1.02E-17	9.84E-18	8.92E-18	8.81E-18
Ho-159	7.31E-18	6.71E-18	6.25E-18	5.98E-18	5.38E-18	5.31E-18
Ho-160	3.66E-17	3.38E-17	3.19E-17	3.07E-17	2.81E-17	2.78E-17
Ho-161	5.66E-19	4.71E-19	4.12E-19	3.82E-19	3.21E-19	3.15E-19
Ho-162	2.98E-18	2.72E-18	2.53E-18	2.43E-18	2.21E-18	2.18E-18
Ho-162m	1.15E-17	1.06E-17	9.97E-18	9.61E-18	8.82E-18	8.72E-18
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	3.11E-19	2.57E-19	2.23E-19	2.06E-19	1.73E-19	1.70E-19
Ho-164m	4.38E-19	3.55E-19	3.05E-19	2.80E-19	2.31E-19	2.27E-19
Ho-166	6.44E-19	5.93E-19	5.56E-19	5.36E-19	4.94E-19	4.89E-19
Ho-166m	3.55E-17	3.29E-17	3.10E-17	2.98E-17	2.72E-17	2.69E-17
Ho-167	7.93E-18	7.39E-18	6.94E-18	6.67E-18	6.02E-18	5.94E-18
Ho-168	1.93E-17	1.78E-17	1.68E-17	1.62E-17	1.49E-17	1.47E-17
Ho-168m	6.23E-20	5.06E-20	4.35E-20	3.99E-20	3.30E-20	3.24E-20
Ho-170	3.70E-17	3.42E-17	3.22E-17	3.11E-17	2.85E-17	2.82E-17
Erbium						
Er-154	1.03E-18	9.07E-19	8.28E-19	7.83E-19	6.90E-19	6.79E-19
Er-156	7.57E-19	6.46E-19	5.75E-19	5.38E-19	4.62E-19	4.55E-19
Er-159	2.04E-17	1.89E-17	1.79E-17	1.72E-17	1.58E-17	1.56E-17
Er-161	2.11E-17	1.95E-17	1.83E-17	1.77E-17	1.62E-17	1.60E-17
Er-163	4.10E-19	3.36E-19	2.90E-19	2.67E-19	2.23E-19	2.19E-19
Er-165	3.74E-19	3.04E-19	2.61E-19	2.39E-19	1.98E-19	1.94E-19
Er-167m	1.96E-18	1.84E-18	1.71E-18	1.64E-18	1.47E-18	1.45E-18
Er-169	8.48E-22	7.29E-22	6.55E-22	6.14E-22	5.28E-22	5.19E-22
Er-171	7.87E-18	7.33E-18	6.86E-18	6.59E-18	5.93E-18	5.85E-18
Er-172	1.11E-17	1.02E-17	9.61E-18	9.23E-18	8.38E-18	8.26E-18
Er-173	1.78E-17	1.65E-17	1.55E-17	1.49E-17	1.36E-17	1.34E-17
Thulium						
Tm-161	2.62E-17	2.43E-17	2.29E-17	2.21E-17	2.03E-17	2.01E-17
Tm-162	3.99E-17	3.72E-17	3.52E-17	3.41E-17	3.16E-17	3.12E-17
Tm-163	2.73E-17	2.53E-17	2.38E-17	2.30E-17	2.12E-17	2.10E-17
Tm-164	1.67E-17	1.55E-17	1.46E-17	1.41E-17	1.29E-17	1.27E-17
Tm-165	1.16E-17	1.07E-17	1.00E-17	9.63E-18	8.73E-18	8.62E-18
Tm-166	4.13E-17	3.84E-17	3.62E-17	3.50E-17	3.25E-17	3.21E-17
Tm-167	2.60E-18	2.38E-18	2.19E-18	2.09E-18	1.86E-18	1.83E-18
Tm-168	2.67E-17	2.47E-17	2.32E-17	2.24E-17	2.04E-17	2.02E-17
Tm-170	7.22E-20	6.41E-20	5.86E-20	5.54E-20	4.89E-20	4.82E-20
Tm-171	7.14E-21	5.96E-21	5.22E-21	4.84E-21	4.07E-21	4.01E-21

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-172	1.00E-17	9.33E-18	8.81E-18	8.53E-18	7.92E-18	7.84E-18
Tm-173	8.58E-18	7.98E-18	7.51E-18	7.22E-18	6.54E-18	6.44E-18
Tm-174	3.87E-17	3.59E-17	3.38E-17	3.25E-17	2.97E-17	2.94E-17
Tm-175	2.38E-17	2.20E-17	2.08E-17	2.00E-17	1.83E-17	1.81E-17
Tm-176	4.14E-17	3.86E-17	3.65E-17	3.53E-17	3.26E-17	3.23E-17
Ytterbium						
Yb-162	4.84E-18	4.45E-18	4.14E-18	3.96E-18	3.57E-18	3.51E-18
Yb-163	1.54E-17	1.42E-17	1.34E-17	1.29E-17	1.19E-17	1.17E-17
Yb-164	7.13E-19	6.15E-19	5.51E-19	5.17E-19	4.48E-19	4.41E-19
Yb-165	6.36E-18	5.79E-18	5.41E-18	5.18E-18	4.70E-18	4.64E-18
Yb-166	1.00E-18	8.41E-19	7.39E-19	6.86E-19	5.79E-19	5.70E-19
Yb-167	4.41E-18	3.99E-18	3.67E-18	3.48E-18	3.09E-18	3.04E-18
Yb-169	5.57E-18	5.05E-18	4.64E-18	4.41E-18	3.90E-18	3.85E-18
Yb-175	8.37E-19	7.78E-19	7.30E-19	7.01E-19	6.32E-19	6.24E-19
Yb-177	4.15E-18	3.83E-18	3.61E-18	3.48E-18	3.20E-18	3.16E-18
Yb-178	8.42E-19	7.84E-19	7.37E-19	7.08E-19	6.40E-19	6.32E-19
Yb-179	2.16E-17	2.00E-17	1.89E-17	1.82E-17	1.66E-17	1.64E-17
Lutetium						
Lu-165	2.33E-17	2.16E-17	2.04E-17	1.96E-17	1.80E-17	1.78E-17
Lu-167	3.50E-17	3.26E-17	3.08E-17	2.98E-17	2.76E-17	2.73E-17
Lu-169	2.75E-17	2.55E-17	2.40E-17	2.32E-17	2.14E-17	2.12E-17
Lu-169m	1.17E-23	7.27E-24	5.63E-24	4.76E-24	1.69E-24	1.57E-24
Lu-170	5.21E-17	4.87E-17	4.61E-17	4.47E-17	4.17E-17	4.13E-17
Lu-171	1.35E-17	1.24E-17	1.16E-17	1.12E-17	1.02E-17	1.01E-17
Lu-171m	4.19E-21	3.56E-21	3.17E-21	2.96E-21	2.52E-21	2.48E-21
Lu-172	4.18E-17	3.86E-17	3.64E-17	3.51E-17	3.23E-17	3.20E-17
Lu-172m	1.63E-23	1.20E-23	9.92E-24	8.88E-24	6.35E-24	6.17E-24
Lu-173	3.02E-18	2.72E-18	2.49E-18	2.37E-18	2.09E-18	2.06E-18
Lu-174	1.98E-18	1.78E-18	1.65E-18	1.57E-18	1.43E-18	1.41E-18
Lu-174m	7.70E-19	6.59E-19	5.88E-19	5.51E-19	4.75E-19	4.68E-19
Lu-176	1.02E-17	9.55E-18	8.92E-18	8.58E-18	7.71E-18	7.62E-18
Lu-176m	2.46E-19	2.20E-19	2.02E-19	1.92E-19	1.70E-19	1.67E-19
Lu-177	7.06E-19	6.58E-19	6.13E-19	5.87E-19	5.27E-19	5.20E-19
Lu-177m	2.09E-17	1.95E-17	1.82E-17	1.75E-17	1.57E-17	1.55E-17
Lu-178	2.74E-18	2.54E-18	2.40E-18	2.32E-18	2.15E-18	2.13E-18
Lu-178m	2.24E-17	2.09E-17	1.96E-17	1.88E-17	1.69E-17	1.67E-17
Lu-179	6.86E-19	6.44E-19	6.03E-19	5.80E-19	5.25E-19	5.19E-19
Lu-180	3.26E-17	3.02E-17	2.85E-17	2.75E-17	2.54E-17	2.51E-17
Lu-181	1.25E-17	1.15E-17	1.09E-17	1.05E-17	9.52E-18	9.40E-18
Hafnium						
Hf-167	1.35E-17	1.25E-17	1.18E-17	1.13E-17	1.03E-17	1.01E-17
Hf-169	1.38E-17	1.27E-17	1.20E-17	1.15E-17	1.04E-17	1.03E-17
Hf-170	8.92E-18	8.21E-18	7.69E-18	7.37E-18	6.66E-18	6.57E-18
Hf-172	1.35E-18	1.17E-18	1.06E-18	9.88E-19	8.54E-19	8.40E-19
Hf-173	7.81E-18	7.22E-18	6.73E-18	6.44E-18	5.79E-18	5.71E-18
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-175	7.25E-18	6.71E-18	6.27E-18	6.01E-18	5.40E-18	5.33E-18
Hf-177m	4.87E-17	4.54E-17	4.25E-17	4.09E-17	3.68E-17	3.63E-17
Hf-178m	4.86E-17	4.52E-17	4.25E-17	4.08E-17	3.70E-17	3.65E-17
Hf-179m	1.95E-17	1.81E-17	1.70E-17	1.63E-17	1.47E-17	1.45E-17
Hf-180m	2.13E-17	1.98E-17	1.86E-17	1.78E-17	1.61E-17	1.59E-17
Hf-181	1.15E-17	1.07E-17	1.00E-17	9.64E-18	8.74E-18	8.61E-18
Hf-182	5.15E-18	4.82E-18	4.51E-18	4.33E-18	3.90E-18	3.85E-18
Hf-182m	1.95E-17	1.80E-17	1.69E-17	1.63E-17	1.48E-17	1.46E-17
Hf-183	1.68E-17	1.55E-17	1.46E-17	1.41E-17	1.29E-17	1.27E-17
Hf-184	4.78E-18	4.44E-18	4.14E-18	3.97E-18	3.57E-18	3.52E-18
Tantalum						
Ta-170	2.38E-17	2.20E-17	2.08E-17	2.00E-17	1.82E-17	1.80E-17
Ta-172	3.63E-17	3.37E-17	3.18E-17	3.06E-17	2.82E-17	2.78E-17
Ta-173	1.18E-17	1.09E-17	1.02E-17	9.82E-18	8.99E-18	8.88E-18
Ta-174	2.05E-17	1.91E-17	1.80E-17	1.73E-17	1.59E-17	1.57E-17
Ta-175	2.29E-17	2.13E-17	2.00E-17	1.93E-17	1.78E-17	1.76E-17
Ta-176	4.61E-17	4.30E-17	4.06E-17	3.93E-17	3.66E-17	3.62E-17
Ta-177	9.59E-19	8.38E-19	7.58E-19	7.13E-19	6.21E-19	6.12E-19
Ta-178	2.10E-18	1.90E-18	1.76E-18	1.68E-18	1.52E-18	1.50E-18
Ta-178m	2.43E-17	2.26E-17	2.11E-17	2.03E-17	1.83E-17	1.80E-17
Ta-179	2.93E-19	2.46E-19	2.16E-19	2.01E-19	1.69E-19	1.67E-19
Ta-180	6.00E-19	5.10E-19	4.53E-19	4.22E-19	3.60E-19	3.54E-19
Ta-182	2.73E-17	2.53E-17	2.38E-17	2.30E-17	2.12E-17	2.10E-17
Ta-182m	5.03E-18	4.64E-18	4.31E-18	4.10E-18	3.68E-18	3.62E-18
Ta-183	5.75E-18	5.31E-18	4.94E-18	4.73E-18	4.23E-18	4.18E-18
Ta-184	3.43E-17	3.18E-17	2.99E-17	2.88E-17	2.63E-17	2.60E-17
Ta-185	3.09E-18	2.86E-18	2.66E-18	2.54E-18	2.29E-18	2.26E-18
Ta-186	3.13E-17	2.90E-17	2.74E-17	2.63E-17	2.40E-17	2.37E-17
Tungsten						
W-177	1.90E-17	1.75E-17	1.64E-17	1.58E-17	1.44E-17	1.42E-17
W-178	1.83E-19	1.54E-19	1.36E-19	1.26E-19	1.07E-19	1.06E-19
W-179	6.09E-19	5.11E-19	4.50E-19	4.17E-19	3.53E-19	3.47E-19
W-179m	8.85E-19	7.91E-19	7.22E-19	6.84E-19	6.00E-19	5.92E-19
W-181	4.87E-19	4.10E-19	3.63E-19	3.37E-19	2.85E-19	2.81E-19
W-185	2.29E-21	2.02E-21	1.83E-21	1.73E-21	1.51E-21	1.48E-21
W-185m	4.27E-19	3.89E-19	3.58E-19	3.40E-19	3.03E-19	2.98E-19
W-187	9.75E-18	9.00E-18	8.48E-18	8.15E-18	7.42E-18	7.32E-18
W-188	4.04E-20	3.77E-20	3.51E-20	3.38E-20	3.03E-20	2.99E-20
W-190	2.60E-18	2.35E-18	2.16E-18	2.05E-18	1.82E-18	1.79E-18
Rhenium						
Re-178	3.51E-17	3.28E-17	3.11E-17	3.00E-17	2.78E-17	2.75E-17
Re-179	2.29E-17	2.12E-17	2.00E-17	1.93E-17	1.76E-17	1.74E-17
Re-180	2.58E-17	2.38E-17	2.24E-17	2.16E-17	1.98E-17	1.96E-17
Re-181	1.70E-17	1.57E-17	1.47E-17	1.41E-17	1.29E-17	1.27E-17
Re-182	3.75E-17	3.47E-17	3.26E-17	3.14E-17	2.88E-17	2.85E-17
Re-182m	2.54E-17	2.34E-17	2.21E-17	2.13E-17	1.96E-17	1.94E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-183	2.56E-18	2.30E-18	2.11E-18	2.00E-18	1.77E-18	1.74E-18
Re-184	1.91E-17	1.75E-17	1.65E-17	1.59E-17	1.46E-17	1.44E-17
Re-184m	7.81E-18	7.19E-18	6.74E-18	6.47E-18	5.88E-18	5.81E-18
Re-186	3.91E-19	3.58E-19	3.31E-19	3.15E-19	2.82E-19	2.78E-19
Re-186m	1.81E-19	1.53E-19	1.35E-19	1.26E-19	1.07E-19	1.05E-19
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	1.42E-18	1.32E-18	1.24E-18	1.19E-18	1.09E-18	1.08E-18
Re-188m	9.90E-19	8.67E-19	7.85E-19	7.37E-19	6.40E-19	6.30E-19
Re-189	1.18E-18	1.10E-18	1.03E-18	9.88E-19	8.90E-19	8.79E-19
Re-190	2.95E-17	2.74E-17	2.58E-17	2.48E-17	2.26E-17	2.23E-17
Re-190m	2.02E-17	1.87E-17	1.76E-17	1.69E-17	1.54E-17	1.52E-17
Osmium						
Os-180	2.19E-18	1.98E-18	1.83E-18	1.75E-18	1.56E-18	1.54E-18
Os-181	2.91E-17	2.70E-17	2.54E-17	2.45E-17	2.25E-17	2.23E-17
Os-182	8.96E-18	8.28E-18	7.76E-18	7.44E-18	6.73E-18	6.63E-18
Os-183	1.29E-17	1.19E-17	1.12E-17	1.07E-17	9.68E-18	9.55E-18
Os-183m	2.14E-17	1.97E-17	1.86E-17	1.80E-17	1.66E-17	1.64E-17
Os-185	1.49E-17	1.37E-17	1.29E-17	1.24E-17	1.13E-17	1.12E-17
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	5.09E-23	3.23E-23	2.53E-23	2.17E-23	6.73E-24	6.20E-24
Os-190m	3.51E-17	3.25E-17	3.07E-17	2.95E-17	2.68E-17	2.64E-17
Os-191	1.35E-18	1.21E-18	1.11E-18	1.05E-18	9.33E-19	9.18E-19
Os-191m	7.77E-20	6.64E-20	5.94E-20	5.53E-20	4.74E-20	4.67E-20
Os-193	1.40E-18	1.29E-18	1.21E-18	1.16E-18	1.04E-18	1.03E-18
Os-194	2.07E-20	1.62E-20	1.37E-20	1.25E-20	1.01E-20	9.85E-21
Os-196	1.70E-18	1.57E-18	1.47E-18	1.41E-18	1.27E-18	1.26E-18
Iridium						
Ir-180	3.53E-17	3.27E-17	3.08E-17	2.97E-17	2.71E-17	2.67E-17
Ir-182	3.09E-17	2.87E-17	2.70E-17	2.60E-17	2.37E-17	2.34E-17
Ir-183	2.47E-17	2.29E-17	2.16E-17	2.09E-17	1.92E-17	1.90E-17
Ir-184	4.19E-17	3.89E-17	3.66E-17	3.53E-17	3.25E-17	3.21E-17
Ir-185	1.73E-17	1.61E-17	1.52E-17	1.47E-17	1.35E-17	1.34E-17
Ir-186	3.52E-17	3.27E-17	3.08E-17	2.97E-17	2.73E-17	2.70E-17
Ir-186m	2.65E-17	2.46E-17	2.32E-17	2.24E-17	2.06E-17	2.04E-17
Ir-187	6.69E-18	6.13E-18	5.74E-18	5.51E-18	5.00E-18	4.94E-18
Ir-188	4.29E-17	4.01E-17	3.80E-17	3.68E-17	3.42E-17	3.39E-17
Ir-189	1.20E-18	1.07E-18	9.71E-19	9.18E-19	8.02E-19	7.92E-19
Ir-190	3.22E-17	2.98E-17	2.81E-17	2.70E-17	2.45E-17	2.42E-17
Ir-190m	5.76E-23	3.70E-23	2.93E-23	2.53E-23	7.75E-24	7.12E-24
Ir-190n	7.91E-19	6.87E-19	6.18E-19	5.79E-19	5.01E-19	4.94E-19
Ir-191m	1.21E-18	1.09E-18	1.00E-18	9.48E-19	8.40E-19	8.26E-19
Ir-192	1.80E-17	1.68E-17	1.58E-17	1.52E-17	1.37E-17	1.35E-17
Ir-192m	1.28E-21	1.11E-21	1.02E-21	9.61E-22	8.05E-22	7.93E-22
Ir-192n	9.75E-21	8.52E-21	7.72E-21	7.25E-21	6.24E-21	6.15E-21
Ir-193m	4.31E-21	3.69E-21	3.31E-21	3.08E-21	2.63E-21	2.60E-21
Ir-194	2.14E-18	2.00E-18	1.89E-18	1.82E-18	1.66E-18	1.64E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-194m	5.17E-17	4.80E-17	4.52E-17	4.35E-17	3.96E-17	3.90E-17
Ir-195	9.03E-19	8.02E-19	7.32E-19	6.91E-19	6.05E-19	5.97E-19
Ir-195m	8.01E-18	7.43E-18	6.97E-18	6.69E-18	6.06E-18	5.97E-18
Ir-196	5.40E-18	5.02E-18	4.74E-18	4.57E-18	4.19E-18	4.14E-18
Ir-196m	5.46E-17	5.07E-17	4.78E-17	4.59E-17	4.18E-17	4.12E-17
Platinum						
Pt-184	1.47E-17	1.35E-17	1.26E-17	1.21E-17	1.09E-17	1.08E-17
Pt-186	1.45E-17	1.34E-17	1.26E-17	1.21E-17	1.10E-17	1.09E-17
Pt-187	1.27E-17	1.17E-17	1.10E-17	1.05E-17	9.58E-18	9.46E-18
Pt-188	3.85E-18	3.53E-18	3.27E-18	3.13E-18	2.79E-18	2.75E-18
Pt-189	9.84E-18	9.04E-18	8.47E-18	8.12E-18	7.37E-18	7.28E-18
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	5.67E-18	5.18E-18	4.83E-18	4.61E-18	4.14E-18	4.08E-18
Pt-193	1.41E-22	9.19E-23	7.34E-23	6.39E-23	1.99E-23	1.82E-23
Pt-193m	1.47E-19	1.27E-19	1.15E-19	1.07E-19	9.26E-20	9.13E-20
Pt-195m	1.07E-18	9.39E-19	8.54E-19	8.03E-19	6.99E-19	6.89E-19
Pt-197	4.13E-19	3.74E-19	3.44E-19	3.26E-19	2.88E-19	2.84E-19
Pt-197m	1.48E-18	1.35E-18	1.25E-18	1.19E-18	1.06E-18	1.05E-18
Pt-199	4.44E-18	4.12E-18	3.89E-18	3.74E-18	3.40E-18	3.35E-18
Pt-200	1.06E-18	9.63E-19	8.90E-19	8.47E-19	7.52E-19	7.42E-19
Pt-202	9.70E-20	9.29E-20	8.97E-20	8.78E-20	8.36E-20	8.31E-20
Gold						
Au-186	3.28E-17	3.05E-17	2.87E-17	2.76E-17	2.53E-17	2.50E-17
Au-187	2.22E-17	2.06E-17	1.95E-17	1.88E-17	1.73E-17	1.72E-17
Au-190	4.84E-17	4.54E-17	4.30E-17	4.17E-17	3.87E-17	3.83E-17
Au-191	1.25E-17	1.15E-17	1.08E-17	1.04E-17	9.40E-18	9.28E-18
Au-192	3.99E-17	3.73E-17	3.53E-17	3.42E-17	3.17E-17	3.14E-17
Au-193	3.02E-18	2.75E-18	2.54E-18	2.42E-18	2.15E-18	2.13E-18
Au-193m	4.13E-18	3.86E-18	3.61E-18	3.47E-18	3.11E-18	3.08E-18
Au-194	2.17E-17	2.02E-17	1.90E-17	1.84E-17	1.69E-17	1.67E-17
Au-195	1.17E-18	1.03E-18	9.31E-19	8.74E-19	7.59E-19	7.48E-19
Au-195m	4.20E-18	3.93E-18	3.67E-18	3.53E-18	3.17E-18	3.13E-18
Au-196	1.00E-17	9.31E-18	8.72E-18	8.37E-18	7.54E-18	7.44E-18
Au-196m	4.62E-18	4.27E-18	3.96E-18	3.78E-18	3.38E-18	3.33E-18
Au-198	8.96E-18	8.33E-18	7.85E-18	7.54E-18	6.84E-18	6.74E-18
Au-198m	1.07E-17	1.00E-17	9.31E-18	8.92E-18	8.00E-18	7.89E-18
Au-199	1.92E-18	1.78E-18	1.66E-18	1.58E-18	1.43E-18	1.40E-18
Au-200	6.05E-18	5.62E-18	5.31E-18	5.13E-18	4.73E-18	4.67E-18
Au-200m	4.37E-17	4.06E-17	3.82E-17	3.67E-17	3.34E-17	3.30E-17
Au-201	7.83E-19	7.26E-19	6.85E-19	6.58E-19	6.00E-19	5.91E-19
Au-202	4.01E-18	3.73E-18	3.53E-18	3.40E-18	3.14E-18	3.10E-18
Mercury						
Hg-190	3.65E-18	3.34E-18	3.09E-18	2.94E-18	2.63E-18	2.58E-18
Hg-191m	3.18E-17	2.95E-17	2.78E-17	2.68E-17	2.45E-17	2.42E-17
Hg-192	5.32E-18	4.91E-18	4.57E-18	4.37E-18	3.91E-18	3.86E-18
Hg-193	1.75E-17	1.62E-17	1.52E-17	1.47E-17	1.35E-17	1.33E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-193m	2.18E-17	2.02E-17	1.90E-17	1.83E-17	1.68E-17	1.66E-17
Hg-194	2.23E-22	1.49E-22	1.21E-22	1.07E-22	3.41E-23	3.12E-23
Hg-195	3.85E-18	3.51E-18	3.28E-18	3.14E-18	2.85E-18	2.81E-18
Hg-195m	4.06E-18	3.75E-18	3.50E-18	3.36E-18	3.03E-18	2.99E-18
Hg-197	1.04E-18	9.05E-19	8.21E-19	7.70E-19	6.67E-19	6.58E-19
Hg-197m	1.75E-18	1.61E-18	1.49E-18	1.42E-18	1.27E-18	1.25E-18
Hg-199m	3.56E-18	3.29E-18	3.06E-18	2.92E-18	2.62E-18	2.58E-18
Hg-203	5.15E-18	4.82E-18	4.51E-18	4.34E-18	3.90E-18	3.86E-18
Hg-205	1.74E-19	1.64E-19	1.55E-19	1.50E-19	1.38E-19	1.36E-19
Hg-206	2.65E-18	2.47E-18	2.32E-18	2.23E-18	2.01E-18	1.99E-18
Hg-207	5.61E-17	5.24E-17	4.95E-17	4.79E-17	4.45E-17	4.40E-17
Thallium						
Tl-190	2.91E-17	2.70E-17	2.55E-17	2.45E-17	2.23E-17	2.20E-17
Tl-190m	5.43E-17	5.03E-17	4.74E-17	4.56E-17	4.17E-17	4.11E-17
Tl-194	2.02E-17	1.87E-17	1.76E-17	1.69E-17	1.54E-17	1.52E-17
Tl-194m	5.53E-17	5.11E-17	4.82E-17	4.64E-17	4.23E-17	4.18E-17
Tl-195	2.54E-17	2.36E-17	2.23E-17	2.16E-17	2.00E-17	1.97E-17
Tl-196	3.95E-17	3.68E-17	3.48E-17	3.36E-17	3.10E-17	3.07E-17
Tl-197	9.42E-18	8.69E-18	8.17E-18	7.85E-18	7.17E-18	7.08E-18
Tl-198	4.21E-17	3.92E-17	3.71E-17	3.58E-17	3.32E-17	3.28E-17
Tl-198m	2.65E-17	2.45E-17	2.31E-17	2.22E-17	2.02E-17	1.99E-17
Tl-199	4.97E-18	4.57E-18	4.26E-18	4.08E-18	3.67E-18	3.62E-18
Tl-200	2.80E-17	2.60E-17	2.45E-17	2.36E-17	2.17E-17	2.14E-17
Tl-201	1.46E-18	1.30E-18	1.19E-18	1.12E-18	9.87E-19	9.73E-19
Tl-202	9.89E-18	9.14E-18	8.59E-18	8.24E-18	7.45E-18	7.34E-18
Tl-204	2.59E-20	2.30E-20	2.11E-20	1.99E-20	1.76E-20	1.74E-20
Tl-206	6.55E-20	6.25E-20	6.01E-20	5.88E-20	5.57E-20	5.54E-20
Tl-206m	5.31E-17	4.92E-17	4.63E-17	4.46E-17	4.07E-17	4.02E-17
Tl-207	1.04E-19	9.76E-20	9.30E-20	9.03E-20	8.44E-20	8.37E-20
Tl-208	6.74E-17	6.35E-17	6.03E-17	5.85E-17	5.47E-17	5.42E-17
Tl-209	4.53E-17	4.22E-17	3.99E-17	3.86E-17	3.57E-17	3.53E-17
Tl-210	5.91E-17	5.50E-17	5.20E-17	5.03E-17	4.65E-17	4.60E-17
Lead						
Pb-194	2.28E-17	2.11E-17	1.99E-17	1.92E-17	1.76E-17	1.74E-17
Pb-195m	3.60E-17	3.33E-17	3.14E-17	3.02E-17	2.75E-17	2.72E-17
Pb-196	1.03E-17	9.48E-18	8.89E-18	8.53E-18	7.70E-18	7.60E-18
Pb-197	3.24E-17	3.01E-17	2.84E-17	2.74E-17	2.53E-17	2.50E-17
Pb-197m	2.52E-17	2.34E-17	2.20E-17	2.12E-17	1.93E-17	1.90E-17
Pb-198	9.06E-18	8.38E-18	7.85E-18	7.53E-18	6.79E-18	6.70E-18
Pb-199	2.19E-17	2.03E-17	1.92E-17	1.85E-17	1.70E-17	1.68E-17
Pb-200	3.87E-18	3.54E-18	3.29E-18	3.13E-18	2.80E-18	2.76E-18
Pb-201	1.61E-17	1.49E-17	1.40E-17	1.35E-17	1.23E-17	1.21E-17
Pb-201m	7.96E-18	7.35E-18	6.93E-18	6.66E-18	6.07E-18	5.99E-18
Pb-202	2.38E-22	1.52E-22	1.21E-22	1.04E-22	3.25E-23	2.98E-23
Pb-202m	4.39E-17	4.05E-17	3.82E-17	3.68E-17	3.38E-17	3.33E-17
Pb-203	6.38E-18	5.92E-18	5.52E-18	5.30E-18	4.75E-18	4.69E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-204m	4.54E-17	4.19E-17	3.96E-17	3.81E-17	3.50E-17	3.46E-17
Pb-205	2.41E-22	1.54E-22	1.22E-22	1.06E-22	3.29E-23	3.02E-23
Pb-209	4.34E-21	3.90E-21	3.60E-21	3.42E-21	3.04E-21	3.00E-21
Pb-210	1.95E-20	1.56E-20	1.32E-20	1.21E-20	9.77E-21	9.57E-21
Pb-211	1.46E-18	1.36E-18	1.28E-18	1.23E-18	1.13E-18	1.11E-18
Pb-212	2.96E-18	2.75E-18	2.56E-18	2.46E-18	2.21E-18	2.18E-18
Pb-214	5.45E-18	5.07E-18	4.76E-18	4.57E-18	4.13E-18	4.07E-18
Bismuth						
Bi-197	3.65E-17	3.38E-17	3.19E-17	3.08E-17	2.83E-17	2.80E-17
Bi-200	5.31E-17	4.91E-17	4.63E-17	4.46E-17	4.08E-17	4.02E-17
Bi-201	3.66E-17	3.39E-17	3.20E-17	3.10E-17	2.86E-17	2.83E-17
Bi-202	5.97E-17	5.53E-17	5.22E-17	5.03E-17	4.62E-17	4.56E-17
Bi-203	5.02E-17	4.67E-17	4.41E-17	4.26E-17	3.95E-17	3.91E-17
Bi-204	6.29E-17	5.82E-17	5.49E-17	5.30E-17	4.87E-17	4.82E-17
Bi-205	3.55E-17	3.30E-17	3.12E-17	3.02E-17	2.79E-17	2.76E-17
Bi-206	7.07E-17	6.55E-17	6.18E-17	5.96E-17	5.48E-17	5.42E-17
Bi-207	3.32E-17	3.07E-17	2.89E-17	2.79E-17	2.56E-17	2.53E-17
Bi-208	5.12E-17	4.84E-17	4.61E-17	4.48E-17	4.22E-17	4.18E-17
Bi-210	2.88E-20	2.73E-20	2.61E-20	2.54E-20	2.39E-20	2.37E-20
Bi-210m	5.65E-18	5.28E-18	4.95E-18	4.76E-18	4.29E-18	4.24E-18
Bi-211	1.03E-18	9.61E-19	9.03E-19	8.68E-19	7.83E-19	7.73E-19
Bi-212	2.32E-18	2.15E-18	2.03E-18	1.96E-18	1.81E-18	1.79E-18
Bi-212n	6.27E-20	5.98E-20	5.77E-20	5.64E-20	5.35E-20	5.32E-20
Bi-213	2.85E-18	2.65E-18	2.50E-18	2.40E-18	2.18E-18	2.15E-18
Bi-214	3.15E-17	2.93E-17	2.77E-17	2.68E-17	2.49E-17	2.46E-17
Bi-215	5.54E-18	5.15E-18	4.85E-18	4.67E-18	4.25E-18	4.20E-18
Bi-216	1.68E-17	1.56E-17	1.47E-17	1.41E-17	1.29E-17	1.27E-17
Polonium						
Po-203	3.49E-17	3.23E-17	3.05E-17	2.94E-17	2.71E-17	2.68E-17
Po-204	2.46E-17	2.27E-17	2.13E-17	2.05E-17	1.88E-17	1.85E-17
Po-205	3.39E-17	3.13E-17	2.96E-17	2.85E-17	2.63E-17	2.60E-17
Po-206	2.56E-17	2.36E-17	2.23E-17	2.14E-17	1.96E-17	1.94E-17
Po-207	2.76E-17	2.55E-17	2.40E-17	2.32E-17	2.13E-17	2.11E-17
Po-208	4.57E-22	4.23E-22	3.98E-22	3.82E-22	3.48E-22	3.43E-22
Po-209	1.32E-19	1.22E-19	1.15E-19	1.11E-19	1.01E-19	9.99E-20
Po-210	2.15E-22	1.98E-22	1.87E-22	1.80E-22	1.66E-22	1.64E-22
Po-211	1.81E-19	1.67E-19	1.57E-19	1.52E-19	1.39E-19	1.37E-19
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	1.57E-18	1.48E-18	1.41E-18	1.37E-18	1.28E-18	1.27E-18
Po-213	8.30E-22	7.65E-22	7.22E-22	6.96E-22	6.38E-22	6.31E-22
Po-214	1.84E-21	1.69E-21	1.60E-21	1.54E-21	1.41E-21	1.40E-21
Po-215	3.92E-21	3.64E-21	3.43E-21	3.30E-21	2.99E-21	2.95E-21
Po-216	3.38E-22	3.12E-22	2.95E-22	2.84E-22	2.61E-22	2.58E-22
Po-218	6.77E-26	5.65E-26	5.01E-26	4.67E-26	3.94E-26	3.86E-26
Astatine						
At-204	5.14E-17	4.75E-17	4.48E-17	4.31E-17	3.93E-17	3.88E-17

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
At-205	2.46E-17	2.28E-17	2.15E-17	2.07E-17	1.90E-17	1.87E-17
At-206	5.43E-17	5.03E-17	4.74E-17	4.57E-17	4.18E-17	4.12E-17
At-207	4.28E-17	3.98E-17	3.75E-17	3.62E-17	3.34E-17	3.30E-17
At-208	6.56E-17	6.08E-17	5.74E-17	5.53E-17	5.08E-17	5.02E-17
At-209	4.96E-17	4.59E-17	4.32E-17	4.16E-17	3.81E-17	3.76E-17
At-210	6.27E-17	5.83E-17	5.50E-17	5.32E-17	4.93E-17	4.87E-17
At-211	5.69E-19	5.09E-19	4.68E-19	4.43E-19	3.90E-19	3.84E-19
At-215	3.77E-21	3.51E-21	3.30E-21	3.17E-21	2.87E-21	2.83E-21
At-216	4.42E-20	4.03E-20	3.73E-20	3.55E-20	3.16E-20	3.11E-20
At-217	5.19E-21	4.83E-21	4.52E-21	4.35E-21	3.92E-21	3.87E-21
At-218	2.71E-22	2.60E-22	2.51E-22	2.46E-22	2.34E-22	2.33E-22
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	1.02E-17	9.49E-18	8.92E-18	8.58E-18	7.77E-18	7.67E-18
Radon						
Rn-207	2.15E-17	1.99E-17	1.87E-17	1.80E-17	1.64E-17	1.62E-17
Rn-209	2.55E-17	2.37E-17	2.24E-17	2.16E-17	1.98E-17	1.95E-17
Rn-210	1.31E-18	1.21E-18	1.14E-18	1.10E-18	1.00E-18	9.89E-19
Rn-211	4.04E-17	3.74E-17	3.53E-17	3.41E-17	3.13E-17	3.10E-17
Rn-212	7.52E-21	6.94E-21	6.56E-21	6.31E-21	5.77E-21	5.70E-21
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	1.68E-20	1.56E-20	1.47E-20	1.42E-20	1.29E-20	1.27E-20
Rn-219	1.28E-18	1.20E-18	1.12E-18	1.08E-18	9.74E-19	9.62E-19
Rn-220	1.40E-20	1.30E-20	1.22E-20	1.18E-20	1.07E-20	1.06E-20
Rn-222	8.66E-21	8.03E-21	7.58E-21	7.28E-21	6.62E-21	6.53E-21
Rn-223	7.41E-18	6.86E-18	6.46E-18	6.22E-18	5.68E-18	5.61E-18
Francium						
Fr-212	2.42E-17	2.25E-17	2.12E-17	2.05E-17	1.88E-17	1.86E-17
Fr-219	7.81E-20	7.27E-20	6.84E-20	6.57E-20	5.94E-20	5.86E-20
Fr-220	1.63E-19	1.48E-19	1.37E-19	1.30E-19	1.16E-19	1.14E-19
Fr-221	6.17E-19	5.79E-19	5.40E-19	5.19E-19	4.66E-19	4.60E-19
Fr-222	3.82E-18	3.57E-18	3.34E-18	3.22E-18	2.92E-18	2.88E-18
Fr-223	9.13E-19	8.22E-19	7.56E-19	7.19E-19	6.38E-19	6.29E-19
Fr-224	1.19E-17	1.11E-17	1.04E-17	1.01E-17	9.30E-18	9.19E-18
Fr-227	9.54E-18	8.83E-18	8.31E-18	7.98E-18	7.25E-18	7.15E-18
Radium						
Ra-219	3.65E-18	3.40E-18	3.19E-18	3.06E-18	2.76E-18	2.72E-18
Ra-220	1.04E-19	9.65E-20	9.10E-20	8.75E-20	7.94E-20	7.83E-20
Ra-221	7.01E-19	6.49E-19	6.05E-19	5.76E-19	5.18E-19	5.09E-19
Ra-222	2.02E-19	1.89E-19	1.77E-19	1.71E-19	1.54E-19	1.52E-19
Ra-223	2.77E-18	2.57E-18	2.40E-18	2.29E-18	2.06E-18	2.03E-18
Ra-224	2.23E-19	2.10E-19	1.96E-19	1.89E-19	1.69E-19	1.67E-19
Ra-225	8.88E-20	6.74E-20	5.59E-20	5.05E-20	4.00E-20	3.90E-20
Ra-226	1.53E-19	1.43E-19	1.34E-19	1.28E-19	1.15E-19	1.14E-19
Ra-227	3.06E-18	2.84E-18	2.67E-18	2.57E-18	2.32E-18	2.29E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-228	1.18E-21	8.11E-22	6.93E-22	6.43E-22	2.72E-22	2.49E-22
Ra-230	1.58E-18	1.46E-18	1.37E-18	1.31E-18	1.18E-18	1.16E-18
Actinium						
Ac-223	3.56E-19	3.31E-19	3.10E-19	2.97E-19	2.67E-19	2.63E-19
Ac-224	4.50E-18	4.19E-18	3.91E-18	3.74E-18	3.35E-18	3.30E-18
Ac-225	2.70E-19	2.49E-19	2.32E-19	2.22E-19	1.98E-19	1.95E-19
Ac-226	2.73E-18	2.56E-18	2.39E-18	2.29E-18	2.06E-18	2.03E-18
Ac-227	1.65E-21	1.43E-21	1.30E-21	1.23E-21	1.03E-21	1.01E-21
Ac-228	1.88E-17	1.74E-17	1.64E-17	1.58E-17	1.46E-17	1.44E-17
Ac-230	1.16E-17	1.08E-17	1.03E-17	9.93E-18	9.22E-18	9.12E-18
Ac-231	8.98E-18	8.40E-18	7.87E-18	7.56E-18	6.81E-18	6.72E-18
Ac-232	2.42E-17	2.26E-17	2.14E-17	2.08E-17	1.93E-17	1.91E-17
Ac-233	1.13E-17	1.04E-17	9.87E-18	9.48E-18	8.64E-18	8.52E-18
Thorium						
Th-223	1.30E-18	1.19E-18	1.11E-18	1.05E-18	9.40E-19	9.24E-19
Th-224	4.81E-19	4.50E-19	4.20E-19	4.03E-19	3.63E-19	3.58E-19
Th-226	1.53E-19	1.43E-19	1.33E-19	1.28E-19	1.14E-19	1.13E-19
Th-227	2.57E-18	2.40E-18	2.24E-18	2.15E-18	1.93E-18	1.91E-18
Th-228	3.87E-20	3.55E-20	3.29E-20	3.14E-20	2.78E-20	2.74E-20
Th-229	1.56E-18	1.43E-18	1.33E-18	1.27E-18	1.13E-18	1.11E-18
Th-230	6.82E-21	5.98E-21	5.45E-21	5.13E-21	4.40E-21	4.33E-21
Th-231	2.00E-19	1.78E-19	1.64E-19	1.55E-19	1.35E-19	1.33E-19
Th-232	3.43E-21	2.90E-21	2.61E-21	2.44E-21	2.01E-21	1.97E-21
Th-233	7.74E-19	7.16E-19	6.74E-19	6.48E-19	5.89E-19	5.81E-19
Th-234	1.43E-19	1.28E-19	1.18E-19	1.11E-19	9.76E-20	9.60E-20
Th-235	1.29E-18	1.19E-18	1.13E-18	1.09E-18	9.96E-19	9.84E-19
Th-236	7.34E-19	6.82E-19	6.42E-19	6.16E-19	5.59E-19	5.51E-19
Protactinium						
Pa-227	3.26E-19	2.95E-19	2.72E-19	2.58E-19	2.27E-19	2.23E-19
Pa-228	2.91E-17	2.70E-17	2.55E-17	2.45E-17	2.25E-17	2.23E-17
Pa-229	1.08E-18	9.87E-19	9.19E-19	8.75E-19	7.78E-19	7.64E-19
Pa-230	1.43E-17	1.32E-17	1.24E-17	1.20E-17	1.10E-17	1.08E-17
Pa-231	7.18E-19	6.67E-19	6.24E-19	6.00E-19	5.38E-19	5.31E-19
Pa-232	2.04E-17	1.89E-17	1.78E-17	1.72E-17	1.58E-17	1.56E-17
Pa-233	4.56E-18	4.26E-18	3.99E-18	3.83E-18	3.45E-18	3.40E-18
Pa-234	3.16E-17	2.93E-17	2.76E-17	2.66E-17	2.44E-17	2.41E-17
Pa-234m	5.03E-19	4.71E-19	4.48E-19	4.34E-19	4.05E-19	4.01E-19
Pa-235	4.81E-20	4.59E-20	4.41E-20	4.31E-20	4.08E-20	4.05E-20
Pa-236	1.95E-17	1.82E-17	1.72E-17	1.66E-17	1.54E-17	1.52E-17
Pa-237	1.35E-17	1.25E-17	1.18E-17	1.14E-17	1.04E-17	1.03E-17
Uranium						
U-227	2.35E-18	2.19E-18	2.05E-18	1.97E-18	1.76E-18	1.74E-18
U-228	7.56E-20	7.00E-20	6.52E-20	6.23E-20	5.56E-20	5.47E-20
U-230	2.13E-20	1.93E-20	1.78E-20	1.70E-20	1.49E-20	1.47E-20
U-231	1.23E-18	1.13E-18	1.05E-18	9.96E-19	8.85E-19	8.69E-19
U-232	4.80E-21	4.12E-21	3.73E-21	3.52E-21	2.91E-21	2.85E-21

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-233	4.95E-21	4.44E-21	4.09E-21	3.90E-21	3.38E-21	3.32E-21
U-234	2.67E-21	2.21E-21	1.98E-21	1.86E-21	1.45E-21	1.41E-21
U-235	3.39E-18	3.18E-18	2.96E-18	2.84E-18	2.56E-18	2.52E-18
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	1.61E-21	1.27E-21	1.12E-21	1.05E-21	7.50E-22	7.26E-22
U-237	2.49E-18	2.30E-18	2.14E-18	2.04E-18	1.82E-18	1.79E-18
U-238	1.35E-21	1.07E-21	9.52E-22	8.92E-22	6.53E-22	6.34E-22
U-239	8.50E-19	7.56E-19	6.95E-19	6.59E-19	5.82E-19	5.75E-19
U-240	8.40E-20	7.66E-20	7.10E-20	6.75E-20	5.97E-20	5.86E-20
U-242	8.56E-19	7.86E-19	7.36E-19	7.05E-19	6.37E-19	6.29E-19
Neptunium						
Np-232	2.58E-17	2.38E-17	2.25E-17	2.16E-17	1.98E-17	1.95E-17
Np-233	1.59E-18	1.47E-18	1.37E-18	1.31E-18	1.17E-18	1.15E-18
Np-234	2.31E-17	2.15E-17	2.03E-17	1.96E-17	1.82E-17	1.80E-17
Np-235	1.27E-20	1.10E-20	1.01E-20	9.53E-21	7.85E-21	7.67E-21
Np-236	2.65E-18	2.46E-18	2.29E-18	2.19E-18	1.96E-18	1.93E-18
Np-236m	8.79E-19	8.12E-19	7.59E-19	7.25E-19	6.50E-19	6.39E-19
Np-237	3.92E-19	3.54E-19	3.27E-19	3.10E-19	2.73E-19	2.69E-19
Np-238	1.27E-17	1.17E-17	1.11E-17	1.07E-17	9.87E-18	9.76E-18
Np-239	3.53E-18	3.30E-18	3.08E-18	2.96E-18	2.65E-18	2.61E-18
Np-240	2.27E-17	2.10E-17	1.98E-17	1.91E-17	1.75E-17	1.73E-17
Np-240m	7.07E-18	6.56E-18	6.19E-18	5.96E-18	5.47E-18	5.40E-18
Np-241	7.55E-19	7.02E-19	6.58E-19	6.29E-19	5.67E-19	5.58E-19
Np-242	5.84E-18	5.43E-18	5.14E-18	4.97E-18	4.61E-18	4.57E-18
Np-242m	1.99E-17	1.83E-17	1.73E-17	1.67E-17	1.53E-17	1.51E-17
Plutonium						
Pu-232	1.08E-18	1.00E-18	9.33E-19	8.90E-19	7.96E-19	7.81E-19
Pu-234	1.17E-18	1.08E-18	1.01E-18	9.62E-19	8.60E-19	8.44E-19
Pu-235	1.62E-18	1.50E-18	1.40E-18	1.34E-18	1.20E-18	1.18E-18
Pu-236	1.79E-21	1.34E-21	1.17E-21	1.09E-21	7.18E-22	6.88E-22
Pu-237	8.33E-19	7.68E-19	7.16E-19	6.82E-19	6.09E-19	5.97E-19
Pu-238	1.37E-21	9.87E-22	8.49E-22	7.86E-22	4.73E-22	4.48E-22
Pu-239	1.71E-21	1.45E-21	1.32E-21	1.25E-21	1.03E-21	1.00E-21
Pu-240	1.34E-21	9.76E-22	8.41E-22	7.78E-22	4.78E-22	4.54E-22
Pu-241	2.89E-23	2.67E-23	2.49E-23	2.37E-23	2.12E-23	2.08E-23
Pu-242	2.69E-21	2.27E-21	2.08E-21	1.99E-21	1.64E-21	1.61E-21
Pu-243	4.08E-19	3.69E-19	3.40E-19	3.23E-19	2.85E-19	2.81E-19
Pu-244	4.14E-19	3.87E-19	3.66E-19	3.55E-19	3.29E-19	3.26E-19
Pu-245	8.75E-18	8.11E-18	7.64E-18	7.35E-18	6.70E-18	6.62E-18
Pu-246	2.62E-18	2.43E-18	2.26E-18	2.17E-18	1.94E-18	1.91E-18
Americium						
Am-237	7.62E-18	7.10E-18	6.66E-18	6.40E-18	5.78E-18	5.70E-18
Am-238	1.92E-17	1.78E-17	1.68E-17	1.62E-17	1.49E-17	1.47E-17
Am-239	4.49E-18	4.19E-18	3.91E-18	3.75E-18	3.36E-18	3.31E-18
Am-240	2.21E-17	2.04E-17	1.93E-17	1.86E-17	1.71E-17	1.69E-17
Am-241	2.83E-19	2.38E-19	2.10E-19	1.95E-19	1.65E-19	1.62E-19

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-242	2.52E-19	2.33E-19	2.17E-19	2.07E-19	1.84E-19	1.81E-19
Am-242m	8.47E-21	6.79E-21	6.04E-21	5.66E-21	4.36E-21	4.23E-21
Am-243	8.35E-19	7.30E-19	6.63E-19	6.23E-19	5.40E-19	5.32E-19
Am-244	1.73E-17	1.60E-17	1.51E-17	1.45E-17	1.33E-17	1.31E-17
Am-244m	3.70E-19	3.43E-19	3.25E-19	3.14E-19	2.90E-19	2.87E-19
Am-245	6.41E-19	6.00E-19	5.61E-19	5.38E-19	4.83E-19	4.76E-19
Am-246	1.59E-17	1.47E-17	1.39E-17	1.33E-17	1.22E-17	1.20E-17
Am-246m	2.13E-17	1.97E-17	1.86E-17	1.79E-17	1.65E-17	1.64E-17
Am-247	2.74E-18	2.56E-18	2.40E-18	2.30E-18	2.07E-18	2.04E-18
Curium						
Cm-238	1.44E-18	1.33E-18	1.25E-18	1.19E-18	1.07E-18	1.05E-18
Cm-239	5.10E-18	4.77E-18	4.45E-18	4.26E-18	3.83E-18	3.78E-18
Cm-240	1.84E-21	1.32E-21	1.14E-21	1.05E-21	6.65E-22	6.31E-22
Cm-241	1.05E-17	9.76E-18	9.19E-18	8.82E-18	7.99E-18	7.87E-18
Cm-242	1.57E-21	1.11E-21	9.50E-22	8.76E-22	5.37E-22	5.08E-22
Cm-243	2.58E-18	2.41E-18	2.25E-18	2.16E-18	1.94E-18	1.91E-18
Cm-244	1.63E-21	1.22E-21	1.07E-21	9.97E-22	6.90E-22	6.63E-22
Cm-245	1.90E-18	1.76E-18	1.65E-18	1.57E-18	1.41E-18	1.38E-18
Cm-246	7.64E-20	7.12E-20	6.73E-20	6.51E-20	6.03E-20	5.97E-20
Cm-247	6.95E-18	6.47E-18	6.09E-18	5.86E-18	5.30E-18	5.23E-18
Cm-248	2.74E-17	2.56E-17	2.43E-17	2.35E-17	2.18E-17	2.16E-17
Cm-249	4.35E-19	4.02E-19	3.80E-19	3.65E-19	3.33E-19	3.28E-19
Cm-250	2.78E-16	2.60E-16	2.47E-16	2.39E-16	2.22E-16	2.19E-16
Cm-251	2.46E-18	2.28E-18	2.15E-18	2.07E-18	1.89E-18	1.86E-18
Berkelium						
Bk-245	4.48E-18	4.18E-18	3.91E-18	3.75E-18	3.37E-18	3.31E-18
Bk-246	1.83E-17	1.69E-17	1.59E-17	1.53E-17	1.41E-17	1.39E-17
Bk-247	2.88E-18	2.68E-18	2.50E-18	2.39E-18	2.14E-18	2.11E-18
Bk-248m	1.07E-18	9.91E-19	9.32E-19	8.93E-19	8.08E-19	7.95E-19
Bk-249	4.44E-23	3.63E-23	3.20E-23	2.98E-23	2.47E-23	2.42E-23
Bk-250	1.95E-17	1.80E-17	1.70E-17	1.64E-17	1.52E-17	1.50E-17
Bk-251	1.63E-18	1.52E-18	1.42E-18	1.36E-18	1.22E-18	1.20E-18
Californium						
Cf-244	1.70E-21	1.14E-21	9.57E-22	8.73E-22	5.03E-22	4.70E-22
Cf-246	2.02E-21	1.58E-21	1.40E-21	1.31E-21	9.96E-22	9.64E-22
Cf-247	1.71E-18	1.58E-18	1.48E-18	1.41E-18	1.27E-18	1.25E-18
Cf-248	8.47E-21	7.54E-21	7.03E-21	6.75E-21	6.00E-21	5.91E-21
Cf-249	7.16E-18	6.67E-18	6.27E-18	6.03E-18	5.45E-18	5.38E-18
Cf-250	2.06E-19	1.93E-19	1.82E-19	1.76E-19	1.64E-19	1.62E-19
Cf-251	2.32E-18	2.17E-18	2.03E-18	1.94E-18	1.74E-18	1.71E-18
Cf-252	9.52E-18	8.90E-18	8.43E-18	8.16E-18	7.58E-18	7.49E-18
Cf-253	7.37E-21	5.29E-21	4.44E-21	4.05E-21	2.83E-21	2.72E-21
Cf-254	3.52E-16	3.29E-16	3.12E-16	3.02E-16	2.80E-16	2.77E-16
Cf-255	5.84E-21	5.31E-21	4.93E-21	4.71E-21	4.24E-21	4.19E-21
Einsteinium						
Es-249	8.63E-18	8.01E-18	7.54E-18	7.24E-18	6.58E-18	6.49E-18

Table 4-3. Reference person effective dose rate coefficients for soil to 5 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Es-250	2.54E-17	2.35E-17	2.21E-17	2.13E-17	1.94E-17	1.92E-17
Es-250m	1.16E-17	1.08E-17	1.01E-17	9.77E-18	8.99E-18	8.89E-18
Es-251	1.71E-18	1.59E-18	1.48E-18	1.42E-18	1.27E-18	1.25E-18
Es-253	7.28E-21	6.64E-21	6.20E-21	5.93E-21	5.28E-21	5.20E-21
Es-254	6.58E-20	5.59E-20	5.05E-20	4.76E-20	3.99E-20	3.91E-20
Es-254m	1.04E-17	9.62E-18	9.08E-18	8.74E-18	7.99E-18	7.89E-18
Es-255	1.46E-20	1.36E-20	1.29E-20	1.25E-20	1.16E-20	1.14E-20
Es-256	7.78E-20	7.33E-20	7.03E-20	6.86E-20	6.46E-20	6.41E-20
Fermium						
Fm-251	3.06E-18	2.84E-18	2.66E-18	2.55E-18	2.31E-18	2.28E-18
Fm-252	7.21E-21	6.31E-21	5.84E-21	5.59E-21	4.91E-21	4.83E-21
Fm-253	1.11E-18	1.03E-18	9.64E-19	9.20E-19	8.26E-19	8.12E-19
Fm-254	1.48E-19	1.38E-19	1.31E-19	1.26E-19	1.17E-19	1.16E-19
Fm-255	4.04E-20	3.31E-20	2.95E-20	2.76E-20	2.23E-20	2.18E-20
Fm-256	2.59E-16	2.43E-16	2.30E-16	2.22E-16	2.06E-16	2.04E-16
Fm-257	2.82E-18	2.63E-18	2.47E-18	2.37E-18	2.14E-18	2.11E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm.

Explanation of entries

For each radionuclide, values for the age-dependent effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. Reference person organ equivalent dose coefficients h_T are provided electronically.[14]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^3), that is, the effective dose per unit time-integrated exposure to a radionuclide

w_T: The tissue weighting factor

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^3) for tissue *T*.

The dose rate coefficients provided in Table 4-4 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

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

To convert from SI units (Sv Bq^{-1} s^{-1} m^3) to conventional units (mrem μCi^{-1} y^{-1} cm^3), multiply table entries by 1.168×10^{23}.

To convert from SI units from a source per unit volume (Sv Bq^{-1} s^{-1} m^3) to conventional units for a source per unit mass basis (mrem μCi^{-1} y^{-1} g), multiply table entries by 1.868×10^{23}.

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

[14] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	1.80E-27	1.18E-27	9.56E-28	8.44E-28	2.72E-28	2.49E-28
Beryllium						
Be-7	1.70E-18	1.58E-18	1.48E-18	1.42E-18	1.29E-18	1.27E-18
Be-10	7.28E-21	6.57E-21	6.04E-21	5.73E-21	5.08E-21	5.00E-21
Carbon						
C-10	6.03E-17	5.58E-17	5.25E-17	5.03E-17	4.59E-17	4.53E-17
C-11	3.49E-17	3.24E-17	3.05E-17	2.92E-17	2.66E-17	2.62E-17
C-14	1.00E-22	7.99E-23	6.90E-23	6.35E-23	5.16E-23	5.04E-23
Nitrogen						
N-13	3.49E-17	3.24E-17	3.05E-17	2.92E-17	2.66E-17	2.62E-17
N-16	1.30E-16	1.27E-16	1.22E-16	1.20E-16	1.14E-16	1.14E-16
Oxygen						
O-14	1.12E-16	1.05E-16	9.93E-17	9.61E-17	8.92E-17	8.82E-17
O-15	3.51E-17	3.26E-17	3.06E-17	2.93E-17	2.67E-17	2.63E-17
O-19	3.27E-17	3.03E-17	2.85E-17	2.76E-17	2.54E-17	2.51E-17
Fluorine						
F-17	3.51E-17	3.26E-17	3.06E-17	2.93E-17	2.67E-17	2.63E-17
F-18	3.38E-17	3.14E-17	2.95E-17	2.83E-17	2.57E-17	2.54E-17
Neon						
Ne-19	3.52E-17	3.27E-17	3.07E-17	2.94E-17	2.68E-17	2.64E-17
Ne-24	1.87E-17	1.73E-17	1.63E-17	1.56E-17	1.42E-17	1.40E-17
Sodium						
Na-22	7.59E-17	7.02E-17	6.60E-17	6.36E-17	5.84E-17	5.77E-17
Na-24	1.38E-16	1.29E-16	1.23E-16	1.19E-16	1.12E-16	1.10E-16
Magnesium						
Mg-27	3.14E-17	2.88E-17	2.70E-17	2.61E-17	2.39E-17	2.37E-17
Mg-28	4.70E-17	4.34E-17	4.07E-17	3.94E-17	3.63E-17	3.59E-17
Aluminum						
Al-26	9.15E-17	8.53E-17	8.06E-17	7.79E-17	7.20E-17	7.12E-17
Al-28	6.12E-17	5.72E-17	5.41E-17	5.26E-17	4.89E-17	4.84E-17
Al-29	4.81E-17	4.45E-17	4.19E-17	4.06E-17	3.76E-17	3.72E-17
Silicon						
Si-31	1.18E-19	1.12E-19	1.06E-19	1.04E-19	9.71E-20	9.63E-20
Si-32	3.00E-22	2.50E-22	2.21E-22	2.05E-22	1.73E-22	1.69E-22
Phosphorus						
P-30	3.55E-17	3.30E-17	3.10E-17	2.97E-17	2.70E-17	2.67E-17
P-32	1.24E-19	1.18E-19	1.13E-19	1.10E-19	1.04E-19	1.04E-19
P-33	4.11E-22	3.46E-22	3.07E-22	2.86E-22	2.43E-22	2.38E-22
Sulfur						
S-35	1.09E-22	8.75E-23	7.59E-23	7.00E-23	5.72E-23	5.60E-23
S-37	9.45E-17	9.00E-17	8.58E-17	8.37E-17	7.88E-17	7.80E-17
S-38	5.76E-17	5.40E-17	5.11E-17	4.97E-17	4.63E-17	4.58E-17
Chlorine						
Cl-34	3.60E-17	3.34E-17	3.14E-17	3.01E-17	2.74E-17	2.71E-17
Cl-34m	7.07E-17	6.63E-17	6.27E-17	6.07E-17	5.63E-17	5.57E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	1.61E-20	1.49E-20	1.39E-20	1.33E-20	1.21E-20	1.19E-20
Cl-38	4.97E-17	4.66E-17	4.41E-17	4.29E-17	4.00E-17	3.95E-17
Cl-39	5.03E-17	4.66E-17	4.38E-17	4.25E-17	3.92E-17	3.88E-17
Cl-40	1.35E-16	1.27E-16	1.21E-16	1.18E-16	1.10E-16	1.09E-16
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	5.80E-21	5.23E-21	4.80E-21	4.55E-21	4.03E-21	3.97E-21
Ar-41	4.48E-17	4.14E-17	3.89E-17	3.77E-17	3.48E-17	3.45E-17
Ar-42	6.87E-21	6.22E-21	5.73E-21	5.44E-21	4.85E-21	4.77E-21
Ar-43	5.32E-17	4.95E-17	4.66E-17	4.52E-17	4.19E-17	4.14E-17
Ar-44	6.60E-17	6.16E-17	5.81E-17	5.64E-17	5.23E-17	5.17E-17
Potassium						
K-38	1.08E-16	1.01E-16	9.57E-17	9.27E-17	8.59E-17	8.49E-17
K-40	5.50E-18	5.11E-18	4.81E-18	4.67E-18	4.32E-18	4.28E-18
K-42	1.02E-17	9.48E-18	8.95E-18	8.68E-18	8.06E-18	7.97E-18
K-43	3.29E-17	3.05E-17	2.87E-17	2.75E-17	2.50E-17	2.47E-17
K-44	8.14E-17	7.61E-17	7.19E-17	6.98E-17	6.49E-17	6.43E-17
K-45	6.23E-17	5.83E-17	5.50E-17	5.34E-17	4.96E-17	4.90E-17
K-46	9.69E-17	9.10E-17	8.62E-17	8.39E-17	7.83E-17	7.75E-17
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	4.36E-22	3.68E-22	3.27E-22	3.05E-22	2.59E-22	2.54E-22
Ca-47	3.67E-17	3.39E-17	3.19E-17	3.09E-17	2.85E-17	2.82E-17
Ca-49	1.02E-16	9.70E-17	9.25E-17	9.03E-17	8.50E-17	8.42E-17
Scandium						
Sc-42m	1.45E-16	1.35E-16	1.27E-16	1.23E-16	1.13E-16	1.11E-16
Sc-43	3.36E-17	3.12E-17	2.94E-17	2.81E-17	2.56E-17	2.53E-17
Sc-44	7.41E-17	6.85E-17	6.43E-17	6.20E-17	5.68E-17	5.61E-17
Sc-44m	8.97E-18	8.36E-18	7.86E-18	7.53E-18	6.81E-18	6.72E-18
Sc-46	7.04E-17	6.47E-17	6.07E-17	5.87E-17	5.39E-17	5.34E-17
Sc-47	3.16E-18	2.98E-18	2.76E-18	2.64E-18	2.39E-18	2.35E-18
Sc-48	1.17E-16	1.08E-16	1.01E-16	9.81E-17	9.03E-17	8.93E-17
Sc-49	2.12E-19	2.02E-19	1.93E-19	1.88E-19	1.78E-19	1.76E-19
Sc-50	1.12E-16	1.03E-16	9.73E-17	9.42E-17	8.69E-17	8.60E-17
Titanium						
Ti-44	2.41E-18	2.11E-18	1.91E-18	1.79E-18	1.55E-18	1.53E-18
Ti-45	2.98E-17	2.77E-17	2.60E-17	2.49E-17	2.27E-17	2.24E-17
Ti-51	1.25E-17	1.16E-17	1.10E-17	1.05E-17	9.51E-18	9.39E-18
Ti-52	3.43E-18	3.21E-18	2.99E-18	2.85E-18	2.57E-18	2.53E-18
Vanadium						
V-47	3.42E-17	3.18E-17	2.99E-17	2.86E-17	2.60E-17	2.57E-17
V-48	1.01E-16	9.36E-17	8.79E-17	8.49E-17	7.81E-17	7.73E-17
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	4.92E-17	4.57E-17	4.31E-17	4.18E-17	3.87E-17	3.83E-17
V-52	5.04E-17	4.68E-17	4.40E-17	4.27E-17	3.95E-17	3.91E-17
V-53	3.67E-17	3.37E-17	3.16E-17	3.06E-17	2.81E-17	2.78E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Chromium						
Cr-48	1.34E-17	1.25E-17	1.18E-17	1.13E-17	1.01E-17	1.00E-17
Cr-49	3.51E-17	3.25E-17	3.06E-17	2.93E-17	2.66E-17	2.62E-17
Cr-51	1.05E-18	9.76E-19	9.19E-19	8.78E-19	7.93E-19	7.83E-19
Cr-55	3.45E-19	3.28E-19	3.15E-19	3.07E-19	2.90E-19	2.87E-19
Cr-56	1.68E-18	1.50E-18	1.38E-18	1.30E-18	1.14E-18	1.13E-18
Manganese						
Mn-50m	1.61E-16	1.49E-16	1.40E-16	1.35E-16	1.25E-16	1.23E-16
Mn-51	3.44E-17	3.19E-17	3.00E-17	2.87E-17	2.62E-17	2.58E-17
Mn-52	1.20E-16	1.11E-16	1.04E-16	1.01E-16	9.28E-17	9.18E-17
Mn-52m	8.34E-17	7.74E-17	7.28E-17	7.03E-17	6.46E-17	6.39E-17
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	2.92E-17	2.69E-17	2.52E-17	2.43E-17	2.23E-17	2.20E-17
Mn-56	5.85E-17	5.43E-17	5.12E-17	4.96E-17	4.58E-17	4.53E-17
Mn-57	3.49E-18	3.24E-18	3.04E-18	2.93E-18	2.69E-18	2.66E-18
Mn-58m	8.35E-17	7.72E-17	7.26E-17	7.03E-17	6.48E-17	6.41E-17
Iron						
Fe-52	2.45E-17	2.28E-17	2.14E-17	2.05E-17	1.86E-17	1.84E-17
Fe-53	4.05E-17	3.76E-17	3.54E-17	3.39E-17	3.09E-17	3.05E-17
Fe-53m	1.06E-16	9.81E-17	9.22E-17	8.92E-17	8.22E-17	8.13E-17
Fe-55	4.28E-27	4.01E-27	3.72E-27	3.55E-27	3.20E-27	3.14E-27
Fe-59	4.15E-17	3.82E-17	3.59E-17	3.48E-17	3.20E-17	3.17E-17
Fe-60	2.10E-22	1.72E-22	1.50E-22	1.39E-22	1.15E-22	1.12E-22
Fe-61	4.85E-17	4.48E-17	4.21E-17	4.08E-17	3.76E-17	3.72E-17
Fe-62	1.75E-17	1.62E-17	1.53E-17	1.46E-17	1.33E-17	1.31E-17
Cobalt						
Co-54m	1.37E-16	1.27E-16	1.19E-16	1.15E-16	1.06E-16	1.04E-16
Co-55	6.91E-17	6.39E-17	6.00E-17	5.78E-17	5.29E-17	5.23E-17
Co-56	1.24E-16	1.16E-16	1.09E-16	1.06E-16	9.79E-17	9.68E-17
Co-57	3.17E-18	2.97E-18	2.76E-18	2.63E-18	2.37E-18	2.33E-18
Co-58	3.40E-17	3.13E-17	2.93E-17	2.82E-17	2.58E-17	2.55E-17
Co-58m	2.33E-23	1.55E-23	1.26E-23	1.13E-23	7.87E-24	7.47E-24
Co-60	8.74E-17	8.06E-17	7.57E-17	7.34E-17	6.78E-17	6.71E-17
Co-60m	1.31E-19	1.19E-19	1.11E-19	1.08E-19	9.85E-20	9.74E-20
Co-61	2.34E-18	2.10E-18	1.93E-18	1.84E-18	1.65E-18	1.64E-18
Co-62	5.60E-17	5.19E-17	4.89E-17	4.75E-17	4.40E-17	4.35E-17
Co-62m	9.37E-17	8.67E-17	8.16E-17	7.91E-17	7.31E-17	7.24E-17
Nickel						
Ni-56	5.87E-17	5.42E-17	5.08E-17	4.90E-17	4.48E-17	4.43E-17
Ni-57	6.67E-17	6.19E-17	5.83E-17	5.64E-17	5.20E-17	5.14E-17
Ni-59	5.31E-22	4.93E-22	4.64E-22	4.44E-22	4.04E-22	3.99E-22
Ni-63	2.61E-24	1.82E-24	1.50E-24	1.35E-24	9.17E-25	8.76E-25
Ni-65	1.95E-17	1.81E-17	1.70E-17	1.65E-17	1.52E-17	1.51E-17
Ni-66	3.90E-22	3.28E-22	2.92E-22	2.72E-22	2.30E-22	2.26E-22
Copper						
Cu-57	4.20E-17	3.90E-17	3.67E-17	3.52E-17	3.22E-17	3.18E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cu-59	5.02E-17	4.66E-17	4.38E-17	4.21E-17	3.84E-17	3.79E-17
Cu-60	1.34E-16	1.25E-16	1.18E-16	1.14E-16	1.05E-16	1.04E-16
Cu-61	2.81E-17	2.61E-17	2.45E-17	2.35E-17	2.14E-17	2.12E-17
Cu-62	3.49E-17	3.24E-17	3.05E-17	2.92E-17	2.66E-17	2.62E-17
Cu-64	6.31E-18	5.86E-18	5.51E-18	5.28E-18	4.80E-18	4.74E-18
Cu-66	3.74E-18	3.44E-18	3.23E-18	3.13E-18	2.89E-18	2.86E-18
Cu-67	3.31E-18	3.09E-18	2.88E-18	2.75E-18	2.48E-18	2.44E-18
Cu-69	1.87E-17	1.72E-17	1.61E-17	1.56E-17	1.43E-17	1.42E-17
Zinc						
Zn-60	5.24E-17	4.86E-17	4.57E-17	4.38E-17	3.99E-17	3.94E-17
Zn-61	5.32E-17	4.95E-17	4.66E-17	4.49E-17	4.11E-17	4.06E-17
Zn-62	1.48E-17	1.37E-17	1.29E-17	1.23E-17	1.12E-17	1.11E-17
Zn-63	3.78E-17	3.51E-17	3.30E-17	3.16E-17	2.88E-17	2.85E-17
Zn-65	2.03E-17	1.86E-17	1.75E-17	1.69E-17	1.56E-17	1.54E-17
Zn-69	1.92E-20	1.79E-20	1.69E-20	1.63E-20	1.50E-20	1.49E-20
Zn-69m	1.41E-17	1.31E-17	1.23E-17	1.18E-17	1.07E-17	1.06E-17
Zn-71	1.11E-17	1.03E-17	9.69E-18	9.32E-18	8.52E-18	8.42E-18
Zn-71m	5.34E-17	4.96E-17	4.66E-17	4.47E-17	4.07E-17	4.02E-17
Zn-72	4.10E-18	3.85E-18	3.57E-18	3.41E-18	3.08E-18	3.03E-18
Gallium						
Ga-64	1.15E-16	1.07E-16	1.01E-16	9.79E-17	9.05E-17	8.95E-17
Ga-65	3.92E-17	3.64E-17	3.42E-17	3.28E-17	2.98E-17	2.95E-17
Ga-66	8.32E-17	7.81E-17	7.40E-17	7.18E-17	6.67E-17	6.60E-17
Ga-67	4.55E-18	4.24E-18	3.97E-18	3.79E-18	3.41E-18	3.36E-18
Ga-68	3.26E-17	3.03E-17	2.85E-17	2.73E-17	2.48E-17	2.45E-17
Ga-70	3.60E-19	3.35E-19	3.16E-19	3.06E-19	2.84E-19	2.81E-19
Ga-72	9.27E-17	8.63E-17	8.14E-17	7.88E-17	7.30E-17	7.22E-17
Ga-73	1.14E-17	1.06E-17	9.98E-18	9.56E-18	8.64E-18	8.53E-18
Ga-74	1.07E-16	1.00E-16	9.47E-17	9.18E-17	8.52E-17	8.42E-17
Germanium						
Ge-66	2.22E-17	2.06E-17	1.94E-17	1.86E-17	1.69E-17	1.66E-17
Ge-67	4.85E-17	4.51E-17	4.24E-17	4.07E-17	3.72E-17	3.67E-17
Ge-68	4.26E-23	2.63E-23	2.03E-23	1.71E-23	5.27E-24	4.85E-24
Ge-69	3.29E-17	3.04E-17	2.85E-17	2.75E-17	2.52E-17	2.49E-17
Ge-71	4.32E-23	2.67E-23	2.06E-23	1.73E-23	5.35E-24	4.92E-24
Ge-75	1.18E-18	1.10E-18	1.03E-18	9.89E-19	8.92E-19	8.80E-19
Ge-77	3.65E-17	3.39E-17	3.19E-17	3.07E-17	2.80E-17	2.76E-17
Ge-78	9.03E-18	8.43E-18	7.93E-18	7.59E-18	6.83E-18	6.75E-18
Arsenic						
As-68	1.29E-16	1.19E-16	1.12E-16	1.09E-16	9.99E-17	9.87E-17
As-69	3.93E-17	3.66E-17	3.44E-17	3.30E-17	3.01E-17	2.97E-17
As-70	1.47E-16	1.36E-16	1.28E-16	1.24E-16	1.14E-16	1.13E-16
As-71	1.90E-17	1.77E-17	1.66E-17	1.59E-17	1.45E-17	1.43E-17
As-72	6.18E-17	5.72E-17	5.37E-17	5.17E-17	4.73E-17	4.67E-17
As-73	6.72E-20	5.57E-20	4.84E-20	4.47E-20	3.73E-20	3.68E-20
As-74	2.61E-17	2.42E-17	2.27E-17	2.18E-17	1.98E-17	1.96E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-76	1.47E-17	1.36E-17	1.28E-17	1.23E-17	1.13E-17	1.12E-17
As-77	2.76E-19	2.57E-19	2.42E-19	2.31E-19	2.09E-19	2.06E-19
As-78	4.56E-17	4.23E-17	3.98E-17	3.84E-17	3.54E-17	3.50E-17
As-79	1.37E-18	1.27E-18	1.20E-18	1.15E-18	1.06E-18	1.05E-18
Selenium						
Se-70	2.37E-17	2.20E-17	2.07E-17	1.98E-17	1.80E-17	1.77E-17
Se-71	5.53E-17	5.13E-17	4.82E-17	4.63E-17	4.23E-17	4.18E-17
Se-72	2.54E-19	2.02E-19	1.72E-19	1.57E-19	1.28E-19	1.26E-19
Se-73	3.61E-17	3.35E-17	3.15E-17	3.02E-17	2.74E-17	2.70E-17
Se-73m	8.91E-18	8.27E-18	7.77E-18	7.45E-18	6.78E-18	6.69E-18
Se-75	1.19E-17	1.11E-17	1.04E-17	9.94E-18	8.96E-18	8.84E-18
Se-77m	2.52E-18	2.37E-18	2.20E-18	2.10E-18	1.90E-18	1.87E-18
Se-79	1.16E-22	9.20E-23	7.95E-23	7.32E-23	5.95E-23	5.82E-23
Se-79m	2.05E-19	1.88E-19	1.75E-19	1.66E-19	1.47E-19	1.44E-19
Se-81	3.66E-19	3.42E-19	3.23E-19	3.11E-19	2.86E-19	2.83E-19
Se-81m	3.27E-19	3.03E-19	2.82E-19	2.68E-19	2.40E-19	2.35E-19
Se-83	9.00E-17	8.36E-17	7.87E-17	7.60E-17	6.99E-17	6.91E-17
Se-83m	3.45E-17	3.19E-17	3.00E-17	2.91E-17	2.68E-17	2.65E-17
Se-84	1.42E-17	1.32E-17	1.25E-17	1.19E-17	1.08E-17	1.07E-17
Bromine						
Br-72	1.04E-16	9.63E-17	9.06E-17	8.73E-17	8.02E-17	7.93E-17
Br-73	4.91E-17	4.55E-17	4.27E-17	4.10E-17	3.73E-17	3.69E-17
Br-74	1.52E-16	1.43E-16	1.36E-16	1.32E-16	1.23E-16	1.21E-16
Br-74m	1.40E-16	1.31E-16	1.24E-16	1.20E-16	1.11E-16	1.09E-16
Br-75	4.05E-17	3.77E-17	3.54E-17	3.39E-17	3.08E-17	3.04E-17
Br-76	9.47E-17	8.85E-17	8.35E-17	8.08E-17	7.46E-17	7.38E-17
Br-76m	5.15E-19	4.44E-19	3.98E-19	3.74E-19	3.25E-19	3.21E-19
Br-77	1.06E-17	9.83E-18	9.24E-18	8.86E-18	8.04E-18	7.94E-18
Br-77m	3.54E-19	3.28E-19	3.06E-19	2.91E-19	2.60E-19	2.55E-19
Br-78	3.57E-17	3.31E-17	3.11E-17	2.98E-17	2.72E-17	2.68E-17
Br-80	2.76E-18	2.56E-18	2.41E-18	2.32E-18	2.12E-18	2.09E-18
Br-80m	9.32E-20	6.85E-20	5.61E-20	5.04E-20	3.91E-20	3.79E-20
Br-82	9.18E-17	8.47E-17	7.95E-17	7.67E-17	7.03E-17	6.95E-17
Br-82m	1.08E-19	9.93E-20	9.32E-20	8.99E-20	8.24E-20	8.15E-20
Br-83	2.56E-19	2.38E-19	2.23E-19	2.14E-19	1.95E-19	1.93E-19
Br-84	5.94E-17	5.57E-17	5.27E-17	5.12E-17	4.77E-17	4.72E-17
Br-84m	9.61E-17	8.89E-17	8.36E-17	8.08E-17	7.44E-17	7.36E-17
Br-85	2.59E-18	2.40E-18	2.26E-18	2.19E-18	2.02E-18	1.99E-18
Krypton						
Kr-74	3.51E-17	3.26E-17	3.07E-17	2.94E-17	2.67E-17	2.63E-17
Kr-75	4.35E-17	4.04E-17	3.79E-17	3.64E-17	3.31E-17	3.27E-17
Kr-76	1.37E-17	1.27E-17	1.19E-17	1.14E-17	1.03E-17	1.02E-17
Kr-77	3.45E-17	3.21E-17	3.01E-17	2.88E-17	2.62E-17	2.58E-17
Kr-79	8.40E-18	7.80E-18	7.33E-18	7.03E-18	6.39E-18	6.31E-18
Kr-81	2.77E-20	2.56E-20	2.40E-20	2.29E-20	2.03E-20	2.00E-20
Kr-81m	3.92E-18	3.67E-18	3.44E-18	3.29E-18	2.96E-18	2.92E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-83m	5.16E-22	3.53E-22	2.91E-22	2.62E-22	1.01E-22	9.32E-23
Kr-85	8.57E-20	7.94E-20	7.46E-20	7.14E-20	6.49E-20	6.41E-20
Kr-85m	4.66E-18	4.38E-18	4.07E-18	3.89E-18	3.52E-18	3.46E-18
Kr-87	2.71E-17	2.54E-17	2.40E-17	2.32E-17	2.15E-17	2.13E-17
Kr-88	6.57E-17	6.16E-17	5.83E-17	5.67E-17	5.28E-17	5.22E-17
Kr-89	6.56E-17	6.13E-17	5.80E-17	5.62E-17	5.21E-17	5.16E-17
Rubidium						
Rb-77	5.28E-17	4.89E-17	4.60E-17	4.41E-17	4.03E-17	3.98E-17
Rb-78	1.35E-16	1.27E-16	1.21E-16	1.17E-16	1.09E-16	1.08E-16
Rb-78m	1.10E-16	1.03E-16	9.68E-17	9.34E-17	8.58E-17	8.48E-17
Rb-79	4.91E-17	4.56E-17	4.28E-17	4.11E-17	3.74E-17	3.69E-17
Rb-80	4.18E-17	3.88E-17	3.65E-17	3.50E-17	3.19E-17	3.15E-17
Rb-81	1.72E-17	1.60E-17	1.50E-17	1.44E-17	1.31E-17	1.29E-17
Rb-81m	7.62E-19	7.03E-19	6.59E-19	6.33E-19	5.75E-19	5.68E-19
Rb-82	3.85E-17	3.57E-17	3.36E-17	3.22E-17	2.94E-17	2.90E-17
Rb-82m	1.01E-16	9.35E-17	8.78E-17	8.47E-17	7.76E-17	7.67E-17
Rb-83	1.66E-17	1.54E-17	1.45E-17	1.39E-17	1.26E-17	1.25E-17
Rb-84	3.14E-17	2.90E-17	2.72E-17	2.62E-17	2.39E-17	2.37E-17
Rb-84m	1.24E-17	1.16E-17	1.09E-17	1.04E-17	9.43E-18	9.31E-18
Rb-86	3.39E-18	3.12E-18	2.93E-18	2.83E-18	2.61E-18	2.58E-18
Rb-86m	1.88E-17	1.74E-17	1.64E-17	1.57E-17	1.43E-17	1.41E-17
Rb-87	1.06E-21	9.15E-22	8.21E-22	7.70E-22	6.62E-22	6.50E-22
Rb-88	2.29E-17	2.14E-17	2.02E-17	1.96E-17	1.82E-17	1.80E-17
Rb-89	7.73E-17	7.18E-17	6.77E-17	6.56E-17	6.08E-17	6.01E-17
Rb-90	6.62E-17	6.28E-17	5.97E-17	5.82E-17	5.46E-17	5.41E-17
Rb-90m	1.09E-16	1.02E-16	9.66E-17	9.38E-17	8.74E-17	8.65E-17
Strontium						
Sr-79	4.03E-17	3.75E-17	3.52E-17	3.38E-17	3.07E-17	3.03E-17
Sr-80	1.47E-17	1.36E-17	1.28E-17	1.23E-17	1.11E-17	1.10E-17
Sr-81	4.70E-17	4.37E-17	4.10E-17	3.93E-17	3.58E-17	3.54E-17
Sr-82	2.21E-21	1.52E-21	1.28E-21	1.16E-21	4.00E-22	3.65E-22
Sr-83	2.79E-17	2.59E-17	2.43E-17	2.34E-17	2.14E-17	2.11E-17
Sr-85	1.68E-17	1.56E-17	1.47E-17	1.41E-17	1.28E-17	1.26E-17
Sr-85m	6.78E-18	6.34E-18	5.95E-18	5.69E-18	5.12E-18	5.05E-18
Sr-87m	1.07E-17	9.95E-18	9.36E-18	8.95E-18	8.11E-18	8.00E-18
Sr-89	9.28E-20	8.82E-20	8.46E-20	8.24E-20	7.76E-20	7.71E-20
Sr-90	4.70E-21	4.21E-21	3.86E-21	3.66E-21	3.23E-21	3.18E-21
Sr-91	2.49E-17	2.29E-17	2.15E-17	2.07E-17	1.90E-17	1.88E-17
Sr-92	4.65E-17	4.30E-17	4.04E-17	3.92E-17	3.62E-17	3.59E-17
Sr-93	7.80E-17	7.23E-17	6.81E-17	6.58E-17	6.05E-17	5.99E-17
Sr-94	4.97E-17	4.61E-17	4.34E-17	4.21E-17	3.89E-17	3.85E-17
Yttrium						
Y-81	3.98E-17	3.70E-17	3.48E-17	3.33E-17	3.03E-17	2.99E-17
Y-83	4.62E-17	4.29E-17	4.03E-17	3.87E-17	3.54E-17	3.49E-17
Y-83m	2.85E-17	2.65E-17	2.49E-17	2.38E-17	2.17E-17	2.14E-17
Y-84m	1.39E-16	1.28E-16	1.20E-16	1.16E-16	1.06E-16	1.05E-16

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-85	3.70E-17	3.43E-17	3.23E-17	3.09E-17	2.81E-17	2.78E-17
Y-85m	4.52E-17	4.21E-17	3.96E-17	3.82E-17	3.51E-17	3.46E-17
Y-86	1.23E-16	1.14E-16	1.08E-16	1.04E-16	9.57E-17	9.46E-17
Y-86m	6.90E-18	6.45E-18	6.05E-18	5.79E-18	5.22E-18	5.15E-18
Y-87	1.49E-17	1.39E-17	1.30E-17	1.25E-17	1.13E-17	1.12E-17
Y-87m	1.02E-17	9.52E-18	8.96E-18	8.57E-18	7.76E-18	7.66E-18
Y-88	9.24E-17	8.60E-17	8.11E-17	7.86E-17	7.29E-17	7.21E-17
Y-89m	3.16E-17	2.90E-17	2.72E-17	2.63E-17	2.41E-17	2.38E-17
Y-90	2.41E-19	2.30E-19	2.21E-19	2.15E-19	2.04E-19	2.02E-19
Y-90m	2.10E-17	1.95E-17	1.84E-17	1.76E-17	1.59E-17	1.57E-17
Y-91	2.06E-19	1.93E-19	1.83E-19	1.78E-19	1.66E-19	1.64E-19
Y-91m	1.82E-17	1.68E-17	1.58E-17	1.52E-17	1.38E-17	1.36E-17
Y-92	9.36E-18	8.64E-18	8.12E-18	7.86E-18	7.23E-18	7.16E-18
Y-93	3.65E-18	3.40E-18	3.21E-18	3.11E-18	2.87E-18	2.84E-18
Y-94	2.77E-17	2.56E-17	2.41E-17	2.33E-17	2.14E-17	2.12E-17
Y-95	3.76E-17	3.54E-17	3.35E-17	3.26E-17	3.04E-17	3.01E-17
Zirconium						
Zr-85	5.08E-17	4.72E-17	4.44E-17	4.26E-17	3.88E-17	3.83E-17
Zr-86	8.78E-18	8.19E-18	7.69E-18	7.36E-18	6.63E-18	6.54E-18
Zr-87	3.19E-17	2.96E-17	2.79E-17	2.67E-17	2.43E-17	2.40E-17
Zr-88	1.28E-17	1.19E-17	1.12E-17	1.07E-17	9.73E-18	9.61E-18
Zr-89	4.02E-17	3.70E-17	3.47E-17	3.34E-17	3.06E-17	3.03E-17
Zr-89m	2.19E-17	2.03E-17	1.91E-17	1.83E-17	1.67E-17	1.65E-17
Zr-93	3.04E-24	2.12E-24	1.74E-24	1.57E-24	1.06E-24	1.02E-24
Zr-95	2.56E-17	2.35E-17	2.21E-17	2.13E-17	1.94E-17	1.92E-17
Zr-97	3.08E-17	2.84E-17	2.66E-17	2.56E-17	2.35E-17	2.32E-17
Niobium						
Nb-87	4.13E-17	3.84E-17	3.61E-17	3.46E-17	3.14E-17	3.10E-17
Nb-88	1.46E-16	1.35E-16	1.27E-16	1.22E-16	1.12E-16	1.11E-16
Nb-88m	1.42E-16	1.32E-16	1.24E-16	1.19E-16	1.10E-16	1.08E-16
Nb-89	4.66E-17	4.35E-17	4.11E-17	3.96E-17	3.64E-17	3.60E-17
Nb-89m	4.48E-17	4.16E-17	3.91E-17	3.75E-17	3.41E-17	3.37E-17
Nb-90	1.42E-16	1.33E-16	1.25E-16	1.22E-16	1.13E-16	1.12E-16
Nb-91	6.01E-20	5.46E-20	5.10E-20	4.88E-20	4.30E-20	4.24E-20
Nb-91m	8.71E-19	8.01E-19	7.52E-19	7.28E-19	6.70E-19	6.63E-19
Nb-92	5.21E-17	4.80E-17	4.50E-17	4.34E-17	3.97E-17	3.93E-17
Nb-92m	3.36E-17	3.09E-17	2.89E-17	2.80E-17	2.57E-17	2.54E-17
Nb-93m	1.18E-21	8.08E-22	6.91E-22	6.41E-22	3.05E-22	2.80E-22
Nb-94	5.45E-17	5.01E-17	4.70E-17	4.53E-17	4.15E-17	4.10E-17
Nb-94m	1.59E-19	1.45E-19	1.35E-19	1.30E-19	1.18E-19	1.17E-19
Nb-95	2.67E-17	2.46E-17	2.31E-17	2.22E-17	2.03E-17	2.01E-17
Nb-95m	1.99E-18	1.86E-18	1.74E-18	1.67E-18	1.50E-18	1.48E-18
Nb-96	8.57E-17	7.90E-17	7.41E-17	7.15E-17	6.55E-17	6.47E-17
Nb-97	2.32E-17	2.14E-17	2.01E-17	1.93E-17	1.76E-17	1.74E-17
Nb-98m	9.80E-17	9.06E-17	8.51E-17	8.22E-17	7.56E-17	7.47E-17
Nb-99	4.95E-18	4.64E-18	4.32E-18	4.13E-18	3.74E-18	3.68E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-99m	2.59E-17	2.43E-17	2.30E-17	2.23E-17	2.07E-17	2.05E-17
Molybdenum						
Mo-89	4.27E-17	3.96E-17	3.73E-17	3.58E-17	3.27E-17	3.23E-17
Mo-90	2.69E-17	2.50E-17	2.35E-17	2.26E-17	2.05E-17	2.03E-17
Mo-91	3.40E-17	3.16E-17	2.97E-17	2.84E-17	2.59E-17	2.56E-17
Mo-91m	4.80E-17	4.45E-17	4.18E-17	4.03E-17	3.70E-17	3.66E-17
Mo-93	6.63E-21	4.52E-21	3.87E-21	3.59E-21	1.71E-21	1.57E-21
Mo-93m	7.99E-17	7.41E-17	6.97E-17	6.74E-17	6.20E-17	6.13E-17
Mo-99	5.08E-18	4.69E-18	4.39E-18	4.23E-18	3.86E-18	3.82E-18
Mo-101	5.06E-17	4.70E-17	4.42E-17	4.27E-17	3.93E-17	3.89E-17
Mo-102	5.85E-19	5.48E-19	5.13E-19	4.90E-19	4.42E-19	4.36E-19
Technetium						
Tc-91	8.50E-17	7.94E-17	7.50E-17	7.25E-17	6.69E-17	6.61E-17
Tc-91m	4.97E-17	4.61E-17	4.34E-17	4.16E-17	3.80E-17	3.75E-17
Tc-92	1.31E-16	1.22E-16	1.15E-16	1.11E-16	1.02E-16	1.00E-16
Tc-93	5.40E-17	5.01E-17	4.71E-17	4.57E-17	4.22E-17	4.18E-17
Tc-93m	3.14E-17	2.96E-17	2.80E-17	2.72E-17	2.52E-17	2.49E-17
Tc-94	9.26E-17	8.52E-17	7.99E-17	7.70E-17	7.05E-17	6.97E-17
Tc-94m	6.75E-17	6.25E-17	5.88E-17	5.67E-17	5.20E-17	5.14E-17
Tc-95	2.74E-17	2.52E-17	2.37E-17	2.28E-17	2.09E-17	2.06E-17
Tc-95m	2.31E-17	2.13E-17	2.00E-17	1.92E-17	1.75E-17	1.73E-17
Tc-96	8.72E-17	8.02E-17	7.51E-17	7.25E-17	6.64E-17	6.57E-17
Tc-96m	1.45E-18	1.34E-18	1.26E-18	1.21E-18	1.11E-18	1.10E-18
Tc-97	8.53E-21	5.77E-21	4.91E-21	4.53E-21	2.35E-21	2.17E-21
Tc-97m	1.52E-20	1.19E-20	1.06E-20	9.94E-21	7.39E-21	7.11E-21
Tc-98	4.92E-17	4.54E-17	4.26E-17	4.10E-17	3.74E-17	3.70E-17
Tc-99	8.70E-22	7.49E-22	6.72E-22	6.30E-22	5.41E-22	5.31E-22
Tc-99m	3.47E-18	3.27E-18	3.02E-18	2.89E-18	2.61E-18	2.57E-18
Tc-101	1.11E-17	1.04E-17	9.78E-18	9.35E-18	8.46E-18	8.35E-18
Tc-102	3.73E-18	3.48E-18	3.29E-18	3.17E-18	2.93E-18	2.90E-18
Tc-102m	8.49E-17	7.90E-17	7.45E-17	7.20E-17	6.65E-17	6.57E-17
Tc-104	7.66E-17	7.16E-17	6.76E-17	6.54E-17	6.05E-17	5.98E-17
Tc-105	2.70E-17	2.51E-17	2.36E-17	2.27E-17	2.08E-17	2.06E-17
Ruthenium						
Ru-92	6.88E-17	6.40E-17	6.01E-17	5.78E-17	5.29E-17	5.22E-17
Ru-94	1.73E-17	1.60E-17	1.50E-17	1.44E-17	1.32E-17	1.30E-17
Ru-95	4.23E-17	3.92E-17	3.68E-17	3.55E-17	3.25E-17	3.21E-17
Ru-97	7.21E-18	6.74E-18	6.32E-18	6.05E-18	5.44E-18	5.37E-18
Ru-103	1.69E-17	1.57E-17	1.48E-17	1.42E-17	1.29E-17	1.27E-17
Ru-105	2.57E-17	2.38E-17	2.23E-17	2.14E-17	1.95E-17	1.93E-17
Ru-106	1.83E-25	1.23E-25	1.02E-25	9.27E-26	4.89E-26	4.56E-26
Ru-107	1.22E-17	1.13E-17	1.06E-17	1.02E-17	9.35E-18	9.25E-18
Ru-108	1.81E-18	1.70E-18	1.58E-18	1.51E-18	1.36E-18	1.34E-18
Rhodium						
Rh-94	1.32E-16	1.22E-16	1.15E-16	1.11E-16	1.02E-16	1.01E-16
Rh-95	8.81E-17	8.17E-17	7.69E-17	7.43E-17	6.84E-17	6.76E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rh-95m	2.99E-17	2.80E-17	2.65E-17	2.56E-17	2.36E-17	2.33E-17
Rh-96	1.36E-16	1.26E-16	1.18E-16	1.14E-16	1.04E-16	1.03E-16
Rh-96m	4.41E-17	4.09E-17	3.85E-17	3.72E-17	3.42E-17	3.38E-17
Rh-97	4.93E-17	4.58E-17	4.31E-17	4.14E-17	3.79E-17	3.74E-17
Rh-97m	7.39E-17	6.91E-17	6.53E-17	6.33E-17	5.86E-17	5.80E-17
Rh-98	6.27E-17	5.82E-17	5.47E-17	5.26E-17	4.81E-17	4.75E-17
Rh-99	1.81E-17	1.68E-17	1.58E-17	1.51E-17	1.38E-17	1.36E-17
Rh-99m	2.17E-17	2.02E-17	1.89E-17	1.82E-17	1.66E-17	1.64E-17
Rh-100	9.31E-17	8.68E-17	8.19E-17	7.93E-17	7.34E-17	7.26E-17
Rh-100m	1.41E-18	1.30E-18	1.21E-18	1.17E-18	1.06E-18	1.05E-18
Rh-101	8.12E-18	7.60E-18	7.10E-18	6.79E-18	6.11E-18	6.02E-18
Rh-101m	9.03E-18	8.42E-18	7.92E-18	7.57E-18	6.84E-18	6.75E-18
Rh-102	1.71E-17	1.58E-17	1.49E-17	1.43E-17	1.30E-17	1.28E-17
Rh-102m	7.42E-17	6.85E-17	6.43E-17	6.19E-17	5.66E-17	5.59E-17
Rh-103m	2.19E-21	1.48E-21	1.23E-21	1.12E-21	7.12E-22	6.70E-22
Rh-104	6.88E-19	6.44E-19	6.11E-19	5.90E-19	5.46E-19	5.40E-19
Rh-104m	4.27E-19	3.60E-19	3.18E-19	2.96E-19	2.50E-19	2.46E-19
Rh-105	2.54E-18	2.37E-18	2.23E-18	2.13E-18	1.93E-18	1.90E-18
Rh-106	7.63E-18	7.08E-18	6.67E-18	6.41E-18	5.86E-18	5.79E-18
Rh-106m	9.88E-17	9.13E-17	8.58E-17	8.27E-17	7.59E-17	7.50E-17
Rh-107	1.04E-17	9.68E-18	9.11E-18	8.71E-18	7.87E-18	7.77E-18
Rh-108	1.17E-17	1.08E-17	1.02E-17	9.80E-18	8.93E-18	8.82E-18
Rh-109	9.93E-18	9.27E-18	8.72E-18	8.34E-18	7.54E-18	7.44E-18
Palladium						
Pd-96	4.89E-17	4.52E-17	4.24E-17	4.08E-17	3.73E-17	3.69E-17
Pd-97	8.11E-17	7.55E-17	7.12E-17	6.87E-17	6.32E-17	6.25E-17
Pd-98	1.29E-17	1.19E-17	1.11E-17	1.07E-17	9.74E-18	9.61E-18
Pd-99	4.30E-17	4.00E-17	3.76E-17	3.62E-17	3.32E-17	3.28E-17
Pd-100	1.93E-18	1.72E-18	1.58E-18	1.49E-18	1.30E-18	1.28E-18
Pd-101	1.11E-17	1.03E-17	9.68E-18	9.30E-18	8.48E-18	8.37E-18
Pd-103	2.24E-20	1.59E-20	1.36E-20	1.25E-20	8.59E-21	8.19E-21
Pd-107	1.12E-25	7.57E-26	6.31E-26	5.73E-26	2.78E-26	2.58E-26
Pd-109	1.29E-19	1.15E-19	1.06E-19	1.01E-19	8.92E-20	8.77E-20
Pd-109m	3.22E-18	3.01E-18	2.82E-18	2.69E-18	2.42E-18	2.39E-18
Pd-111	1.83E-18	1.70E-18	1.60E-18	1.55E-18	1.42E-18	1.41E-18
Pd-112	4.75E-21	3.27E-21	2.79E-21	2.57E-21	1.50E-21	1.40E-21
Pd-114	8.58E-19	8.03E-19	7.54E-19	7.22E-19	6.53E-19	6.44E-19
Silver						
Ag-99	7.93E-17	7.36E-17	6.93E-17	6.68E-17	6.13E-17	6.05E-17
Ag-100m	9.82E-17	9.11E-17	8.58E-17	8.27E-17	7.59E-17	7.50E-17
Ag-101	5.37E-17	4.98E-17	4.68E-17	4.50E-17	4.11E-17	4.06E-17
Ag-102	1.17E-16	1.09E-16	1.02E-16	9.88E-17	9.09E-17	8.99E-17
Ag-102m	6.72E-17	6.29E-17	5.95E-17	5.76E-17	5.34E-17	5.28E-17
Ag-103	2.80E-17	2.60E-17	2.44E-17	2.34E-17	2.14E-17	2.12E-17
Ag-104	9.35E-17	8.64E-17	8.11E-17	7.83E-17	7.18E-17	7.10E-17
Ag-104m	6.14E-17	5.72E-17	5.40E-17	5.20E-17	4.78E-17	4.72E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-105	1.66E-17	1.54E-17	1.45E-17	1.39E-17	1.26E-17	1.24E-17
Ag-105m	3.31E-20	3.08E-20	2.89E-20	2.77E-20	2.51E-20	2.48E-20
Ag-106	2.38E-17	2.21E-17	2.08E-17	1.99E-17	1.81E-17	1.79E-17
Ag-106m	9.67E-17	8.94E-17	8.40E-17	8.10E-17	7.42E-17	7.34E-17
Ag-108	7.26E-19	6.74E-19	6.35E-19	6.11E-19	5.60E-19	5.53E-19
Ag-108m	5.54E-17	5.12E-17	4.81E-17	4.62E-17	4.21E-17	4.16E-17
Ag-109m	7.99E-20	6.91E-20	6.29E-20	5.92E-20	5.07E-20	4.96E-20
Ag-110	1.44E-18	1.34E-18	1.27E-18	1.22E-18	1.13E-18	1.12E-18
Ag-110m	9.63E-17	8.87E-17	8.33E-17	8.04E-17	7.38E-17	7.29E-17
Ag-111	8.98E-19	8.37E-19	7.88E-19	7.54E-19	6.82E-19	6.73E-19
Ag-111m	1.15E-19	1.05E-19	9.79E-20	9.35E-20	8.36E-20	8.24E-20
Ag-112	2.43E-17	2.26E-17	2.13E-17	2.05E-17	1.89E-17	1.87E-17
Ag-113	2.57E-18	2.39E-18	2.25E-18	2.16E-18	1.97E-18	1.94E-18
Ag-113m	7.12E-18	6.62E-18	6.22E-18	5.96E-18	5.40E-18	5.34E-18
Ag-114	9.99E-18	9.31E-18	8.79E-18	8.49E-18	7.83E-18	7.75E-18
Ag-115	1.67E-17	1.55E-17	1.47E-17	1.42E-17	1.31E-17	1.30E-17
Ag-116	7.33E-17	6.86E-17	6.49E-17	6.29E-17	5.83E-17	5.77E-17
Ag-117	4.41E-17	4.13E-17	3.91E-17	3.79E-17	3.52E-17	3.48E-17
Cadmium						
Cd-101	8.47E-17	7.88E-17	7.42E-17	7.17E-17	6.60E-17	6.52E-17
Cd-102	2.81E-17	2.60E-17	2.45E-17	2.35E-17	2.14E-17	2.12E-17
Cd-103	7.08E-17	6.60E-17	6.23E-17	6.03E-17	5.58E-17	5.52E-17
Cd-104	7.37E-18	6.77E-18	6.34E-18	6.08E-18	5.52E-18	5.46E-18
Cd-105	4.41E-17	4.11E-17	3.87E-17	3.74E-17	3.45E-17	3.41E-17
Cd-107	2.97E-19	2.63E-19	2.42E-19	2.30E-19	2.03E-19	1.99E-19
Cd-109	1.07E-19	8.71E-20	7.77E-20	7.25E-20	5.96E-20	5.80E-20
Cd-111m	8.63E-18	8.07E-18	7.57E-18	7.24E-18	6.52E-18	6.43E-18
Cd-113	7.60E-22	6.54E-22	5.87E-22	5.50E-22	4.73E-22	4.64E-22
Cd-113m	6.29E-21	5.71E-21	5.28E-21	5.02E-21	4.46E-21	4.39E-21
Cd-115	6.57E-18	6.10E-18	5.73E-18	5.49E-18	5.00E-18	4.93E-18
Cd-115m	1.25E-18	1.15E-18	1.08E-18	1.05E-18	9.65E-19	9.55E-19
Cd-117	3.72E-17	3.44E-17	3.24E-17	3.13E-17	2.88E-17	2.85E-17
Cd-117m	7.01E-17	6.52E-17	6.15E-17	5.96E-17	5.52E-17	5.46E-17
Cd-118	3.08E-21	2.74E-21	2.50E-21	2.36E-21	2.07E-21	2.04E-21
Cd-119	5.60E-17	5.22E-17	4.92E-17	4.77E-17	4.41E-17	4.36E-17
Cd-119m	7.92E-17	7.36E-17	6.94E-17	6.72E-17	6.22E-17	6.16E-17
Indium						
In-103	9.41E-17	8.76E-17	8.25E-17	7.96E-17	7.32E-17	7.24E-17
In-105	6.58E-17	6.11E-17	5.75E-17	5.54E-17	5.08E-17	5.02E-17
In-106	1.24E-16	1.14E-16	1.07E-16	1.03E-16	9.43E-17	9.33E-17
In-106m	9.66E-17	9.01E-17	8.50E-17	8.21E-17	7.56E-17	7.48E-17
In-107	5.16E-17	4.81E-17	4.53E-17	4.38E-17	4.03E-17	3.98E-17
In-108	1.35E-16	1.25E-16	1.17E-16	1.13E-16	1.04E-16	1.03E-16
In-108m	9.26E-17	8.68E-17	8.21E-17	7.95E-17	7.36E-17	7.28E-17
In-109	2.11E-17	1.95E-17	1.84E-17	1.77E-17	1.61E-17	1.59E-17
In-109m	2.11E-17	1.95E-17	1.83E-17	1.76E-17	1.60E-17	1.58E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-110	1.08E-16	9.90E-17	9.29E-17	8.95E-17	8.20E-17	8.11E-17
In-110m	5.40E-17	5.02E-17	4.72E-17	4.54E-17	4.16E-17	4.11E-17
In-111	1.20E-17	1.12E-17	1.05E-17	1.01E-17	9.06E-18	8.94E-18
In-111m	1.61E-17	1.49E-17	1.40E-17	1.34E-17	1.22E-17	1.21E-17
In-112	9.00E-18	8.35E-18	7.85E-18	7.52E-18	6.85E-18	6.76E-18
In-112m	6.23E-19	5.78E-19	5.33E-19	5.08E-19	4.56E-19	4.49E-19
In-113m	8.55E-18	7.96E-18	7.48E-18	7.16E-18	6.48E-18	6.40E-18
In-114	2.41E-19	2.27E-19	2.17E-19	2.11E-19	1.98E-19	1.96E-19
In-114m	2.37E-18	2.19E-18	2.05E-18	1.97E-18	1.79E-18	1.76E-18
In-115	2.69E-21	2.38E-21	2.17E-21	2.05E-21	1.79E-21	1.76E-21
In-115m	5.12E-18	4.77E-18	4.49E-18	4.29E-18	3.88E-18	3.83E-18
In-116m	8.56E-17	7.92E-17	7.45E-17	7.21E-17	6.66E-17	6.59E-17
In-117	2.30E-17	2.14E-17	2.01E-17	1.92E-17	1.75E-17	1.73E-17
In-117m	2.80E-18	2.61E-18	2.45E-18	2.34E-18	2.12E-18	2.09E-18
In-118	3.61E-18	3.36E-18	3.17E-18	3.08E-18	2.85E-18	2.82E-18
In-118m	9.70E-17	8.94E-17	8.39E-17	8.12E-17	7.47E-17	7.39E-17
In-119	2.69E-17	2.47E-17	2.32E-17	2.23E-17	2.04E-17	2.02E-17
In-119m	2.52E-18	2.33E-18	2.19E-18	2.12E-18	1.96E-18	1.94E-18
In-121	3.27E-17	3.00E-17	2.82E-17	2.72E-17	2.49E-17	2.47E-17
In-121m	2.22E-18	2.05E-18	1.93E-18	1.87E-18	1.73E-18	1.71E-18
Tin						
Sn-106	4.06E-17	3.76E-17	3.53E-17	3.39E-17	3.10E-17	3.06E-17
Sn-108	2.21E-17	2.06E-17	1.93E-17	1.85E-17	1.68E-17	1.66E-17
Sn-109	7.53E-17	6.99E-17	6.59E-17	6.38E-17	5.90E-17	5.84E-17
Sn-110	8.92E-18	8.32E-18	7.83E-18	7.48E-18	6.74E-18	6.65E-18
Sn-111	1.64E-17	1.52E-17	1.43E-17	1.38E-17	1.26E-17	1.25E-17
Sn-113	2.15E-19	1.89E-19	1.75E-19	1.66E-19	1.45E-19	1.42E-19
Sn-113m	4.03E-20	2.85E-20	2.37E-20	2.14E-20	1.60E-20	1.54E-20
Sn-117m	4.11E-18	3.86E-18	3.57E-18	3.42E-18	3.08E-18	3.03E-18
Sn-119m	3.52E-20	2.36E-20	1.91E-20	1.71E-20	1.20E-20	1.14E-20
Sn-121	1.35E-21	1.18E-21	1.07E-21	1.01E-21	8.72E-22	8.56E-22
Sn-121m	1.67E-20	1.16E-20	9.41E-21	8.42E-21	6.25E-21	5.99E-21
Sn-123	3.13E-19	2.90E-19	2.73E-19	2.65E-19	2.45E-19	2.43E-19
Sn-123m	4.07E-18	3.83E-18	3.55E-18	3.39E-18	3.07E-18	3.02E-18
Sn-125	1.19E-17	1.09E-17	1.03E-17	9.94E-18	9.16E-18	9.06E-18
Sn-125m	1.16E-17	1.09E-17	1.02E-17	9.79E-18	8.86E-18	8.75E-18
Sn-126	9.56E-19	8.53E-19	7.83E-19	7.39E-19	6.47E-19	6.36E-19
Sn-127	6.59E-17	6.10E-17	5.73E-17	5.54E-17	5.11E-17	5.05E-17
Sn-127m	1.98E-17	1.84E-17	1.73E-17	1.66E-17	1.52E-17	1.50E-17
Sn-128	1.89E-17	1.75E-17	1.64E-17	1.57E-17	1.43E-17	1.41E-17
Sn-129	3.54E-17	3.27E-17	3.08E-17	2.97E-17	2.72E-17	2.69E-17
Sn-130	3.10E-17	2.86E-17	2.68E-17	2.58E-17	2.35E-17	2.32E-17
Sn-130m	3.05E-17	2.82E-17	2.64E-17	2.55E-17	2.35E-17	2.32E-17
Antimony						
Sb-111	5.08E-17	4.71E-17	4.42E-17	4.24E-17	3.87E-17	3.82E-17
Sb-113	4.33E-17	4.02E-17	3.78E-17	3.62E-17	3.30E-17	3.26E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sb-114	9.33E-17	8.64E-17	8.12E-17	7.85E-17	7.22E-17	7.13E-17
Sb-115	3.00E-17	2.79E-17	2.62E-17	2.51E-17	2.29E-17	2.26E-17
Sb-116	7.84E-17	7.27E-17	6.84E-17	6.62E-17	6.10E-17	6.03E-17
Sb-116m	1.07E-16	9.83E-17	9.23E-17	8.91E-17	8.19E-17	8.10E-17
Sb-117	4.99E-18	4.66E-18	4.33E-18	4.14E-18	3.75E-18	3.69E-18
Sb-118	2.76E-17	2.56E-17	2.41E-17	2.31E-17	2.11E-17	2.08E-17
Sb-118m	8.93E-17	8.23E-17	7.72E-17	7.47E-17	6.86E-17	6.79E-17
Sb-119	5.72E-20	3.83E-20	3.10E-20	2.77E-20	1.95E-20	1.86E-20
Sb-120	1.52E-17	1.41E-17	1.32E-17	1.27E-17	1.15E-17	1.14E-17
Sb-120m	8.38E-17	7.72E-17	7.23E-17	7.00E-17	6.42E-17	6.36E-17
Sb-122	1.54E-17	1.43E-17	1.34E-17	1.29E-17	1.18E-17	1.16E-17
Sb-122m	8.16E-19	6.89E-19	6.12E-19	5.70E-19	4.84E-19	4.77E-19
Sb-124	6.39E-17	5.94E-17	5.59E-17	5.41E-17	4.99E-17	4.93E-17
Sb-124m	1.52E-17	1.41E-17	1.32E-17	1.27E-17	1.16E-17	1.14E-17
Sb-124n	2.13E-24	1.42E-24	1.15E-24	1.02E-24	7.28E-25	6.92E-25
Sb-125	1.44E-17	1.34E-17	1.26E-17	1.20E-17	1.09E-17	1.08E-17
Sb-126	9.55E-17	8.82E-17	8.28E-17	7.96E-17	7.27E-17	7.18E-17
Sb-126m	5.36E-17	4.96E-17	4.65E-17	4.47E-17	4.08E-17	4.03E-17
Sb-127	2.39E-17	2.21E-17	2.07E-17	1.99E-17	1.82E-17	1.79E-17
Sb-128	1.07E-16	9.90E-17	9.29E-17	8.94E-17	8.17E-17	8.07E-17
Sb-128m	6.62E-17	6.11E-17	5.73E-17	5.52E-17	5.04E-17	4.98E-17
Sb-129	5.08E-17	4.69E-17	4.40E-17	4.25E-17	3.91E-17	3.87E-17
Sb-130	1.13E-16	1.04E-16	9.79E-17	9.44E-17	8.64E-17	8.55E-17
Sb-130m	9.45E-17	8.70E-17	8.16E-17	7.88E-17	7.22E-17	7.14E-17
Sb-131	7.18E-17	6.65E-17	6.25E-17	6.05E-17	5.57E-17	5.51E-17
Sb-133	9.43E-17	8.77E-17	8.26E-17	8.01E-17	7.41E-17	7.33E-17
Tellurium						
Te-113	7.70E-17	7.15E-17	6.73E-17	6.49E-17	5.97E-17	5.90E-17
Te-114	4.30E-17	3.99E-17	3.75E-17	3.62E-17	3.34E-17	3.30E-17
Te-115	7.75E-17	7.18E-17	6.75E-17	6.51E-17	5.98E-17	5.91E-17
Te-115m	8.98E-17	8.32E-17	7.83E-17	7.56E-17	6.96E-17	6.88E-17
Te-116	2.45E-18	2.24E-18	2.09E-18	1.99E-18	1.80E-18	1.77E-18
Te-117	5.29E-17	4.91E-17	4.62E-17	4.46E-17	4.11E-17	4.06E-17
Te-118	5.68E-20	3.82E-20	3.08E-20	2.74E-20	1.98E-20	1.88E-20
Te-119	2.60E-17	2.40E-17	2.26E-17	2.17E-17	1.98E-17	1.96E-17
Te-119m	5.10E-17	4.71E-17	4.42E-17	4.28E-17	3.93E-17	3.89E-17
Te-121	1.92E-17	1.78E-17	1.67E-17	1.60E-17	1.46E-17	1.44E-17
Te-121m	6.46E-18	6.02E-18	5.64E-18	5.41E-18	4.88E-18	4.81E-18
Te-123	9.87E-23	6.64E-23	5.35E-23	4.77E-23	3.43E-23	3.27E-23
Te-123m	3.92E-18	3.68E-18	3.41E-18	3.26E-18	2.94E-18	2.89E-18
Te-125m	1.26E-19	8.75E-20	7.14E-20	6.40E-20	4.81E-20	4.61E-20
Te-127	1.70E-19	1.58E-19	1.48E-19	1.42E-19	1.29E-19	1.27E-19
Te-127m	4.29E-20	3.09E-20	2.57E-20	2.33E-20	1.81E-20	1.74E-20
Te-129	2.04E-18	1.89E-18	1.78E-18	1.71E-18	1.55E-18	1.54E-18
Te-129m	1.09E-18	9.98E-19	9.34E-19	8.99E-19	8.20E-19	8.10E-19
Te-131	1.39E-17	1.29E-17	1.21E-17	1.16E-17	1.06E-17	1.05E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-131m	5.00E-17	4.62E-17	4.33E-17	4.18E-17	3.83E-17	3.79E-17
Te-132	6.60E-18	6.14E-18	5.76E-18	5.50E-18	4.94E-18	4.87E-18
Te-133	4.11E-17	3.82E-17	3.60E-17	3.47E-17	3.19E-17	3.15E-17
Te-133m	6.42E-17	5.93E-17	5.56E-17	5.37E-17	4.93E-17	4.88E-17
Te-134	2.91E-17	2.69E-17	2.52E-17	2.42E-17	2.21E-17	2.18E-17
Iodine						
I-118	7.04E-17	6.53E-17	6.14E-17	5.90E-17	5.39E-17	5.33E-17
I-118m	1.30E-16	1.20E-16	1.13E-16	1.09E-16	9.93E-17	9.81E-17
I-119	3.05E-17	2.83E-17	2.66E-17	2.55E-17	2.32E-17	2.29E-17
I-120	9.04E-17	8.44E-17	7.97E-17	7.70E-17	7.11E-17	7.03E-17
I-120m	1.21E-16	1.13E-16	1.06E-16	1.02E-16	9.35E-17	9.24E-17
I-121	1.25E-17	1.16E-17	1.09E-17	1.04E-17	9.45E-18	9.33E-18
I-122	3.32E-17	3.08E-17	2.90E-17	2.78E-17	2.53E-17	2.50E-17
I-123	4.46E-18	4.17E-18	3.86E-18	3.69E-18	3.33E-18	3.28E-18
I-124	3.78E-17	3.51E-17	3.30E-17	3.18E-17	2.92E-17	2.89E-17
I-125	1.41E-19	9.63E-20	7.75E-20	6.91E-20	5.08E-20	4.86E-20
I-126	1.46E-17	1.35E-17	1.27E-17	1.22E-17	1.11E-17	1.10E-17
I-128	2.41E-18	2.25E-18	2.11E-18	2.03E-18	1.85E-18	1.82E-18
I-129	1.07E-19	7.52E-20	6.08E-20	5.43E-20	4.12E-20	3.97E-20
I-130	7.40E-17	6.84E-17	6.42E-17	6.17E-17	5.64E-17	5.57E-17
I-130m	3.64E-18	3.37E-18	3.17E-18	3.04E-18	2.78E-18	2.74E-18
I-131	1.28E-17	1.19E-17	1.12E-17	1.07E-17	9.68E-18	9.55E-18
I-132	7.88E-17	7.27E-17	6.83E-17	6.58E-17	6.03E-17	5.96E-17
I-132m	1.14E-17	1.05E-17	9.87E-18	9.49E-18	8.65E-18	8.55E-18
I-133	2.11E-17	1.96E-17	1.84E-17	1.76E-17	1.61E-17	1.59E-17
I-134	9.05E-17	8.34E-17	7.82E-17	7.56E-17	6.94E-17	6.86E-17
I-134m	8.66E-18	8.04E-18	7.55E-18	7.23E-18	6.52E-18	6.44E-18
I-135	5.48E-17	5.08E-17	4.78E-17	4.63E-17	4.27E-17	4.23E-17
Xenon						
Xe-120	1.22E-17	1.13E-17	1.06E-17	1.01E-17	9.23E-18	9.11E-18
Xe-121	4.93E-17	4.60E-17	4.34E-17	4.19E-17	3.86E-17	3.81E-17
Xe-122	1.54E-18	1.41E-18	1.32E-18	1.26E-18	1.13E-18	1.11E-18
Xe-123	2.08E-17	1.93E-17	1.81E-17	1.74E-17	1.60E-17	1.58E-17
Xe-125	7.72E-18	7.17E-18	6.71E-18	6.42E-18	5.80E-18	5.72E-18
Xe-127	8.02E-18	7.48E-18	7.00E-18	6.69E-18	6.03E-18	5.94E-18
Xe-127m	4.28E-18	4.00E-18	3.71E-18	3.54E-18	3.19E-18	3.14E-18
Xe-129m	4.52E-19	3.81E-19	3.41E-19	3.20E-19	2.75E-19	2.70E-19
Xe-131m	1.60E-19	1.34E-19	1.19E-19	1.11E-19	9.52E-20	9.32E-20
Xe-133	6.71E-19	5.84E-19	5.29E-19	4.97E-19	4.30E-19	4.23E-19
Xe-133m	8.06E-19	7.37E-19	6.86E-19	6.54E-19	5.83E-19	5.75E-19
Xe-135	7.96E-18	7.44E-18	6.99E-18	6.69E-18	6.02E-18	5.95E-18
Xe-135m	1.44E-17	1.34E-17	1.26E-17	1.21E-17	1.10E-17	1.08E-17
Xe-137	7.23E-18	6.74E-18	6.36E-18	6.11E-18	5.60E-18	5.53E-18
Xe-138	3.80E-17	3.56E-17	3.36E-17	3.25E-17	3.01E-17	2.98E-17
Cesium						
Cs-121	4.06E-17	3.77E-17	3.54E-17	3.40E-17	3.09E-17	3.06E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cs-121m	4.03E-17	3.74E-17	3.52E-17	3.37E-17	3.07E-17	3.03E-17
Cs-123	3.68E-17	3.41E-17	3.21E-17	3.07E-17	2.80E-17	2.77E-17
Cs-124	4.06E-17	3.78E-17	3.55E-17	3.41E-17	3.11E-17	3.07E-17
Cs-125	2.54E-17	2.35E-17	2.21E-17	2.12E-17	1.94E-17	1.91E-17
Cs-126	3.98E-17	3.70E-17	3.48E-17	3.34E-17	3.04E-17	3.00E-17
Cs-127	1.38E-17	1.28E-17	1.21E-17	1.15E-17	1.05E-17	1.03E-17
Cs-128	3.05E-17	2.84E-17	2.67E-17	2.56E-17	2.33E-17	2.30E-17
Cs-129	8.39E-18	7.78E-18	7.31E-18	6.98E-18	6.32E-18	6.23E-18
Cs-130	1.69E-17	1.57E-17	1.47E-17	1.41E-17	1.29E-17	1.27E-17
Cs-130m	1.08E-18	9.53E-19	8.66E-19	8.17E-19	7.15E-19	7.03E-19
Cs-131	8.95E-20	6.16E-20	4.96E-20	4.41E-20	3.30E-20	3.17E-20
Cs-132	2.41E-17	2.23E-17	2.09E-17	2.01E-17	1.83E-17	1.81E-17
Cs-134	5.41E-17	4.99E-17	4.68E-17	4.51E-17	4.12E-17	4.07E-17
Cs-134m	4.71E-19	4.32E-19	3.97E-19	3.77E-19	3.37E-19	3.31E-19
Cs-135	6.27E-22	5.35E-22	4.78E-22	4.47E-22	3.82E-22	3.74E-22
Cs-135m	5.59E-17	5.14E-17	4.82E-17	4.65E-17	4.25E-17	4.21E-17
Cs-136	7.38E-17	6.79E-17	6.37E-17	6.15E-17	5.64E-17	5.57E-17
Cs-137	5.93E-21	5.43E-21	5.06E-21	4.84E-21	4.38E-21	4.33E-21
Cs-138	8.14E-17	7.57E-17	7.14E-17	6.92E-17	6.40E-17	6.33E-17
Cs-138m	1.38E-17	1.28E-17	1.21E-17	1.17E-17	1.07E-17	1.06E-17
Cs-139	1.11E-17	1.03E-17	9.76E-18	9.48E-18	8.81E-18	8.72E-18
Cs-140	6.09E-17	5.70E-17	5.39E-17	5.22E-17	4.85E-17	4.80E-17
Barium						
Ba-124	1.87E-17	1.73E-17	1.63E-17	1.56E-17	1.42E-17	1.41E-17
Ba-126	1.91E-17	1.76E-17	1.65E-17	1.59E-17	1.45E-17	1.43E-17
Ba-127	2.44E-17	2.26E-17	2.13E-17	2.04E-17	1.86E-17	1.84E-17
Ba-128	1.46E-18	1.34E-18	1.25E-18	1.19E-18	1.07E-18	1.05E-18
Ba-129	1.06E-17	9.86E-18	9.26E-18	8.89E-18	8.11E-18	8.01E-18
Ba-129m	5.34E-17	4.94E-17	4.64E-17	4.47E-17	4.10E-17	4.05E-17
Ba-131	1.48E-17	1.38E-17	1.29E-17	1.24E-17	1.12E-17	1.10E-17
Ba-131m	1.56E-18	1.43E-18	1.33E-18	1.26E-18	1.12E-18	1.10E-18
Ba-133	1.18E-17	1.09E-17	1.02E-17	9.78E-18	8.81E-18	8.69E-18
Ba-133m	1.68E-18	1.55E-18	1.45E-18	1.38E-18	1.24E-18	1.22E-18
Ba-135m	1.44E-18	1.32E-18	1.24E-18	1.18E-18	1.06E-18	1.04E-18
Ba-137m	2.06E-17	1.91E-17	1.79E-17	1.72E-17	1.57E-17	1.55E-17
Ba-139	1.55E-18	1.45E-18	1.36E-18	1.30E-18	1.19E-18	1.17E-18
Ba-140	6.01E-18	5.58E-18	5.24E-18	5.02E-18	4.56E-18	4.50E-18
Ba-141	3.15E-17	2.92E-17	2.75E-17	2.65E-17	2.42E-17	2.39E-17
Ba-142	3.59E-17	3.31E-17	3.10E-17	3.00E-17	2.75E-17	2.72E-17
Lanthanum						
La-128	9.74E-17	9.03E-17	8.49E-17	8.17E-17	7.47E-17	7.38E-17
La-129	3.08E-17	2.86E-17	2.69E-17	2.58E-17	2.34E-17	2.31E-17
La-130	7.66E-17	7.11E-17	6.69E-17	6.44E-17	5.89E-17	5.82E-17
La-131	2.15E-17	1.99E-17	1.87E-17	1.79E-17	1.63E-17	1.61E-17
La-132	6.77E-17	6.31E-17	5.94E-17	5.73E-17	5.27E-17	5.21E-17
La-132m	2.21E-17	2.04E-17	1.91E-17	1.84E-17	1.67E-17	1.65E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-133	4.74E-18	4.37E-18	4.10E-18	3.93E-18	3.57E-18	3.52E-18
La-134	2.46E-17	2.28E-17	2.15E-17	2.06E-17	1.87E-17	1.85E-17
La-135	4.68E-19	4.08E-19	3.72E-19	3.52E-19	3.11E-19	3.06E-19
La-136	1.35E-17	1.25E-17	1.18E-17	1.13E-17	1.03E-17	1.01E-17
La-137	1.16E-19	8.21E-20	6.64E-20	5.92E-20	4.53E-20	4.36E-20
La-138	4.24E-17	3.92E-17	3.69E-17	3.57E-17	3.30E-17	3.26E-17
La-140	7.95E-17	7.39E-17	6.96E-17	6.74E-17	6.23E-17	6.16E-17
La-141	1.20E-18	1.12E-18	1.05E-18	1.02E-18	9.53E-19	9.44E-19
La-142	8.00E-17	7.50E-17	7.10E-17	6.90E-17	6.42E-17	6.35E-17
La-143	9.49E-18	8.84E-18	8.34E-18	8.08E-18	7.49E-18	7.41E-18
Cerium						
Ce-130	1.56E-17	1.44E-17	1.35E-17	1.30E-17	1.18E-17	1.16E-17
Ce-131	5.51E-17	5.11E-17	4.80E-17	4.62E-17	4.23E-17	4.18E-17
Ce-132	7.69E-18	7.17E-18	6.69E-18	6.40E-18	5.76E-18	5.68E-18
Ce-133	1.67E-17	1.55E-17	1.45E-17	1.39E-17	1.26E-17	1.24E-17
Ce-133m	5.82E-17	5.40E-17	5.07E-17	4.89E-17	4.49E-17	4.44E-17
Ce-134	1.81E-19	1.40E-19	1.19E-19	1.09E-19	8.90E-20	8.67E-20
Ce-135	2.71E-17	2.51E-17	2.36E-17	2.26E-17	2.06E-17	2.03E-17
Ce-137	5.10E-19	4.45E-19	4.05E-19	3.83E-19	3.38E-19	3.33E-19
Ce-137m	1.26E-18	1.15E-18	1.07E-18	1.02E-18	9.13E-19	9.01E-19
Ce-139	4.00E-18	3.73E-18	3.45E-18	3.29E-18	2.96E-18	2.92E-18
Ce-141	2.02E-18	1.89E-18	1.74E-18	1.67E-18	1.50E-18	1.48E-18
Ce-143	8.63E-18	7.98E-18	7.48E-18	7.17E-18	6.49E-18	6.40E-18
Ce-144	4.46E-19	4.13E-19	3.81E-19	3.63E-19	3.26E-19	3.20E-19
Ce-145	2.72E-17	2.50E-17	2.35E-17	2.26E-17	2.06E-17	2.04E-17
Praseodymium						
Pr-134	1.08E-16	1.00E-16	9.41E-17	9.05E-17	8.27E-17	8.17E-17
Pr-134m	7.94E-17	7.39E-17	6.96E-17	6.70E-17	6.15E-17	6.07E-17
Pr-135	2.89E-17	2.69E-17	2.52E-17	2.42E-17	2.21E-17	2.18E-17
Pr-136	7.33E-17	6.82E-17	6.42E-17	6.18E-17	5.67E-17	5.60E-17
Pr-137	1.21E-17	1.12E-17	1.05E-17	1.01E-17	9.19E-18	9.08E-18
Pr-138	2.82E-17	2.61E-17	2.46E-17	2.36E-17	2.15E-17	2.12E-17
Pr-138m	8.52E-17	7.85E-17	7.37E-17	7.10E-17	6.50E-17	6.43E-17
Pr-139	3.71E-18	3.41E-18	3.20E-18	3.07E-18	2.79E-18	2.75E-18
Pr-140	1.85E-17	1.71E-17	1.61E-17	1.54E-17	1.40E-17	1.39E-17
Pr-142	2.20E-18	2.05E-18	1.93E-18	1.88E-18	1.74E-18	1.73E-18
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	1.90E-20	1.78E-20	1.68E-20	1.62E-20	1.49E-20	1.48E-20
Pr-144	1.38E-18	1.30E-18	1.23E-18	1.19E-18	1.11E-18	1.10E-18
Pr-144m	1.25E-19	1.03E-19	9.07E-20	8.48E-20	7.30E-20	7.17E-20
Pr-145	7.61E-19	7.04E-19	6.62E-19	6.40E-19	5.89E-19	5.83E-19
Pr-146	3.52E-17	3.27E-17	3.08E-17	2.98E-17	2.75E-17	2.72E-17
Pr-147	1.56E-17	1.44E-17	1.35E-17	1.30E-17	1.19E-17	1.17E-17
Pr-148	3.45E-17	3.21E-17	3.02E-17	2.92E-17	2.69E-17	2.66E-17
Pr-148m	3.24E-17	3.01E-17	2.83E-17	2.71E-17	2.47E-17	2.44E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Neodymium						
Nd-134	1.70E-17	1.58E-17	1.48E-17	1.42E-17	1.29E-17	1.27E-17
Nd-135	4.21E-17	3.91E-17	3.67E-17	3.52E-17	3.20E-17	3.16E-17
Nd-136	7.84E-18	7.21E-18	6.74E-18	6.45E-18	5.85E-18	5.77E-18
Nd-137	3.94E-17	3.64E-17	3.42E-17	3.30E-17	3.02E-17	2.98E-17
Nd-138	6.42E-19	5.65E-19	5.15E-19	4.86E-19	4.27E-19	4.21E-19
Nd-139	1.46E-17	1.35E-17	1.27E-17	1.22E-17	1.11E-17	1.10E-17
Nd-139m	5.36E-17	4.94E-17	4.63E-17	4.47E-17	4.09E-17	4.05E-17
Nd-140	1.73E-19	1.27E-19	1.04E-19	9.36E-20	7.33E-20	7.12E-20
Nd-141	1.82E-18	1.65E-18	1.54E-18	1.47E-18	1.34E-18	1.32E-18
Nd-141m	2.42E-17	2.23E-17	2.09E-17	2.01E-17	1.84E-17	1.82E-17
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	3.98E-18	3.66E-18	3.43E-18	3.27E-18	2.96E-18	2.92E-18
Nd-149	1.17E-17	1.09E-17	1.02E-17	9.78E-18	8.85E-18	8.73E-18
Nd-151	2.87E-17	2.65E-17	2.49E-17	2.40E-17	2.20E-17	2.17E-17
Nd-152	5.25E-18	4.90E-18	4.60E-18	4.40E-18	3.97E-18	3.92E-18
Promethium						
Pm-136	9.46E-17	8.76E-17	8.23E-17	7.90E-17	7.21E-17	7.12E-17
Pm-137m	5.98E-17	5.54E-17	5.20E-17	5.00E-17	4.55E-17	4.49E-17
Pm-139	3.22E-17	2.99E-17	2.81E-17	2.70E-17	2.46E-17	2.43E-17
Pm-140	3.70E-17	3.44E-17	3.23E-17	3.10E-17	2.83E-17	2.79E-17
Pm-140m	1.05E-16	9.70E-17	9.10E-17	8.77E-17	8.02E-17	7.93E-17
Pm-141	2.50E-17	2.32E-17	2.18E-17	2.09E-17	1.91E-17	1.89E-17
Pm-142	2.97E-17	2.75E-17	2.59E-17	2.48E-17	2.27E-17	2.24E-17
Pm-143	1.02E-17	9.33E-18	8.73E-18	8.40E-18	7.67E-18	7.58E-18
Pm-144	5.33E-17	4.92E-17	4.62E-17	4.44E-17	4.05E-17	4.00E-17
Pm-145	2.22E-19	1.69E-19	1.41E-19	1.28E-19	1.02E-19	9.99E-20
Pm-146	2.54E-17	2.34E-17	2.20E-17	2.11E-17	1.92E-17	1.90E-17
Pm-147	3.45E-22	2.95E-22	2.64E-22	2.47E-22	2.12E-22	2.08E-22
Pm-148	2.01E-17	1.86E-17	1.75E-17	1.69E-17	1.56E-17	1.54E-17
Pm-148m	6.87E-17	6.35E-17	5.96E-17	5.73E-17	5.23E-17	5.17E-17
Pm-149	4.19E-19	3.90E-19	3.67E-19	3.51E-19	3.18E-19	3.15E-19
Pm-150	5.08E-17	4.71E-17	4.43E-17	4.28E-17	3.93E-17	3.89E-17
Pm-151	1.05E-17	9.74E-18	9.14E-18	8.75E-18	7.93E-18	7.83E-18
Pm-152	1.01E-17	9.37E-18	8.81E-18	8.51E-18	7.83E-18	7.75E-18
Pm-152m	5.14E-17	4.76E-17	4.47E-17	4.32E-17	3.96E-17	3.92E-17
Pm-153	1.98E-18	1.84E-18	1.71E-18	1.63E-18	1.47E-18	1.45E-18
Pm-154	6.12E-17	5.69E-17	5.37E-17	5.21E-17	4.83E-17	4.78E-17
Pm-154m	6.12E-17	5.67E-17	5.34E-17	5.16E-17	4.75E-17	4.70E-17
Samarium						
Sm-139	4.96E-17	4.61E-17	4.33E-17	4.16E-17	3.79E-17	3.75E-17
Sm-140	1.86E-17	1.72E-17	1.61E-17	1.55E-17	1.42E-17	1.40E-17
Sm-141	4.80E-17	4.46E-17	4.20E-17	4.03E-17	3.69E-17	3.65E-17
Sm-141m	6.61E-17	6.12E-17	5.75E-17	5.54E-17	5.07E-17	5.01E-17
Sm-142	2.99E-18	2.74E-18	2.55E-18	2.44E-18	2.21E-18	2.18E-18
Sm-143	1.78E-17	1.65E-17	1.55E-17	1.49E-17	1.35E-17	1.34E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-143m	2.38E-17	2.19E-17	2.06E-17	1.98E-17	1.81E-17	1.79E-17
Sm-145	5.03E-19	3.91E-19	3.29E-19	2.99E-19	2.42E-19	2.37E-19
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.49E-23	1.01E-23	8.36E-24	7.56E-24	5.01E-24	4.74E-24
Sm-153	1.09E-18	9.72E-19	8.89E-19	8.39E-19	7.37E-19	7.23E-19
Sm-155	2.54E-18	2.35E-18	2.19E-18	2.09E-18	1.87E-18	1.84E-18
Sm-156	3.12E-18	2.90E-18	2.71E-18	2.58E-18	2.32E-18	2.28E-18
Sm-157	1.35E-17	1.26E-17	1.18E-17	1.13E-17	1.03E-17	1.02E-17
Europium						
Eu-142	4.28E-17	3.98E-17	3.75E-17	3.60E-17	3.29E-17	3.25E-17
Eu-142m	1.20E-16	1.11E-16	1.04E-16	9.99E-17	9.14E-17	9.03E-17
Eu-143	3.88E-17	3.61E-17	3.39E-17	3.27E-17	2.99E-17	2.95E-17
Eu-144	3.84E-17	3.57E-17	3.36E-17	3.23E-17	2.95E-17	2.92E-17
Eu-145	4.34E-17	4.01E-17	3.77E-17	3.65E-17	3.36E-17	3.32E-17
Eu-146	8.23E-17	7.61E-17	7.15E-17	6.90E-17	6.33E-17	6.26E-17
Eu-147	1.48E-17	1.36E-17	1.28E-17	1.23E-17	1.12E-17	1.11E-17
Eu-148	7.61E-17	7.04E-17	6.61E-17	6.36E-17	5.82E-17	5.75E-17
Eu-149	1.31E-18	1.18E-18	1.09E-18	1.04E-18	9.21E-19	9.07E-19
Eu-150	5.22E-17	4.84E-17	4.54E-17	4.36E-17	3.97E-17	3.93E-17
Eu-150m	1.60E-18	1.49E-18	1.39E-18	1.34E-18	1.22E-18	1.20E-18
Eu-152	3.96E-17	3.66E-17	3.43E-17	3.31E-17	3.04E-17	3.01E-17
Eu-152m	1.01E-17	9.26E-18	8.67E-18	8.37E-18	7.67E-18	7.59E-18
Eu-152n	1.43E-18	1.29E-18	1.19E-18	1.12E-18	9.88E-19	9.69E-19
Eu-154	4.28E-17	3.95E-17	3.70E-17	3.58E-17	3.29E-17	3.25E-17
Eu-154m	1.11E-18	9.78E-19	8.90E-19	8.37E-19	7.30E-19	7.17E-19
Eu-155	1.19E-18	1.08E-18	9.94E-19	9.40E-19	8.29E-19	8.14E-19
Eu-156	4.24E-17	3.93E-17	3.70E-17	3.59E-17	3.32E-17	3.28E-17
Eu-157	8.88E-18	8.19E-18	7.67E-18	7.34E-18	6.64E-18	6.55E-18
Eu-158	4.50E-17	4.15E-17	3.90E-17	3.77E-17	3.47E-17	3.43E-17
Eu-159	9.06E-18	8.30E-18	7.75E-18	7.45E-18	6.79E-18	6.71E-18
Gadolinium						
Gd-142	3.55E-17	3.29E-17	3.10E-17	2.98E-17	2.72E-17	2.69E-17
Gd-143m	7.22E-17	6.69E-17	6.29E-17	6.06E-17	5.54E-17	5.48E-17
Gd-144	3.05E-17	2.85E-17	2.68E-17	2.59E-17	2.38E-17	2.35E-17
Gd-145	8.17E-17	7.64E-17	7.22E-17	7.00E-17	6.49E-17	6.42E-17
Gd-145m	2.35E-17	2.17E-17	2.04E-17	1.96E-17	1.79E-17	1.77E-17
Gd-146	5.25E-18	4.81E-18	4.43E-18	4.21E-18	3.75E-18	3.68E-18
Gd-147	4.70E-17	4.34E-17	4.07E-17	3.92E-17	3.58E-17	3.54E-17
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	1.64E-17	1.51E-17	1.42E-17	1.36E-17	1.23E-17	1.21E-17
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	1.31E-18	1.18E-18	1.08E-18	1.02E-18	9.08E-19	8.94E-19
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	1.63E-18	1.44E-18	1.31E-18	1.23E-18	1.07E-18	1.05E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-159	1.57E-18	1.45E-18	1.36E-18	1.30E-18	1.17E-18	1.16E-18
Gd-162	1.40E-17	1.30E-17	1.23E-17	1.17E-17	1.06E-17	1.05E-17
Terbium						
Tb-146	1.25E-16	1.16E-16	1.09E-16	1.06E-16	9.78E-17	9.67E-17
Tb-147	7.46E-17	6.90E-17	6.48E-17	6.26E-17	5.76E-17	5.69E-17
Tb-147m	6.52E-17	6.06E-17	5.71E-17	5.53E-17	5.11E-17	5.05E-17
Tb-148	8.07E-17	7.50E-17	7.06E-17	6.81E-17	6.27E-17	6.20E-17
Tb-148m	1.08E-16	9.97E-17	9.36E-17	9.01E-17	8.23E-17	8.13E-17
Tb-149	4.56E-17	4.23E-17	3.98E-17	3.84E-17	3.52E-17	3.48E-17
Tb-149m	4.70E-17	4.33E-17	4.06E-17	3.91E-17	3.57E-17	3.53E-17
Tb-150	8.19E-17	7.65E-17	7.22E-17	6.99E-17	6.47E-17	6.40E-17
Tb-150m	8.60E-17	7.95E-17	7.46E-17	7.16E-17	6.53E-17	6.45E-17
Tb-151	3.21E-17	2.98E-17	2.79E-17	2.68E-17	2.44E-17	2.41E-17
Tb-151m	2.32E-18	2.13E-18	1.99E-18	1.91E-18	1.73E-18	1.71E-18
Tb-152	5.00E-17	4.65E-17	4.39E-17	4.23E-17	3.89E-17	3.85E-17
Tb-152m	2.42E-17	2.25E-17	2.11E-17	2.02E-17	1.83E-17	1.81E-17
Tb-153	9.58E-18	8.82E-18	8.24E-18	7.90E-18	7.15E-18	7.06E-18
Tb-154	7.63E-17	7.12E-17	6.72E-17	6.52E-17	6.05E-17	5.99E-17
Tb-155	3.88E-18	3.55E-18	3.28E-18	3.11E-18	2.77E-18	2.73E-18
Tb-156	6.52E-17	6.02E-17	5.66E-17	5.46E-17	5.01E-17	4.95E-17
Tb-156m	3.93E-19	3.21E-19	2.76E-19	2.54E-19	2.10E-19	2.06E-19
Tb-156n	4.59E-20	3.89E-20	3.45E-20	3.21E-20	2.74E-20	2.69E-20
Tb-157	4.04E-20	3.18E-20	2.68E-20	2.45E-20	1.98E-20	1.94E-20
Tb-158	2.69E-17	2.47E-17	2.31E-17	2.23E-17	2.04E-17	2.02E-17
Tb-160	3.87E-17	3.57E-17	3.34E-17	3.23E-17	2.96E-17	2.93E-17
Tb-161	3.90E-19	3.26E-19	2.87E-19	2.67E-19	2.25E-19	2.21E-19
Tb-162	3.77E-17	3.48E-17	3.26E-17	3.14E-17	2.87E-17	2.83E-17
Tb-163	2.65E-17	2.46E-17	2.32E-17	2.22E-17	2.01E-17	1.99E-17
Tb-164	8.37E-17	7.75E-17	7.28E-17	7.03E-17	6.45E-17	6.38E-17
Tb-165	2.91E-17	2.70E-17	2.54E-17	2.45E-17	2.27E-17	2.24E-17
Dysprosium						
Dy-148	2.39E-17	2.21E-17	2.07E-17	1.99E-17	1.81E-17	1.79E-17
Dy-149	5.45E-17	5.04E-17	4.74E-17	4.58E-17	4.22E-17	4.17E-17
Dy-150	8.77E-18	8.14E-18	7.64E-18	7.30E-18	6.60E-18	6.51E-18
Dy-151	4.63E-17	4.28E-17	4.02E-17	3.88E-17	3.56E-17	3.52E-17
Dy-152	8.37E-18	7.78E-18	7.29E-18	6.96E-18	6.25E-18	6.17E-18
Dy-153	2.76E-17	2.54E-17	2.38E-17	2.30E-17	2.10E-17	2.07E-17
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	2.15E-17	1.99E-17	1.86E-17	1.80E-17	1.64E-17	1.62E-17
Dy-157	1.05E-17	9.74E-18	9.14E-18	8.73E-18	7.86E-18	7.76E-18
Dy-159	4.18E-19	3.34E-19	2.84E-19	2.60E-19	2.12E-19	2.08E-19
Dy-165	8.07E-19	7.42E-19	6.94E-19	6.65E-19	6.03E-19	5.95E-19
Dy-165m	4.72E-19	4.33E-19	4.03E-19	3.85E-19	3.46E-19	3.41E-19
Dy-166	6.49E-19	5.64E-19	5.08E-19	4.76E-19	4.12E-19	4.06E-19
Dy-167	1.77E-17	1.65E-17	1.55E-17	1.48E-17	1.35E-17	1.33E-17
Dy-168	1.27E-17	1.18E-17	1.11E-17	1.06E-17	9.61E-18	9.48E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Holmium						
Ho-150	6.62E-17	6.12E-17	5.74E-17	5.52E-17	5.04E-17	4.98E-17
Ho-153	3.44E-17	3.19E-17	2.99E-17	2.87E-17	2.62E-17	2.59E-17
Ho-153m	3.52E-17	3.27E-17	3.07E-17	2.94E-17	2.67E-17	2.64E-17
Ho-154	6.44E-17	5.98E-17	5.62E-17	5.40E-17	4.93E-17	4.87E-17
Ho-154m	8.26E-17	7.66E-17	7.20E-17	6.91E-17	6.29E-17	6.21E-17
Ho-155	1.96E-17	1.82E-17	1.71E-17	1.64E-17	1.50E-17	1.48E-17
Ho-156	7.08E-17	6.58E-17	6.19E-17	5.97E-17	5.48E-17	5.42E-17
Ho-157	1.78E-17	1.64E-17	1.54E-17	1.47E-17	1.34E-17	1.32E-17
Ho-159	1.04E-17	9.56E-18	8.90E-18	8.51E-18	7.67E-18	7.56E-18
Ho-160	5.76E-17	5.30E-17	4.97E-17	4.79E-17	4.38E-17	4.33E-17
Ho-161	6.16E-19	5.16E-19	4.53E-19	4.21E-19	3.56E-19	3.49E-19
Ho-162	4.48E-18	4.09E-18	3.81E-18	3.67E-18	3.34E-18	3.30E-18
Ho-162m	1.79E-17	1.65E-17	1.55E-17	1.49E-17	1.37E-17	1.35E-17
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	3.28E-19	2.71E-19	2.36E-19	2.19E-19	1.83E-19	1.80E-19
Ho-164m	4.49E-19	3.64E-19	3.12E-19	2.87E-19	2.37E-19	2.33E-19
Ho-166	9.36E-19	8.60E-19	8.06E-19	7.78E-19	7.15E-19	7.07E-19
Ho-166m	5.51E-17	5.08E-17	4.76E-17	4.58E-17	4.18E-17	4.13E-17
Ho-167	1.18E-17	1.10E-17	1.03E-17	9.86E-18	8.91E-18	8.79E-18
Ho-168	3.04E-17	2.80E-17	2.62E-17	2.53E-17	2.32E-17	2.29E-17
Ho-168m	6.37E-20	5.17E-20	4.44E-20	4.08E-20	3.36E-20	3.31E-20
Ho-170	5.83E-17	5.36E-17	5.02E-17	4.85E-17	4.44E-17	4.39E-17
Erbium						
Er-154	1.38E-18	1.23E-18	1.12E-18	1.07E-18	9.47E-19	9.33E-19
Er-156	9.03E-19	7.81E-19	7.01E-19	6.58E-19	5.70E-19	5.61E-19
Er-159	3.21E-17	2.97E-17	2.79E-17	2.69E-17	2.46E-17	2.43E-17
Er-161	3.32E-17	3.06E-17	2.86E-17	2.76E-17	2.53E-17	2.50E-17
Er-163	4.32E-19	3.54E-19	3.07E-19	2.83E-19	2.36E-19	2.32E-19
Er-165	3.82E-19	3.10E-19	2.66E-19	2.45E-19	2.02E-19	1.98E-19
Er-167m	2.78E-18	2.60E-18	2.43E-18	2.32E-18	2.08E-18	2.05E-18
Er-169	9.86E-22	8.56E-22	7.71E-22	7.24E-22	6.25E-22	6.14E-22
Er-171	1.15E-17	1.07E-17	1.00E-17	9.57E-18	8.63E-18	8.51E-18
Er-172	1.68E-17	1.55E-17	1.46E-17	1.39E-17	1.27E-17	1.25E-17
Er-173	2.71E-17	2.50E-17	2.34E-17	2.25E-17	2.05E-17	2.03E-17
Thulium						
Tm-161	4.12E-17	3.83E-17	3.60E-17	3.47E-17	3.20E-17	3.16E-17
Tm-162	6.44E-17	5.99E-17	5.65E-17	5.47E-17	5.05E-17	5.00E-17
Tm-163	4.33E-17	4.00E-17	3.76E-17	3.63E-17	3.34E-17	3.30E-17
Tm-164	2.60E-17	2.42E-17	2.27E-17	2.19E-17	2.00E-17	1.98E-17
Tm-165	1.74E-17	1.61E-17	1.51E-17	1.44E-17	1.31E-17	1.29E-17
Tm-166	6.65E-17	6.17E-17	5.81E-17	5.62E-17	5.19E-17	5.13E-17
Tm-167	3.54E-18	3.25E-18	3.01E-18	2.87E-18	2.56E-18	2.52E-18
Tm-168	4.13E-17	3.80E-17	3.56E-17	3.43E-17	3.13E-17	3.09E-17
Tm-170	8.32E-20	7.39E-20	6.76E-20	6.38E-20	5.62E-20	5.54E-20
Tm-171	7.52E-21	6.28E-21	5.49E-21	5.09E-21	4.28E-21	4.22E-21

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-172	1.63E-17	1.51E-17	1.42E-17	1.37E-17	1.27E-17	1.26E-17
Tm-173	1.29E-17	1.20E-17	1.13E-17	1.08E-17	9.81E-18	9.68E-18
Tm-174	5.98E-17	5.53E-17	5.19E-17	4.99E-17	4.55E-17	4.50E-17
Tm-175	3.73E-17	3.45E-17	3.24E-17	3.11E-17	2.85E-17	2.82E-17
Tm-176	6.64E-17	6.17E-17	5.82E-17	5.63E-17	5.19E-17	5.13E-17
Ytterbium						
Yb-162	6.80E-18	6.28E-18	5.84E-18	5.58E-18	5.03E-18	4.96E-18
Yb-163	2.40E-17	2.22E-17	2.09E-17	2.01E-17	1.84E-17	1.82E-17
Yb-164	8.67E-19	7.55E-19	6.81E-19	6.41E-19	5.59E-19	5.52E-19
Yb-165	9.41E-18	8.60E-18	8.01E-18	7.69E-18	6.98E-18	6.90E-18
Yb-166	1.07E-18	8.97E-19	7.88E-19	7.31E-19	6.17E-19	6.08E-19
Yb-167	5.67E-18	5.16E-18	4.75E-18	4.51E-18	4.01E-18	3.95E-18
Yb-169	7.28E-18	6.64E-18	6.12E-18	5.81E-18	5.16E-18	5.09E-18
Yb-175	1.23E-18	1.15E-18	1.08E-18	1.03E-18	9.31E-19	9.18E-19
Yb-177	6.43E-18	5.93E-18	5.55E-18	5.36E-18	4.91E-18	4.86E-18
Yb-178	1.26E-18	1.18E-18	1.11E-18	1.06E-18	9.57E-19	9.44E-19
Yb-179	3.34E-17	3.09E-17	2.90E-17	2.79E-17	2.54E-17	2.51E-17
Lutetium						
Lu-165	3.62E-17	3.35E-17	3.15E-17	3.03E-17	2.78E-17	2.74E-17
Lu-167	5.63E-17	5.23E-17	4.93E-17	4.77E-17	4.40E-17	4.35E-17
Lu-169	4.39E-17	4.05E-17	3.80E-17	3.68E-17	3.39E-17	3.35E-17
Lu-169m	1.17E-23	7.27E-24	5.63E-24	4.76E-24	1.69E-24	1.57E-24
Lu-170	8.58E-17	8.01E-17	7.56E-17	7.34E-17	6.82E-17	6.75E-17
Lu-171	2.07E-17	1.90E-17	1.78E-17	1.71E-17	1.56E-17	1.54E-17
Lu-171m	4.56E-21	3.88E-21	3.45E-21	3.21E-21	2.73E-21	2.69E-21
Lu-172	6.64E-17	6.11E-17	5.73E-17	5.53E-17	5.08E-17	5.02E-17
Lu-172m	1.64E-23	1.21E-23	9.94E-24	8.90E-24	6.36E-24	6.18E-24
Lu-173	3.98E-18	3.60E-18	3.32E-18	3.15E-18	2.80E-18	2.76E-18
Lu-174	2.88E-18	2.60E-18	2.41E-18	2.32E-18	2.10E-18	2.08E-18
Lu-174m	9.02E-19	7.77E-19	6.96E-19	6.54E-19	5.67E-19	5.59E-19
Lu-176	1.48E-17	1.38E-17	1.30E-17	1.24E-17	1.12E-17	1.10E-17
Lu-176m	2.87E-19	2.57E-19	2.36E-19	2.23E-19	1.97E-19	1.94E-19
Lu-177	9.81E-19	9.13E-19	8.53E-19	8.15E-19	7.31E-19	7.20E-19
Lu-177m	3.02E-17	2.81E-17	2.63E-17	2.52E-17	2.27E-17	2.24E-17
Lu-178	4.34E-18	4.02E-18	3.78E-18	3.66E-18	3.38E-18	3.34E-18
Lu-178m	3.30E-17	3.06E-17	2.88E-17	2.75E-17	2.48E-17	2.45E-17
Lu-179	9.82E-19	9.18E-19	8.62E-19	8.25E-19	7.45E-19	7.36E-19
Lu-180	5.19E-17	4.80E-17	4.51E-17	4.36E-17	4.01E-17	3.96E-17
Lu-181	1.91E-17	1.76E-17	1.65E-17	1.59E-17	1.44E-17	1.43E-17
Hafnium						
Hf-167	2.03E-17	1.89E-17	1.77E-17	1.69E-17	1.54E-17	1.52E-17
Hf-169	2.08E-17	1.93E-17	1.81E-17	1.73E-17	1.57E-17	1.55E-17
Hf-170	1.31E-17	1.21E-17	1.13E-17	1.08E-17	9.79E-18	9.66E-18
Hf-172	1.55E-18	1.35E-18	1.21E-18	1.14E-18	9.85E-19	9.70E-19
Hf-173	1.10E-17	1.01E-17	9.46E-18	9.03E-18	8.13E-18	8.01E-18
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-175	1.06E-17	9.79E-18	9.18E-18	8.76E-18	7.89E-18	7.79E-18
Hf-177m	7.15E-17	6.65E-17	6.24E-17	5.97E-17	5.39E-17	5.31E-17
Hf-178m	7.29E-17	6.78E-17	6.36E-17	6.09E-17	5.52E-17	5.44E-17
Hf-179m	2.86E-17	2.66E-17	2.49E-17	2.38E-17	2.15E-17	2.12E-17
Hf-180m	3.15E-17	2.93E-17	2.75E-17	2.63E-17	2.38E-17	2.35E-17
Hf-181	1.72E-17	1.60E-17	1.50E-17	1.43E-17	1.30E-17	1.28E-17
Hf-182	7.51E-18	7.01E-18	6.58E-18	6.29E-18	5.66E-18	5.59E-18
Hf-182m	2.94E-17	2.72E-17	2.55E-17	2.44E-17	2.22E-17	2.19E-17
Hf-183	2.61E-17	2.40E-17	2.25E-17	2.17E-17	1.98E-17	1.96E-17
Hf-184	6.80E-18	6.33E-18	5.91E-18	5.64E-18	5.08E-18	5.01E-18
Tantalum						
Ta-170	3.64E-17	3.37E-17	3.16E-17	3.04E-17	2.77E-17	2.73E-17
Ta-172	5.73E-17	5.29E-17	4.97E-17	4.80E-17	4.40E-17	4.35E-17
Ta-173	1.81E-17	1.67E-17	1.57E-17	1.51E-17	1.38E-17	1.36E-17
Ta-174	3.19E-17	2.96E-17	2.78E-17	2.68E-17	2.46E-17	2.43E-17
Ta-175	3.62E-17	3.35E-17	3.15E-17	3.04E-17	2.79E-17	2.76E-17
Ta-176	7.52E-17	6.99E-17	6.58E-17	6.38E-17	5.91E-17	5.85E-17
Ta-177	1.16E-18	1.02E-18	9.22E-19	8.69E-19	7.61E-19	7.50E-19
Ta-178	3.02E-18	2.74E-18	2.54E-18	2.44E-18	2.21E-18	2.18E-18
Ta-178m	3.55E-17	3.30E-17	3.10E-17	2.96E-17	2.67E-17	2.63E-17
Ta-179	3.10E-19	2.60E-19	2.29E-19	2.12E-19	1.79E-19	1.76E-19
Ta-180	6.51E-19	5.55E-19	4.93E-19	4.59E-19	3.91E-19	3.85E-19
Ta-182	4.36E-17	4.01E-17	3.76E-17	3.64E-17	3.35E-17	3.31E-17
Ta-182m	6.82E-18	6.33E-18	5.86E-18	5.59E-18	5.01E-18	4.94E-18
Ta-183	8.03E-18	7.43E-18	6.93E-18	6.61E-18	5.93E-18	5.84E-18
Ta-184	5.29E-17	4.89E-17	4.59E-17	4.41E-17	4.02E-17	3.97E-17
Ta-185	4.27E-18	3.96E-18	3.68E-18	3.52E-18	3.17E-18	3.13E-18
Ta-186	4.79E-17	4.44E-17	4.16E-17	4.00E-17	3.64E-17	3.60E-17
Tungsten						
W-177	2.87E-17	2.65E-17	2.48E-17	2.38E-17	2.17E-17	2.14E-17
W-178	1.95E-19	1.64E-19	1.45E-19	1.34E-19	1.14E-19	1.12E-19
W-179	6.49E-19	5.44E-19	4.79E-19	4.44E-19	3.75E-19	3.69E-19
W-179m	1.12E-18	1.00E-18	9.22E-19	8.72E-19	7.68E-19	7.58E-19
W-181	5.19E-19	4.38E-19	3.86E-19	3.58E-19	3.03E-19	2.99E-19
W-185	2.76E-21	2.45E-21	2.23E-21	2.10E-21	1.84E-21	1.81E-21
W-185m	5.50E-19	5.04E-19	4.64E-19	4.41E-19	3.93E-19	3.87E-19
W-187	1.49E-17	1.38E-17	1.29E-17	1.24E-17	1.13E-17	1.12E-17
W-188	5.83E-20	5.42E-20	5.08E-20	4.85E-20	4.36E-20	4.30E-20
W-190	3.31E-18	3.03E-18	2.77E-18	2.63E-18	2.34E-18	2.31E-18
Rhenium						
Re-178	5.63E-17	5.26E-17	4.96E-17	4.80E-17	4.43E-17	4.38E-17
Re-179	3.55E-17	3.29E-17	3.10E-17	2.98E-17	2.72E-17	2.69E-17
Re-180	4.05E-17	3.72E-17	3.49E-17	3.36E-17	3.08E-17	3.04E-17
Re-181	2.58E-17	2.38E-17	2.23E-17	2.14E-17	1.95E-17	1.93E-17
Re-182	5.82E-17	5.37E-17	5.03E-17	4.86E-17	4.45E-17	4.40E-17
Re-182m	4.03E-17	3.71E-17	3.47E-17	3.36E-17	3.09E-17	3.06E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-183	3.25E-18	2.95E-18	2.71E-18	2.57E-18	2.27E-18	2.24E-18
Re-184	2.98E-17	2.73E-17	2.56E-17	2.47E-17	2.25E-17	2.23E-17
Re-184m	1.17E-17	1.07E-17	1.00E-17	9.64E-18	8.76E-18	8.65E-18
Re-186	5.03E-19	4.64E-19	4.27E-19	4.07E-19	3.65E-19	3.59E-19
Re-186m	1.95E-19	1.65E-19	1.46E-19	1.36E-19	1.16E-19	1.14E-19
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	2.07E-18	1.92E-18	1.80E-18	1.73E-18	1.58E-18	1.56E-18
Re-188m	1.14E-18	9.97E-19	9.02E-19	8.47E-19	7.35E-19	7.24E-19
Re-189	1.70E-18	1.58E-18	1.48E-18	1.42E-18	1.28E-18	1.26E-18
Re-190	4.54E-17	4.20E-17	3.95E-17	3.79E-17	3.45E-17	3.41E-17
Re-190m	3.08E-17	2.85E-17	2.68E-17	2.57E-17	2.34E-17	2.31E-17
Osmium						
Os-180	3.05E-18	2.76E-18	2.56E-18	2.44E-18	2.19E-18	2.16E-18
Os-181	4.58E-17	4.23E-17	3.97E-17	3.83E-17	3.51E-17	3.47E-17
Os-182	1.32E-17	1.22E-17	1.14E-17	1.09E-17	9.90E-18	9.77E-18
Os-183	1.90E-17	1.76E-17	1.65E-17	1.58E-17	1.43E-17	1.41E-17
Os-183m	3.41E-17	3.14E-17	2.94E-17	2.84E-17	2.61E-17	2.58E-17
Os-185	2.30E-17	2.12E-17	1.99E-17	1.91E-17	1.74E-17	1.72E-17
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	5.09E-23	3.23E-23	2.53E-23	2.17E-23	6.74E-24	6.20E-24
Os-190m	5.34E-17	4.96E-17	4.66E-17	4.46E-17	4.06E-17	4.00E-17
Os-191	1.66E-18	1.50E-18	1.38E-18	1.30E-18	1.15E-18	1.14E-18
Os-191m	8.49E-20	7.26E-20	6.47E-20	6.03E-20	5.15E-20	5.08E-20
Os-193	2.02E-18	1.87E-18	1.75E-18	1.67E-18	1.51E-18	1.49E-18
Os-194	2.09E-20	1.64E-20	1.38E-20	1.26E-20	1.02E-20	9.95E-21
Os-196	2.47E-18	2.29E-18	2.14E-18	2.05E-18	1.85E-18	1.82E-18
Iridium						
Ir-180	5.42E-17	5.02E-17	4.71E-17	4.52E-17	4.12E-17	4.07E-17
Ir-182	4.75E-17	4.40E-17	4.13E-17	3.97E-17	3.62E-17	3.58E-17
Ir-183	3.90E-17	3.62E-17	3.40E-17	3.28E-17	3.02E-17	2.99E-17
Ir-184	6.57E-17	6.09E-17	5.72E-17	5.51E-17	5.05E-17	5.00E-17
Ir-185	2.75E-17	2.55E-17	2.40E-17	2.32E-17	2.14E-17	2.11E-17
Ir-186	5.51E-17	5.11E-17	4.81E-17	4.63E-17	4.25E-17	4.20E-17
Ir-186m	4.20E-17	3.89E-17	3.66E-17	3.53E-17	3.25E-17	3.21E-17
Ir-187	1.00E-17	9.20E-18	8.59E-18	8.25E-18	7.49E-18	7.40E-18
Ir-188	7.00E-17	6.54E-17	6.17E-17	5.98E-17	5.54E-17	5.48E-17
Ir-189	1.48E-18	1.32E-18	1.21E-18	1.14E-18	1.00E-18	9.87E-19
Ir-190	4.89E-17	4.53E-17	4.26E-17	4.08E-17	3.71E-17	3.66E-17
Ir-190m	5.76E-23	3.70E-23	2.93E-23	2.53E-23	7.75E-24	7.12E-24
Ir-190n	9.03E-19	7.86E-19	7.08E-19	6.63E-19	5.74E-19	5.66E-19
Ir-191m	1.49E-18	1.35E-18	1.24E-18	1.17E-18	1.04E-18	1.02E-18
Ir-192	2.71E-17	2.52E-17	2.37E-17	2.27E-17	2.06E-17	2.03E-17
Ir-192m	1.70E-21	1.51E-21	1.38E-21	1.31E-21	1.12E-21	1.10E-21
Ir-192n	1.16E-20	1.02E-20	9.22E-21	8.67E-21	7.50E-21	7.39E-21
Ir-193m	4.75E-21	4.06E-21	3.63E-21	3.39E-21	2.89E-21	2.85E-21
Ir-194	3.25E-18	3.02E-18	2.84E-18	2.73E-18	2.49E-18	2.46E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-194m	7.93E-17	7.35E-17	6.91E-17	6.62E-17	6.02E-17	5.95E-17
Ir-195	1.07E-18	9.56E-19	8.74E-19	8.24E-19	7.22E-19	7.11E-19
Ir-195m	1.19E-17	1.11E-17	1.04E-17	9.92E-18	8.98E-18	8.87E-18
Ir-196	8.30E-18	7.70E-18	7.24E-18	6.96E-18	6.36E-18	6.29E-18
Ir-196m	8.36E-17	7.76E-17	7.29E-17	6.99E-17	6.36E-17	6.28E-17
Platinum						
Pt-184	2.13E-17	1.97E-17	1.84E-17	1.76E-17	1.59E-17	1.57E-17
Pt-186	2.22E-17	2.04E-17	1.91E-17	1.84E-17	1.67E-17	1.65E-17
Pt-187	1.91E-17	1.75E-17	1.64E-17	1.58E-17	1.43E-17	1.41E-17
Pt-188	5.28E-18	4.86E-18	4.52E-18	4.30E-18	3.85E-18	3.80E-18
Pt-189	1.47E-17	1.35E-17	1.26E-17	1.21E-17	1.10E-17	1.08E-17
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	8.02E-18	7.36E-18	6.86E-18	6.54E-18	5.88E-18	5.80E-18
Pt-193	1.41E-22	9.19E-23	7.34E-23	6.39E-23	1.99E-23	1.82E-23
Pt-193m	1.65E-19	1.42E-19	1.28E-19	1.20E-19	1.03E-19	1.02E-19
Pt-195m	1.24E-18	1.09E-18	9.89E-19	9.29E-19	8.09E-19	7.96E-19
Pt-197	5.21E-19	4.72E-19	4.35E-19	4.12E-19	3.64E-19	3.59E-19
Pt-197m	2.03E-18	1.86E-18	1.73E-18	1.64E-18	1.47E-18	1.45E-18
Pt-199	6.76E-18	6.27E-18	5.89E-18	5.65E-18	5.14E-18	5.07E-18
Pt-200	1.39E-18	1.27E-18	1.18E-18	1.12E-18	9.95E-19	9.81E-19
Pt-202	1.16E-19	1.11E-19	1.06E-19	1.03E-19	9.77E-20	9.70E-20
Gold						
Au-186	5.07E-17	4.70E-17	4.42E-17	4.25E-17	3.88E-17	3.83E-17
Au-187	3.54E-17	3.28E-17	3.08E-17	2.98E-17	2.74E-17	2.71E-17
Au-190	7.87E-17	7.38E-17	6.98E-17	6.76E-17	6.26E-17	6.19E-17
Au-191	1.86E-17	1.72E-17	1.61E-17	1.54E-17	1.40E-17	1.38E-17
Au-192	6.46E-17	6.03E-17	5.69E-17	5.51E-17	5.10E-17	5.04E-17
Au-193	4.05E-18	3.70E-18	3.43E-18	3.26E-18	2.91E-18	2.87E-18
Au-193m	5.98E-18	5.57E-18	5.23E-18	5.00E-18	4.49E-18	4.43E-18
Au-194	3.43E-17	3.19E-17	3.00E-17	2.90E-17	2.66E-17	2.63E-17
Au-195	1.34E-18	1.17E-18	1.06E-18	9.96E-19	8.63E-19	8.50E-19
Au-195m	6.09E-18	5.67E-18	5.33E-18	5.09E-18	4.57E-18	4.51E-18
Au-196	1.48E-17	1.37E-17	1.29E-17	1.23E-17	1.11E-17	1.09E-17
Au-196m	6.24E-18	5.78E-18	5.36E-18	5.11E-18	4.57E-18	4.51E-18
Au-198	1.36E-17	1.26E-17	1.19E-17	1.14E-17	1.03E-17	1.02E-17
Au-198m	1.50E-17	1.39E-17	1.30E-17	1.24E-17	1.11E-17	1.10E-17
Au-199	2.62E-18	2.45E-18	2.27E-18	2.17E-18	1.95E-18	1.92E-18
Au-200	9.59E-18	8.87E-18	8.34E-18	8.06E-18	7.40E-18	7.32E-18
Au-200m	6.68E-17	6.20E-17	5.82E-17	5.58E-17	5.07E-17	5.01E-17
Au-201	1.18E-18	1.10E-18	1.03E-18	9.87E-19	8.98E-19	8.87E-19
Au-202	6.27E-18	5.80E-18	5.46E-18	5.27E-18	4.84E-18	4.78E-18
Mercury						
Hg-190	4.75E-18	4.38E-18	4.03E-18	3.84E-18	3.43E-18	3.38E-18
Hg-191m	4.93E-17	4.57E-17	4.29E-17	4.13E-17	3.77E-17	3.73E-17
Hg-192	7.41E-18	6.84E-18	6.39E-18	6.09E-18	5.45E-18	5.38E-18
Hg-193	2.74E-17	2.53E-17	2.37E-17	2.29E-17	2.10E-17	2.08E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-193m	3.42E-17	3.16E-17	2.97E-17	2.86E-17	2.62E-17	2.59E-17
Hg-194	2.23E-22	1.49E-22	1.21E-22	1.07E-22	3.41E-23	3.12E-23
Hg-195	5.66E-18	5.16E-18	4.81E-18	4.61E-18	4.18E-18	4.13E-18
Hg-195m	5.91E-18	5.46E-18	5.12E-18	4.89E-18	4.41E-18	4.36E-18
Hg-197	1.18E-18	1.03E-18	9.32E-19	8.74E-19	7.56E-19	7.46E-19
Hg-197m	2.31E-18	2.13E-18	1.97E-18	1.87E-18	1.68E-18	1.65E-18
Hg-199m	4.89E-18	4.53E-18	4.21E-18	4.01E-18	3.61E-18	3.56E-18
Hg-203	7.56E-18	7.05E-18	6.63E-18	6.33E-18	5.70E-18	5.63E-18
Hg-205	2.34E-19	2.19E-19	2.07E-19	1.99E-19	1.82E-19	1.80E-19
Hg-206	3.93E-18	3.65E-18	3.43E-18	3.28E-18	2.96E-18	2.93E-18
Hg-207	9.12E-17	8.47E-17	7.98E-17	7.73E-17	7.15E-17	7.07E-17
Thallium						
Tl-190	4.46E-17	4.14E-17	3.89E-17	3.73E-17	3.40E-17	3.36E-17
Tl-190m	8.41E-17	7.78E-17	7.31E-17	7.02E-17	6.40E-17	6.32E-17
Tl-194	3.08E-17	2.85E-17	2.68E-17	2.57E-17	2.33E-17	2.31E-17
Tl-194m	8.54E-17	7.90E-17	7.42E-17	7.12E-17	6.49E-17	6.41E-17
Tl-195	4.08E-17	3.78E-17	3.56E-17	3.44E-17	3.18E-17	3.14E-17
Tl-196	6.31E-17	5.87E-17	5.53E-17	5.34E-17	4.92E-17	4.86E-17
Tl-197	1.44E-17	1.32E-17	1.24E-17	1.19E-17	1.09E-17	1.08E-17
Tl-198	6.77E-17	6.29E-17	5.93E-17	5.73E-17	5.29E-17	5.23E-17
Tl-198m	4.04E-17	3.74E-17	3.51E-17	3.36E-17	3.06E-17	3.02E-17
Tl-199	7.10E-18	6.53E-18	6.10E-18	5.83E-18	5.25E-18	5.18E-18
Tl-200	4.40E-17	4.07E-17	3.82E-17	3.68E-17	3.37E-17	3.33E-17
Tl-201	1.77E-18	1.58E-18	1.44E-18	1.36E-18	1.20E-18	1.18E-18
Tl-202	1.47E-17	1.36E-17	1.28E-17	1.22E-17	1.10E-17	1.09E-17
Tl-204	3.01E-20	2.67E-20	2.45E-20	2.31E-20	2.03E-20	2.01E-20
Tl-206	7.84E-20	7.44E-20	7.13E-20	6.93E-20	6.53E-20	6.47E-20
Tl-206m	8.22E-17	7.60E-17	7.13E-17	6.86E-17	6.25E-17	6.18E-17
Tl-207	1.45E-19	1.35E-19	1.28E-19	1.24E-19	1.15E-19	1.14E-19
Tl-208	1.12E-16	1.05E-16	9.98E-17	9.69E-17	9.03E-17	8.93E-17
Tl-209	7.26E-17	6.76E-17	6.36E-17	6.15E-17	5.68E-17	5.61E-17
Tl-210	9.51E-17	8.82E-17	8.30E-17	8.03E-17	7.40E-17	7.32E-17
Lead						
Pb-194	3.57E-17	3.30E-17	3.10E-17	2.99E-17	2.74E-17	2.71E-17
Pb-195m	5.55E-17	5.13E-17	4.82E-17	4.63E-17	4.22E-17	4.17E-17
Pb-196	1.51E-17	1.40E-17	1.31E-17	1.25E-17	1.13E-17	1.12E-17
Pb-197	5.15E-17	4.77E-17	4.49E-17	4.34E-17	3.99E-17	3.95E-17
Pb-197m	3.87E-17	3.58E-17	3.36E-17	3.23E-17	2.94E-17	2.90E-17
Pb-198	1.32E-17	1.22E-17	1.15E-17	1.10E-17	9.89E-18	9.76E-18
Pb-199	3.46E-17	3.20E-17	3.01E-17	2.90E-17	2.67E-17	2.64E-17
Pb-200	5.18E-18	4.77E-18	4.42E-18	4.21E-18	3.77E-18	3.71E-18
Pb-201	2.46E-17	2.27E-17	2.13E-17	2.04E-17	1.86E-17	1.84E-17
Pb-201m	1.22E-17	1.13E-17	1.06E-17	1.02E-17	9.27E-18	9.16E-18
Pb-202	2.38E-22	1.52E-22	1.21E-22	1.04E-22	3.25E-23	2.98E-23
Pb-202m	6.89E-17	6.35E-17	5.95E-17	5.73E-17	5.24E-17	5.18E-17
Pb-203	9.12E-18	8.44E-18	7.91E-18	7.55E-18	6.78E-18	6.69E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-204m	7.17E-17	6.60E-17	6.18E-17	5.96E-17	5.46E-17	5.40E-17
Pb-205	2.41E-22	1.54E-22	1.22E-22	1.06E-22	3.29E-23	3.02E-23
Pb-209	5.35E-21	4.84E-21	4.46E-21	4.24E-21	3.78E-21	3.72E-21
Pb-210	1.97E-20	1.57E-20	1.34E-20	1.22E-20	9.87E-21	9.68E-21
Pb-211	2.26E-18	2.09E-18	1.96E-18	1.88E-18	1.72E-18	1.70E-18
Pb-212	4.18E-18	3.88E-18	3.64E-18	3.47E-18	3.11E-18	3.07E-18
Pb-214	8.07E-18	7.50E-18	7.05E-18	6.74E-18	6.08E-18	6.00E-18
Bismuth						
Bi-197	5.79E-17	5.35E-17	5.02E-17	4.85E-17	4.45E-17	4.40E-17
Bi-200	8.24E-17	7.61E-17	7.14E-17	6.87E-17	6.27E-17	6.19E-17
Bi-201	5.88E-17	5.43E-17	5.10E-17	4.94E-17	4.55E-17	4.50E-17
Bi-202	9.41E-17	8.69E-17	8.15E-17	7.86E-17	7.20E-17	7.12E-17
Bi-203	8.11E-17	7.52E-17	7.07E-17	6.85E-17	6.32E-17	6.25E-17
Bi-204	9.98E-17	9.20E-17	8.64E-17	8.34E-17	7.65E-17	7.57E-17
Bi-205	5.73E-17	5.31E-17	5.00E-17	4.84E-17	4.47E-17	4.42E-17
Bi-206	1.12E-16	1.03E-16	9.71E-17	9.37E-17	8.59E-17	8.50E-17
Bi-207	5.23E-17	4.83E-17	4.53E-17	4.37E-17	4.00E-17	3.96E-17
Bi-208	8.64E-17	8.18E-17	7.78E-17	7.57E-17	7.10E-17	7.03E-17
Bi-210	3.45E-20	3.25E-20	3.10E-20	3.00E-20	2.81E-20	2.78E-20
Bi-210m	8.36E-18	7.78E-18	7.32E-18	7.00E-18	6.31E-18	6.23E-18
Bi-211	1.54E-18	1.43E-18	1.35E-18	1.29E-18	1.16E-18	1.15E-18
Bi-212	3.67E-18	3.39E-18	3.19E-18	3.08E-18	2.83E-18	2.80E-18
Bi-212n	7.47E-20	7.10E-20	6.81E-20	6.63E-20	6.24E-20	6.20E-20
Bi-213	4.32E-18	4.01E-18	3.77E-18	3.61E-18	3.28E-18	3.24E-18
Bi-214	5.11E-17	4.74E-17	4.47E-17	4.33E-17	4.00E-17	3.95E-17
Bi-215	8.43E-18	7.81E-18	7.34E-18	7.05E-18	6.42E-18	6.34E-18
Bi-216	2.57E-17	2.38E-17	2.24E-17	2.15E-17	1.95E-17	1.93E-17
Polonium						
Po-203	5.54E-17	5.11E-17	4.79E-17	4.63E-17	4.25E-17	4.21E-17
Po-204	3.79E-17	3.48E-17	3.26E-17	3.14E-17	2.86E-17	2.83E-17
Po-205	5.38E-17	4.96E-17	4.65E-17	4.50E-17	4.13E-17	4.08E-17
Po-206	3.97E-17	3.66E-17	3.43E-17	3.30E-17	3.01E-17	2.98E-17
Po-207	4.36E-17	4.01E-17	3.76E-17	3.63E-17	3.32E-17	3.29E-17
Po-208	6.96E-22	6.43E-22	6.03E-22	5.79E-22	5.26E-22	5.20E-22
Po-209	2.04E-19	1.87E-19	1.76E-19	1.69E-19	1.54E-19	1.52E-19
Po-210	3.40E-22	3.13E-22	2.93E-22	2.83E-22	2.59E-22	2.56E-22
Po-211	2.84E-19	2.62E-19	2.46E-19	2.37E-19	2.17E-19	2.14E-19
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	2.62E-18	2.48E-18	2.35E-18	2.28E-18	2.13E-18	2.11E-18
Po-213	1.31E-21	1.20E-21	1.13E-21	1.09E-21	9.96E-22	9.85E-22
Po-214	2.90E-21	2.67E-21	2.50E-21	2.41E-21	2.21E-21	2.18E-21
Po-215	5.95E-21	5.54E-21	5.21E-21	4.98E-21	4.52E-21	4.46E-21
Po-216	5.36E-22	4.92E-22	4.61E-22	4.45E-22	4.07E-22	4.03E-22
Po-218	7.56E-26	6.37E-26	5.66E-26	5.27E-26	4.47E-26	4.38E-26
Astatine						
At-204	7.93E-17	7.33E-17	6.89E-17	6.61E-17	6.02E-17	5.95E-17

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
At-205	3.84E-17	3.55E-17	3.34E-17	3.21E-17	2.94E-17	2.91E-17
At-206	8.45E-17	7.82E-17	7.34E-17	7.06E-17	6.45E-17	6.37E-17
At-207	6.81E-17	6.30E-17	5.93E-17	5.72E-17	5.26E-17	5.20E-17
At-208	1.04E-16	9.57E-17	8.99E-17	8.67E-17	7.95E-17	7.86E-17
At-209	7.74E-17	7.14E-17	6.69E-17	6.45E-17	5.89E-17	5.82E-17
At-210	1.01E-16	9.36E-17	8.80E-17	8.52E-17	7.85E-17	7.77E-17
At-211	6.87E-19	6.14E-19	5.64E-19	5.32E-19	4.68E-19	4.60E-19
At-215	5.67E-21	5.28E-21	4.96E-21	4.74E-21	4.30E-21	4.24E-21
At-216	5.74E-20	5.24E-20	4.86E-20	4.61E-20	4.10E-20	4.04E-20
At-217	7.63E-21	7.08E-21	6.65E-21	6.36E-21	5.74E-21	5.66E-21
At-218	3.34E-22	3.18E-22	3.05E-22	2.97E-22	2.81E-22	2.79E-22
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	1.51E-17	1.41E-17	1.32E-17	1.27E-17	1.15E-17	1.13E-17
Radon						
Rn-207	3.30E-17	3.05E-17	2.87E-17	2.75E-17	2.51E-17	2.48E-17
Rn-209	4.00E-17	3.70E-17	3.48E-17	3.35E-17	3.07E-17	3.04E-17
Rn-210	2.02E-18	1.86E-18	1.75E-18	1.68E-18	1.53E-18	1.51E-18
Rn-211	6.41E-17	5.92E-17	5.55E-17	5.36E-17	4.92E-17	4.86E-17
Rn-212	1.18E-20	1.09E-20	1.02E-20	9.80E-21	8.95E-21	8.84E-21
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	2.62E-20	2.42E-20	2.27E-20	2.18E-20	1.99E-20	1.97E-20
Rn-219	1.90E-18	1.77E-18	1.67E-18	1.60E-18	1.44E-18	1.42E-18
Rn-220	2.16E-20	2.00E-20	1.88E-20	1.80E-20	1.64E-20	1.62E-20
Rn-222	1.33E-20	1.23E-20	1.16E-20	1.11E-20	1.01E-20	9.97E-21
Rn-223	1.14E-17	1.05E-17	9.87E-18	9.49E-18	8.66E-18	8.56E-18
Francium						
Fr-212	3.84E-17	3.54E-17	3.33E-17	3.21E-17	2.95E-17	2.92E-17
Fr-219	1.17E-19	1.09E-19	1.02E-19	9.77E-20	8.85E-20	8.73E-20
Fr-220	2.06E-19	1.88E-19	1.74E-19	1.65E-19	1.47E-19	1.44E-19
Fr-221	8.82E-19	8.24E-19	7.72E-19	7.38E-19	6.63E-19	6.54E-19
Fr-222	5.56E-18	5.18E-18	4.86E-18	4.66E-18	4.22E-18	4.16E-18
Fr-223	1.21E-18	1.09E-18	1.01E-18	9.56E-19	8.51E-19	8.39E-19
Fr-224	1.87E-17	1.74E-17	1.63E-17	1.58E-17	1.45E-17	1.43E-17
Fr-227	1.42E-17	1.32E-17	1.23E-17	1.18E-17	1.08E-17	1.06E-17
Radium						
Ra-219	5.37E-18	5.00E-18	4.70E-18	4.49E-18	4.05E-18	3.99E-18
Ra-220	1.58E-19	1.47E-19	1.39E-19	1.33E-19	1.20E-19	1.19E-19
Ra-221	9.36E-19	8.71E-19	8.07E-19	7.70E-19	6.92E-19	6.81E-19
Ra-222	3.01E-19	2.81E-19	2.64E-19	2.53E-19	2.28E-19	2.25E-19
Ra-223	3.86E-18	3.57E-18	3.34E-18	3.18E-18	2.86E-18	2.82E-18
Ra-224	3.25E-19	3.03E-19	2.85E-19	2.72E-19	2.45E-19	2.42E-19
Ra-225	8.91E-20	6.75E-20	5.60E-20	5.06E-20	4.01E-20	3.91E-20
Ra-226	2.15E-19	2.01E-19	1.88E-19	1.79E-19	1.61E-19	1.59E-19
Ra-227	4.54E-18	4.21E-18	3.96E-18	3.79E-18	3.42E-18	3.38E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-228	1.18E-21	8.11E-22	6.93E-22	6.43E-22	2.72E-22	2.49E-22
Ra-230	2.25E-18	2.09E-18	1.95E-18	1.86E-18	1.68E-18	1.65E-18
Actinium						
Ac-223	5.09E-19	4.73E-19	4.43E-19	4.23E-19	3.81E-19	3.75E-19
Ac-224	6.14E-18	5.71E-18	5.33E-18	5.09E-18	4.56E-18	4.49E-18
Ac-225	3.62E-19	3.34E-19	3.11E-19	2.97E-19	2.65E-19	2.61E-19
Ac-226	3.86E-18	3.61E-18	3.38E-18	3.23E-18	2.90E-18	2.86E-18
Ac-227	2.03E-21	1.78E-21	1.63E-21	1.54E-21	1.31E-21	1.28E-21
Ac-228	2.98E-17	2.75E-17	2.58E-17	2.49E-17	2.28E-17	2.26E-17
Ac-230	1.88E-17	1.75E-17	1.65E-17	1.60E-17	1.48E-17	1.46E-17
Ac-231	1.31E-17	1.22E-17	1.14E-17	1.09E-17	9.85E-18	9.72E-18
Ac-232	3.96E-17	3.69E-17	3.49E-17	3.38E-17	3.13E-17	3.10E-17
Ac-233	1.73E-17	1.60E-17	1.51E-17	1.45E-17	1.32E-17	1.30E-17
Thorium						
Th-223	1.66E-18	1.53E-18	1.42E-18	1.35E-18	1.20E-18	1.18E-18
Th-224	6.81E-19	6.38E-19	5.96E-19	5.69E-19	5.13E-19	5.06E-19
Th-226	2.07E-19	1.92E-19	1.80E-19	1.71E-19	1.54E-19	1.51E-19
Th-227	3.71E-18	3.45E-18	3.24E-18	3.09E-18	2.78E-18	2.74E-18
Th-228	5.05E-20	4.64E-20	4.30E-20	4.09E-20	3.63E-20	3.58E-20
Th-229	2.02E-18	1.86E-18	1.73E-18	1.64E-18	1.46E-18	1.44E-18
Th-230	8.23E-21	7.28E-21	6.63E-21	6.25E-21	5.39E-21	5.30E-21
Th-231	2.41E-19	2.15E-19	1.97E-19	1.86E-19	1.63E-19	1.60E-19
Th-232	3.86E-21	3.30E-21	2.95E-21	2.77E-21	2.30E-21	2.26E-21
Th-233	1.15E-18	1.06E-18	9.98E-19	9.57E-19	8.69E-19	8.58E-19
Th-234	1.70E-19	1.52E-19	1.40E-19	1.32E-19	1.16E-19	1.14E-19
Th-235	1.96E-18	1.81E-18	1.70E-18	1.64E-18	1.50E-18	1.48E-18
Th-236	1.07E-18	9.97E-19	9.35E-19	8.96E-19	8.12E-19	8.01E-19
Protactinium						
Pa-227	3.96E-19	3.58E-19	3.30E-19	3.13E-19	2.76E-19	2.71E-19
Pa-228	4.58E-17	4.23E-17	3.97E-17	3.83E-17	3.51E-17	3.47E-17
Pa-229	1.34E-18	1.23E-18	1.14E-18	1.08E-18	9.60E-19	9.42E-19
Pa-230	2.23E-17	2.05E-17	1.92E-17	1.85E-17	1.69E-17	1.67E-17
Pa-231	1.05E-18	9.73E-19	9.14E-19	8.73E-19	7.85E-19	7.74E-19
Pa-232	3.22E-17	2.97E-17	2.78E-17	2.68E-17	2.46E-17	2.43E-17
Pa-233	6.62E-18	6.17E-18	5.80E-18	5.54E-18	4.99E-18	4.92E-18
Pa-234	4.97E-17	4.58E-17	4.30E-17	4.14E-17	3.79E-17	3.75E-17
Pa-234m	7.43E-19	6.91E-19	6.52E-19	6.32E-19	5.85E-19	5.79E-19
Pa-235	5.74E-20	5.44E-20	5.21E-20	5.07E-20	4.76E-20	4.73E-20
Pa-236	3.14E-17	2.91E-17	2.74E-17	2.65E-17	2.45E-17	2.42E-17
Pa-237	2.13E-17	1.96E-17	1.84E-17	1.77E-17	1.62E-17	1.60E-17
Uranium						
U-227	3.30E-18	3.07E-18	2.87E-18	2.74E-18	2.46E-18	2.43E-18
U-228	1.01E-19	9.34E-20	8.71E-20	8.30E-20	7.40E-20	7.28E-20
U-230	2.78E-20	2.54E-20	2.34E-20	2.22E-20	1.96E-20	1.93E-20
U-231	1.53E-18	1.40E-18	1.31E-18	1.24E-18	1.10E-18	1.08E-18
U-232	5.74E-21	5.00E-21	4.53E-21	4.28E-21	3.59E-21	3.52E-21

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-233	6.55E-21	5.92E-21	5.48E-21	5.21E-21	4.56E-21	4.48E-21
U-234	3.04E-21	2.56E-21	2.29E-21	2.16E-21	1.72E-21	1.67E-21
U-235	4.74E-18	4.45E-18	4.15E-18	3.97E-18	3.57E-18	3.52E-18
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	1.76E-21	1.41E-21	1.25E-21	1.17E-21	8.56E-22	8.29E-22
U-237	3.31E-18	3.06E-18	2.84E-18	2.71E-18	2.42E-18	2.38E-18
U-238	1.54E-21	1.25E-21	1.12E-21	1.05E-21	7.97E-22	7.75E-22
U-239	1.07E-18	9.53E-19	8.75E-19	8.29E-19	7.35E-19	7.25E-19
U-240	1.07E-19	9.83E-20	9.11E-20	8.65E-20	7.66E-20	7.52E-20
U-242	1.24E-18	1.14E-18	1.07E-18	1.02E-18	9.24E-19	9.12E-19
Neptunium						
Np-232	3.99E-17	3.68E-17	3.45E-17	3.32E-17	3.03E-17	3.00E-17
Np-233	2.05E-18	1.89E-18	1.77E-18	1.68E-18	1.50E-18	1.47E-18
Np-234	3.73E-17	3.46E-17	3.26E-17	3.16E-17	2.92E-17	2.88E-17
Np-235	1.52E-20	1.33E-20	1.22E-20	1.15E-20	9.63E-21	9.39E-21
Np-236	3.49E-18	3.25E-18	3.02E-18	2.88E-18	2.58E-18	2.54E-18
Np-236m	1.16E-18	1.07E-18	9.99E-19	9.52E-19	8.53E-19	8.37E-19
Np-237	4.86E-19	4.39E-19	4.06E-19	3.84E-19	3.39E-19	3.33E-19
Np-238	2.04E-17	1.87E-17	1.76E-17	1.70E-17	1.56E-17	1.54E-17
Np-239	4.89E-18	4.55E-18	4.26E-18	4.07E-18	3.65E-18	3.59E-18
Np-240	3.55E-17	3.27E-17	3.07E-17	2.96E-17	2.70E-17	2.67E-17
Np-240m	1.11E-17	1.02E-17	9.62E-18	9.25E-18	8.46E-18	8.36E-18
Np-241	1.01E-18	9.41E-19	8.79E-19	8.39E-19	7.56E-19	7.43E-19
Np-242	9.39E-18	8.71E-18	8.20E-18	7.94E-18	7.33E-18	7.25E-18
Np-242m	3.12E-17	2.87E-17	2.69E-17	2.60E-17	2.37E-17	2.35E-17
Plutonium						
Pu-232	1.37E-18	1.27E-18	1.18E-18	1.13E-18	1.00E-18	9.85E-19
Pu-234	1.48E-18	1.37E-18	1.28E-18	1.22E-18	1.09E-18	1.06E-18
Pu-235	2.12E-18	1.96E-18	1.82E-18	1.74E-18	1.55E-18	1.53E-18
Pu-236	1.92E-21	1.46E-21	1.28E-21	1.19E-21	8.09E-22	7.77E-22
Pu-237	1.05E-18	9.71E-19	9.03E-19	8.59E-19	7.65E-19	7.50E-19
Pu-238	1.42E-21	1.03E-21	8.94E-22	8.27E-22	5.10E-22	4.85E-22
Pu-239	2.15E-21	1.87E-21	1.71E-21	1.62E-21	1.35E-21	1.32E-21
Pu-240	1.40E-21	1.03E-21	8.89E-22	8.24E-22	5.19E-22	4.94E-22
Pu-241	3.70E-23	3.43E-23	3.19E-23	3.03E-23	2.71E-23	2.66E-23
Pu-242	3.72E-21	3.23E-21	2.99E-21	2.86E-21	2.44E-21	2.40E-21
Pu-243	5.06E-19	4.57E-19	4.22E-19	3.99E-19	3.52E-19	3.47E-19
Pu-244	6.71E-19	6.26E-19	5.91E-19	5.72E-19	5.30E-19	5.24E-19
Pu-245	1.34E-17	1.24E-17	1.16E-17	1.12E-17	1.02E-17	1.01E-17
Pu-246	3.57E-18	3.32E-18	3.10E-18	2.96E-18	2.65E-18	2.61E-18
Americium						
Am-237	1.11E-17	1.03E-17	9.67E-18	9.25E-18	8.36E-18	8.24E-18
Am-238	3.02E-17	2.79E-17	2.61E-17	2.52E-17	2.31E-17	2.29E-17
Am-239	6.10E-18	5.67E-18	5.31E-18	5.06E-18	4.54E-18	4.46E-18
Am-240	3.50E-17	3.22E-17	3.01E-17	2.91E-17	2.67E-17	2.64E-17
Am-241	3.02E-19	2.54E-19	2.24E-19	2.08E-19	1.75E-19	1.73E-19

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-242	3.21E-19	2.96E-19	2.76E-19	2.63E-19	2.34E-19	2.29E-19
Am-242m	9.66E-21	7.90E-21	7.06E-21	6.62E-21	5.22E-21	5.08E-21
Am-243	9.53E-19	8.33E-19	7.55E-19	7.08E-19	6.13E-19	6.04E-19
Am-244	2.72E-17	2.50E-17	2.34E-17	2.26E-17	2.06E-17	2.04E-17
Am-244m	5.65E-19	5.21E-19	4.89E-19	4.74E-19	4.36E-19	4.31E-19
Am-245	8.92E-19	8.32E-19	7.79E-19	7.44E-19	6.69E-19	6.59E-19
Am-246	2.44E-17	2.26E-17	2.12E-17	2.03E-17	1.85E-17	1.83E-17
Am-246m	3.41E-17	3.14E-17	2.94E-17	2.84E-17	2.61E-17	2.58E-17
Am-247	3.85E-18	3.59E-18	3.37E-18	3.22E-18	2.90E-18	2.85E-18
Curium						
Cm-238	1.85E-18	1.72E-18	1.60E-18	1.52E-18	1.36E-18	1.34E-18
Cm-239	6.99E-18	6.53E-18	6.09E-18	5.82E-18	5.23E-18	5.15E-18
Cm-240	1.93E-21	1.41E-21	1.21E-21	1.12E-21	7.29E-22	6.95E-22
Cm-241	1.56E-17	1.45E-17	1.36E-17	1.30E-17	1.18E-17	1.17E-17
Cm-242	1.63E-21	1.17E-21	1.00E-21	9.28E-22	5.84E-22	5.54E-22
Cm-243	3.60E-18	3.35E-18	3.14E-18	3.00E-18	2.69E-18	2.65E-18
Cm-244	1.87E-21	1.45E-21	1.28E-21	1.21E-21	8.82E-22	8.53E-22
Cm-245	2.48E-18	2.30E-18	2.14E-18	2.04E-18	1.83E-18	1.79E-18
Cm-246	1.23E-19	1.15E-19	1.08E-19	1.05E-19	9.69E-20	9.59E-20
Cm-247	1.05E-17	9.76E-18	9.18E-18	8.78E-18	7.95E-18	7.85E-18
Cm-248	4.44E-17	4.15E-17	3.92E-17	3.79E-17	3.51E-17	3.47E-17
Cm-249	6.66E-19	6.17E-19	5.79E-19	5.56E-19	5.07E-19	5.00E-19
Cm-250	4.51E-16	4.22E-16	3.98E-16	3.85E-16	3.57E-16	3.53E-16
Cm-251	3.75E-18	3.48E-18	3.27E-18	3.13E-18	2.85E-18	2.81E-18
Berkelium						
Bk-245	6.14E-18	5.72E-18	5.35E-18	5.11E-18	4.59E-18	4.51E-18
Bk-246	2.86E-17	2.63E-17	2.47E-17	2.38E-17	2.18E-17	2.15E-17
Bk-247	3.98E-18	3.69E-18	3.45E-18	3.29E-18	2.94E-18	2.90E-18
Bk-248m	1.53E-18	1.42E-18	1.33E-18	1.28E-18	1.15E-18	1.14E-18
Bk-249	5.18E-23	4.31E-23	3.83E-23	3.57E-23	3.01E-23	2.95E-23
Bk-250	3.14E-17	2.88E-17	2.70E-17	2.61E-17	2.40E-17	2.37E-17
Bk-251	2.16E-18	2.02E-18	1.88E-18	1.79E-18	1.61E-18	1.58E-18
Californium						
Cf-244	1.70E-21	1.14E-21	9.57E-22	8.73E-22	5.03E-22	4.70E-22
Cf-246	2.42E-21	1.95E-21	1.75E-21	1.65E-21	1.30E-21	1.27E-21
Cf-247	2.25E-18	2.09E-18	1.95E-18	1.86E-18	1.67E-18	1.64E-18
Cf-248	1.27E-20	1.15E-20	1.07E-20	1.03E-20	9.30E-21	9.18E-21
Cf-249	1.07E-17	1.00E-17	9.41E-18	9.00E-18	8.14E-18	8.03E-18
Cf-250	3.34E-19	3.11E-19	2.94E-19	2.84E-19	2.63E-19	2.60E-19
Cf-251	3.16E-18	2.95E-18	2.75E-18	2.63E-18	2.36E-18	2.32E-18
Cf-252	1.54E-17	1.44E-17	1.36E-17	1.32E-17	1.22E-17	1.21E-17
Cf-253	7.44E-21	5.35E-21	4.49E-21	4.09E-21	2.87E-21	2.76E-21
Cf-254	5.70E-16	5.33E-16	5.03E-16	4.87E-16	4.51E-16	4.46E-16
Cf-255	7.18E-21	6.55E-21	6.08E-21	5.80E-21	5.21E-21	5.14E-21
Einsteinium						
Es-249	1.29E-17	1.19E-17	1.12E-17	1.07E-17	9.74E-18	9.61E-18

Table 4-4. Reference person effective dose rate coefficients for soil to 15 cm. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Es-250	3.88E-17	3.58E-17	3.35E-17	3.22E-17	2.94E-17	2.90E-17
Es-250m	1.82E-17	1.68E-17	1.57E-17	1.52E-17	1.39E-17	1.38E-17
Es-251	2.24E-18	2.09E-18	1.94E-18	1.85E-18	1.66E-18	1.63E-18
Es-253	1.05E-20	9.62E-21	8.99E-21	8.58E-21	7.68E-21	7.57E-21
Es-254	8.20E-20	7.08E-20	6.45E-20	6.08E-20	5.17E-20	5.08E-20
Es-254m	1.63E-17	1.50E-17	1.41E-17	1.35E-17	1.24E-17	1.22E-17
Es-255	2.35E-20	2.19E-20	2.07E-20	2.00E-20	1.85E-20	1.83E-20
Es-256	9.21E-20	8.65E-20	8.27E-20	8.03E-20	7.52E-20	7.45E-20
Fermium						
Fm-251	4.36E-18	4.04E-18	3.78E-18	3.62E-18	3.28E-18	3.23E-18
Fm-252	1.04E-20	9.32E-21	8.67E-21	8.33E-21	7.42E-21	7.31E-21
Fm-253	1.48E-18	1.38E-18	1.28E-18	1.22E-18	1.10E-18	1.08E-18
Fm-254	2.39E-19	2.23E-19	2.10E-19	2.03E-19	1.88E-19	1.86E-19
Fm-255	4.59E-20	3.80E-20	3.40E-20	3.19E-20	2.60E-20	2.54E-20
Fm-256	4.21E-16	3.93E-16	3.71E-16	3.59E-16	3.32E-16	3.29E-16
Fm-257	4.00E-18	3.74E-18	3.50E-18	3.35E-18	3.03E-18	2.99E-18

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth.

Explanation of entries

For each radionuclide, values for the age-dependent effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. Reference person organ equivalent dose coefficients h_T are provided electronically.[15]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^3), that is, the effective dose per unit time-integrated exposure to a radionuclide

w_T: The tissue weighting factor

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^{-3}) for tissue *T*.

The dose rate coefficients provided in Table 4-5 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

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

To convert from SI units (Sv Bq^{-1} s^{-1} m^3) to conventional units (mrem μCi^{-1} y^{-1} cm^3), multiply table entries by 1.168×10^{23}.

To convert from SI units from a source per unit volume (Sv Bq^{-1} s^{-1} m^3) to conventional units for a source per unit mass basis (mrem μCi^{-1} y^{-1} g), multiply table entries by 1.868×10^{23}.

To derive 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}.

[15] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	1.80E-27	1.18E-27	9.56E-28	8.44E-28	2.72E-28	2.49E-28
Beryllium						
Be-7	1.86E-18	1.73E-18	1.62E-18	1.55E-18	1.41E-18	1.39E-18
Be-10	7.38E-21	6.66E-21	6.12E-21	5.81E-21	5.15E-21	5.07E-21
Carbon						
C-10	6.71E-17	6.22E-17	5.83E-17	5.59E-17	5.09E-17	5.02E-17
C-11	3.84E-17	3.57E-17	3.35E-17	3.21E-17	2.91E-17	2.87E-17
C-14	1.00E-22	7.99E-23	6.90E-23	6.35E-23	5.16E-23	5.04E-23
Nitrogen						
N-13	3.84E-17	3.57E-17	3.35E-17	3.21E-17	2.92E-17	2.87E-17
N-16	1.92E-16	1.88E-16	1.80E-16	1.76E-16	1.68E-16	1.66E-16
Oxygen						
O-14	1.38E-16	1.29E-16	1.22E-16	1.18E-16	1.09E-16	1.08E-16
O-15	3.85E-17	3.58E-17	3.37E-17	3.22E-17	2.93E-17	2.88E-17
O-19	3.83E-17	3.55E-17	3.33E-17	3.22E-17	2.96E-17	2.93E-17
Fluorine						
F-17	3.85E-17	3.58E-17	3.37E-17	3.22E-17	2.93E-17	2.88E-17
F-18	3.72E-17	3.46E-17	3.25E-17	3.11E-17	2.82E-17	2.78E-17
Neon						
Ne-19	3.86E-17	3.59E-17	3.38E-17	3.23E-17	2.94E-17	2.89E-17
Ne-24	2.05E-17	1.91E-17	1.79E-17	1.72E-17	1.56E-17	1.54E-17
Sodium						
Na-22	8.77E-17	8.12E-17	7.62E-17	7.34E-17	6.72E-17	6.64E-17
Na-24	1.76E-16	1.66E-16	1.57E-16	1.52E-16	1.42E-16	1.40E-16
Magnesium						
Mg-27	3.61E-17	3.32E-17	3.11E-17	3.00E-17	2.74E-17	2.71E-17
Mg-28	5.54E-17	5.12E-17	4.80E-17	4.63E-17	4.26E-17	4.21E-17
Aluminum						
Al-26	1.10E-16	1.02E-16	9.65E-17	9.33E-17	8.61E-17	8.50E-17
Al-28	7.64E-17	7.12E-17	6.71E-17	6.51E-17	6.04E-17	5.97E-17
Al-29	5.81E-17	5.38E-17	5.05E-17	4.89E-17	4.51E-17	4.47E-17
Silicon						
Si-31	1.26E-19	1.19E-19	1.14E-19	1.10E-19	1.03E-19	1.02E-19
Si-32	3.01E-22	2.50E-22	2.21E-22	2.05E-22	1.73E-22	1.69E-22
Phosphorus						
P-30	3.90E-17	3.63E-17	3.41E-17	3.26E-17	2.97E-17	2.92E-17
P-32	1.27E-19	1.21E-19	1.16E-19	1.13E-19	1.07E-19	1.06E-19
P-33	4.12E-22	3.47E-22	3.08E-22	2.87E-22	2.43E-22	2.38E-22
Sulfur						
S-35	1.09E-22	8.75E-23	7.59E-23	7.00E-23	5.72E-23	5.60E-23
S-37	1.27E-16	1.20E-16	1.14E-16	1.12E-16	1.05E-16	1.04E-16
S-38	7.27E-17	6.80E-17	6.42E-17	6.23E-17	5.80E-17	5.73E-17
Chlorine						
Cl-34	3.95E-17	3.68E-17	3.45E-17	3.31E-17	3.01E-17	2.96E-17
Cl-34m	8.69E-17	8.15E-17	7.69E-17	7.45E-17	6.90E-17	6.82E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	1.68E-20	1.55E-20	1.45E-20	1.39E-20	1.26E-20	1.24E-20
Cl-38	6.26E-17	5.85E-17	5.53E-17	5.37E-17	4.99E-17	4.94E-17
Cl-39	6.01E-17	5.56E-17	5.22E-17	5.05E-17	4.65E-17	4.60E-17
Cl-40	1.75E-16	1.65E-16	1.56E-16	1.52E-16	1.42E-16	1.40E-16
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	5.88E-21	5.30E-21	4.86E-21	4.61E-21	4.09E-21	4.02E-21
Ar-41	5.37E-17	4.96E-17	4.65E-17	4.50E-17	4.14E-17	4.10E-17
Ar-42	6.96E-21	6.31E-21	5.81E-21	5.52E-21	4.92E-21	4.84E-21
Ar-43	6.46E-17	6.01E-17	5.65E-17	5.47E-17	5.05E-17	5.00E-17
Ar-44	8.09E-17	7.53E-17	7.10E-17	6.88E-17	6.36E-17	6.29E-17
Potassium						
K-38	1.32E-16	1.23E-16	1.16E-16	1.13E-16	1.04E-16	1.03E-16
K-40	6.68E-18	6.19E-18	5.82E-18	5.63E-18	5.20E-18	5.15E-18
K-42	1.24E-17	1.15E-17	1.08E-17	1.05E-17	9.70E-18	9.59E-18
K-43	3.62E-17	3.37E-17	3.16E-17	3.03E-17	2.75E-17	2.71E-17
K-44	1.01E-16	9.47E-17	8.93E-17	8.67E-17	8.04E-17	7.95E-17
K-45	7.68E-17	7.16E-17	6.75E-17	6.54E-17	6.06E-17	5.99E-17
K-46	1.24E-16	1.16E-16	1.10E-16	1.06E-16	9.92E-17	9.82E-17
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	4.37E-22	3.69E-22	3.28E-22	3.06E-22	2.60E-22	2.55E-22
Ca-47	4.38E-17	4.04E-17	3.79E-17	3.67E-17	3.37E-17	3.34E-17
Ca-49	1.37E-16	1.30E-16	1.24E-16	1.21E-16	1.13E-16	1.12E-16
Scandium						
Sc-42m	1.70E-16	1.58E-16	1.48E-16	1.43E-16	1.31E-16	1.30E-16
Sc-43	3.69E-17	3.43E-17	3.22E-17	3.09E-17	2.80E-17	2.76E-17
Sc-44	8.49E-17	7.86E-17	7.36E-17	7.09E-17	6.48E-17	6.41E-17
Sc-44m	9.61E-18	8.96E-18	8.42E-18	8.06E-18	7.28E-18	7.19E-18
Sc-46	8.22E-17	7.56E-17	7.07E-17	6.83E-17	6.26E-17	6.19E-17
Sc-47	3.22E-18	3.03E-18	2.81E-18	2.69E-18	2.43E-18	2.39E-18
Sc-48	1.38E-16	1.27E-16	1.19E-16	1.15E-16	1.06E-16	1.05E-16
Sc-49	2.27E-19	2.15E-19	2.06E-19	2.00E-19	1.89E-19	1.87E-19
Sc-50	1.33E-16	1.23E-16	1.16E-16	1.12E-16	1.03E-16	1.02E-16
Titanium						
Ti-44	2.41E-18	2.11E-18	1.91E-18	1.79E-18	1.55E-18	1.53E-18
Ti-45	3.28E-17	3.05E-17	2.86E-17	2.74E-17	2.49E-17	2.45E-17
Ti-51	1.35E-17	1.26E-17	1.18E-17	1.13E-17	1.03E-17	1.01E-17
Ti-52	3.45E-18	3.24E-18	3.01E-18	2.88E-18	2.60E-18	2.55E-18
Vanadium						
V-47	3.76E-17	3.50E-17	3.29E-17	3.15E-17	2.86E-17	2.82E-17
V-48	1.19E-16	1.10E-16	1.03E-16	9.91E-17	9.09E-17	9.00E-17
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	5.99E-17	5.56E-17	5.22E-17	5.06E-17	4.67E-17	4.62E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
V-52	6.12E-17	5.67E-17	5.32E-17	5.15E-17	4.76E-17	4.71E-17
V-53	4.28E-17	3.94E-17	3.69E-17	3.56E-17	3.26E-17	3.23E-17
Chromium						
Cr-48	1.41E-17	1.32E-17	1.24E-17	1.18E-17	1.07E-17	1.05E-17
Cr-49	3.83E-17	3.56E-17	3.34E-17	3.20E-17	2.90E-17	2.86E-17
Cr-51	1.11E-18	1.04E-18	9.77E-19	9.34E-19	8.43E-19	8.31E-19
Cr-55	3.64E-19	3.46E-19	3.31E-19	3.23E-19	3.04E-19	3.01E-19
Cr-56	1.68E-18	1.50E-18	1.38E-18	1.30E-18	1.15E-18	1.13E-18
Manganese						
Mn-50m	1.88E-16	1.74E-16	1.63E-16	1.57E-16	1.44E-16	1.43E-16
Mn-51	3.78E-17	3.51E-17	3.30E-17	3.16E-17	2.87E-17	2.83E-17
Mn-52	1.41E-16	1.30E-16	1.22E-16	1.18E-16	1.08E-16	1.07E-16
Mn-52m	9.73E-17	9.03E-17	8.48E-17	8.17E-17	7.50E-17	7.41E-17
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	3.35E-17	3.08E-17	2.88E-17	2.77E-17	2.53E-17	2.51E-17
Mn-56	7.05E-17	6.54E-17	6.15E-17	5.95E-17	5.48E-17	5.42E-17
Mn-57	3.89E-18	3.61E-18	3.39E-18	3.26E-18	2.99E-18	2.95E-18
Mn-58m	9.90E-17	9.16E-17	8.60E-17	8.31E-17	7.64E-17	7.56E-17
Iron						
Fe-52	2.66E-17	2.48E-17	2.32E-17	2.22E-17	2.02E-17	1.99E-17
Fe-53	4.45E-17	4.14E-17	3.89E-17	3.73E-17	3.39E-17	3.34E-17
Fe-53m	1.26E-16	1.16E-16	1.09E-16	1.05E-16	9.67E-17	9.57E-17
Fe-55	4.31E-27	4.04E-27	3.75E-27	3.58E-27	3.22E-27	3.17E-27
Fe-59	4.92E-17	4.54E-17	4.25E-17	4.11E-17	3.77E-17	3.74E-17
Fe-60	2.10E-22	1.72E-22	1.50E-22	1.39E-22	1.15E-22	1.13E-22
Fe-61	5.76E-17	5.32E-17	4.99E-17	4.82E-17	4.44E-17	4.39E-17
Fe-62	1.92E-17	1.79E-17	1.68E-17	1.61E-17	1.46E-17	1.44E-17
Cobalt						
Co-54m	1.59E-16	1.47E-16	1.38E-16	1.33E-16	1.22E-16	1.21E-16
Co-55	7.89E-17	7.30E-17	6.84E-17	6.59E-17	6.02E-17	5.95E-17
Co-56	1.52E-16	1.41E-16	1.33E-16	1.29E-16	1.19E-16	1.18E-16
Co-57	3.20E-18	2.99E-18	2.78E-18	2.65E-18	2.39E-18	2.35E-18
Co-58	3.86E-17	3.56E-17	3.33E-17	3.20E-17	2.92E-17	2.89E-17
Co-58m	2.33E-23	1.55E-23	1.26E-23	1.13E-23	7.87E-24	7.47E-24
Co-60	1.04E-16	9.63E-17	9.03E-17	8.73E-17	8.04E-17	7.96E-17
Co-60m	1.54E-19	1.41E-19	1.31E-19	1.26E-19	1.16E-19	1.14E-19
Co-61	2.55E-18	2.29E-18	2.12E-18	2.02E-18	1.81E-18	1.79E-18
Co-62	6.81E-17	6.32E-17	5.93E-17	5.75E-17	5.31E-17	5.26E-17
Co-62m	1.13E-16	1.05E-16	9.81E-17	9.50E-17	8.75E-17	8.67E-17
Nickel						
Ni-56	6.64E-17	6.14E-17	5.75E-17	5.53E-17	5.05E-17	4.99E-17
Ni-57	7.94E-17	7.36E-17	6.91E-17	6.68E-17	6.15E-17	6.08E-17
Ni-59	5.84E-22	5.43E-22	5.10E-22	4.88E-22	4.44E-22	4.37E-22
Ni-63	2.61E-24	1.82E-24	1.50E-24	1.35E-24	9.17E-25	8.76E-25
Ni-65	2.34E-17	2.17E-17	2.03E-17	1.97E-17	1.81E-17	1.80E-17
Ni-66	3.90E-22	3.29E-22	2.92E-22	2.72E-22	2.31E-22	2.26E-22

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Copper						
Cu-57	4.66E-17	4.34E-17	4.08E-17	3.91E-17	3.57E-17	3.52E-17
Cu-59	5.63E-17	5.23E-17	4.91E-17	4.71E-17	4.29E-17	4.24E-17
Cu-60	1.61E-16	1.50E-16	1.41E-16	1.36E-16	1.25E-16	1.24E-16
Cu-61	3.11E-17	2.89E-17	2.71E-17	2.60E-17	2.37E-17	2.33E-17
Cu-62	3.83E-17	3.57E-17	3.35E-17	3.21E-17	2.92E-17	2.87E-17
Cu-64	6.96E-18	6.47E-18	6.08E-18	5.82E-18	5.29E-18	5.21E-18
Cu-66	4.33E-18	3.99E-18	3.74E-18	3.62E-18	3.32E-18	3.29E-18
Cu-67	3.38E-18	3.16E-18	2.95E-18	2.82E-18	2.54E-18	2.50E-18
Cu-69	2.17E-17	2.00E-17	1.87E-17	1.81E-17	1.65E-17	1.64E-17
Zinc						
Zn-60	5.79E-17	5.38E-17	5.04E-17	4.83E-17	4.39E-17	4.33E-17
Zn-61	6.07E-17	5.65E-17	5.31E-17	5.11E-17	4.68E-17	4.61E-17
Zn-62	1.63E-17	1.51E-17	1.42E-17	1.36E-17	1.24E-17	1.22E-17
Zn-63	4.19E-17	3.89E-17	3.65E-17	3.50E-17	3.19E-17	3.14E-17
Zn-65	2.38E-17	2.20E-17	2.05E-17	1.98E-17	1.82E-17	1.80E-17
Zn-69	1.96E-20	1.83E-20	1.72E-20	1.66E-20	1.53E-20	1.51E-20
Zn-69m	1.53E-17	1.42E-17	1.34E-17	1.28E-17	1.16E-17	1.14E-17
Zn-71	1.25E-17	1.16E-17	1.09E-17	1.04E-17	9.53E-18	9.41E-18
Zn-71m	5.92E-17	5.50E-17	5.16E-17	4.95E-17	4.50E-17	4.44E-17
Zn-72	4.16E-18	3.91E-18	3.62E-18	3.46E-18	3.12E-18	3.07E-18
Gallium						
Ga-64	1.39E-16	1.30E-16	1.22E-16	1.18E-16	1.09E-16	1.08E-16
Ga-65	4.32E-17	4.02E-17	3.77E-17	3.61E-17	3.28E-17	3.24E-17
Ga-66	1.04E-16	9.75E-17	9.21E-17	8.93E-17	8.30E-17	8.20E-17
Ga-67	4.74E-18	4.42E-18	4.14E-18	3.95E-18	3.55E-18	3.50E-18
Ga-68	3.59E-17	3.34E-17	3.14E-17	3.01E-17	2.73E-17	2.69E-17
Ga-70	4.04E-19	3.75E-19	3.53E-19	3.42E-19	3.16E-19	3.13E-19
Ga-72	1.13E-16	1.05E-16	9.86E-17	9.55E-17	8.82E-17	8.72E-17
Ga-73	1.23E-17	1.14E-17	1.07E-17	1.03E-17	9.27E-18	9.15E-18
Ga-74	1.32E-16	1.23E-16	1.16E-16	1.13E-16	1.04E-16	1.03E-16
Germanium						
Ge-66	2.43E-17	2.26E-17	2.12E-17	2.03E-17	1.85E-17	1.82E-17
Ge-67	5.42E-17	5.04E-17	4.73E-17	4.54E-17	4.14E-17	4.09E-17
Ge-68	4.26E-23	2.63E-23	2.03E-23	1.71E-23	5.27E-24	4.85E-24
Ge-69	3.79E-17	3.50E-17	3.28E-17	3.16E-17	2.89E-17	2.86E-17
Ge-71	4.32E-23	2.67E-23	2.06E-23	1.73E-23	5.35E-24	4.92E-24
Ge-75	1.24E-18	1.16E-18	1.09E-18	1.04E-18	9.37E-19	9.25E-19
Ge-77	4.10E-17	3.81E-17	3.57E-17	3.43E-17	3.13E-17	3.09E-17
Ge-78	9.51E-18	8.89E-18	8.36E-18	7.99E-18	7.20E-18	7.10E-18
Arsenic						
As-68	1.51E-16	1.40E-16	1.32E-16	1.27E-16	1.17E-16	1.15E-16
As-69	4.37E-17	4.07E-17	3.82E-17	3.66E-17	3.34E-17	3.29E-17
As-70	1.72E-16	1.60E-16	1.50E-16	1.45E-16	1.33E-16	1.31E-16
As-71	2.08E-17	1.94E-17	1.81E-17	1.74E-17	1.58E-17	1.56E-17
As-72	6.99E-17	6.48E-17	6.08E-17	5.84E-17	5.33E-17	5.26E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-73	6.72E-20	5.57E-20	4.84E-20	4.47E-20	3.73E-20	3.68E-20
As-74	2.89E-17	2.68E-17	2.52E-17	2.41E-17	2.19E-17	2.16E-17
As-76	1.67E-17	1.55E-17	1.45E-17	1.40E-17	1.28E-17	1.26E-17
As-77	2.94E-19	2.74E-19	2.57E-19	2.46E-19	2.22E-19	2.19E-19
As-78	5.37E-17	4.98E-17	4.68E-17	4.52E-17	4.15E-17	4.11E-17
As-79	1.51E-18	1.40E-18	1.32E-18	1.27E-18	1.16E-18	1.15E-18
Selenium						
Se-70	2.58E-17	2.40E-17	2.26E-17	2.16E-17	1.96E-17	1.93E-17
Se-71	6.21E-17	5.77E-17	5.41E-17	5.20E-17	4.74E-17	4.68E-17
Se-72	2.54E-19	2.02E-19	1.72E-19	1.57E-19	1.28E-19	1.26E-19
Se-73	3.94E-17	3.66E-17	3.44E-17	3.29E-17	2.98E-17	2.94E-17
Se-73m	9.81E-18	9.12E-18	8.56E-18	8.19E-18	7.45E-18	7.34E-18
Se-75	1.24E-17	1.16E-17	1.09E-17	1.04E-17	9.37E-18	9.23E-18
Se-77m	2.57E-18	2.41E-18	2.24E-18	2.14E-18	1.94E-18	1.91E-18
Se-79	1.16E-22	9.20E-23	7.95E-23	7.32E-23	5.95E-23	5.82E-23
Se-79m	2.05E-19	1.88E-19	1.75E-19	1.66E-19	1.47E-19	1.44E-19
Se-81	3.95E-19	3.69E-19	3.48E-19	3.35E-19	3.07E-19	3.03E-19
Se-81m	3.28E-19	3.03E-19	2.83E-19	2.69E-19	2.40E-19	2.35E-19
Se-83	1.06E-16	9.81E-17	9.21E-17	8.89E-17	8.17E-17	8.07E-17
Se-83m	4.08E-17	3.78E-17	3.55E-17	3.43E-17	3.16E-17	3.12E-17
Se-84	1.54E-17	1.43E-17	1.35E-17	1.29E-17	1.17E-17	1.15E-17
Bromine						
Br-72	1.20E-16	1.11E-16	1.05E-16	1.01E-16	9.23E-17	9.12E-17
Br-73	5.43E-17	5.04E-17	4.73E-17	4.54E-17	4.13E-17	4.07E-17
Br-74	1.91E-16	1.80E-16	1.70E-16	1.65E-16	1.53E-16	1.52E-16
Br-74m	1.69E-16	1.58E-16	1.49E-16	1.44E-16	1.33E-16	1.31E-16
Br-75	4.43E-17	4.12E-17	3.87E-17	3.71E-17	3.37E-17	3.32E-17
Br-76	1.14E-16	1.06E-16	1.00E-16	9.69E-17	8.94E-17	8.83E-17
Br-76m	5.42E-19	4.69E-19	4.22E-19	3.97E-19	3.45E-19	3.40E-19
Br-77	1.16E-17	1.08E-17	1.01E-17	9.66E-18	8.77E-18	8.64E-18
Br-77m	3.54E-19	3.28E-19	3.06E-19	2.91E-19	2.60E-19	2.55E-19
Br-78	3.92E-17	3.65E-17	3.43E-17	3.28E-17	2.98E-17	2.94E-17
Br-80	3.06E-18	2.85E-18	2.67E-18	2.56E-18	2.34E-18	2.31E-18
Br-80m	9.32E-20	6.85E-20	5.61E-20	5.04E-20	3.91E-20	3.79E-20
Br-82	1.06E-16	9.76E-17	9.14E-17	8.80E-17	8.05E-17	7.96E-17
Br-82m	1.22E-19	1.13E-19	1.06E-19	1.02E-19	9.32E-20	9.22E-20
Br-83	2.80E-19	2.61E-19	2.45E-19	2.35E-19	2.14E-19	2.11E-19
Br-84	7.48E-17	7.01E-17	6.61E-17	6.42E-17	5.97E-17	5.91E-17
Br-84m	1.13E-16	1.05E-16	9.81E-17	9.47E-17	8.69E-17	8.60E-17
Br-85	2.99E-18	2.77E-18	2.60E-18	2.51E-18	2.31E-18	2.28E-18
Krypton						
Kr-74	3.83E-17	3.56E-17	3.34E-17	3.20E-17	2.90E-17	2.86E-17
Kr-75	4.79E-17	4.45E-17	4.18E-17	4.00E-17	3.64E-17	3.59E-17
Kr-76	1.46E-17	1.36E-17	1.28E-17	1.23E-17	1.11E-17	1.09E-17
Kr-77	3.75E-17	3.49E-17	3.28E-17	3.14E-17	2.85E-17	2.80E-17
Kr-79	9.21E-18	8.56E-18	8.04E-18	7.70E-18	6.99E-18	6.89E-18

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-81	2.91E-20	2.69E-20	2.52E-20	2.40E-20	2.13E-20	2.10E-20
Kr-81m	4.03E-18	3.78E-18	3.54E-18	3.38E-18	3.04E-18	3.00E-18
Kr-83m	5.16E-22	3.53E-22	2.91E-22	2.62E-22	1.01E-22	9.32E-23
Kr-85	9.34E-20	8.68E-20	8.14E-20	7.79E-20	7.07E-20	6.97E-20
Kr-85m	4.80E-18	4.50E-18	4.19E-18	4.01E-18	3.62E-18	3.56E-18
Kr-87	3.30E-17	3.09E-17	2.92E-17	2.82E-17	2.61E-17	2.58E-17
Kr-88	8.26E-17	7.73E-17	7.30E-17	7.09E-17	6.59E-17	6.51E-17
Kr-89	8.06E-17	7.53E-17	7.10E-17	6.88E-17	6.37E-17	6.30E-17
Rubidium						
Rb-77	5.88E-17	5.46E-17	5.13E-17	4.92E-17	4.48E-17	4.42E-17
Rb-78	1.69E-16	1.59E-16	1.51E-16	1.46E-16	1.36E-16	1.34E-16
Rb-78m	1.29E-16	1.20E-16	1.13E-16	1.09E-16	9.99E-17	9.86E-17
Rb-79	5.42E-17	5.04E-17	4.73E-17	4.53E-17	4.12E-17	4.06E-17
Rb-80	4.61E-17	4.28E-17	4.02E-17	3.85E-17	3.51E-17	3.46E-17
Rb-81	1.90E-17	1.76E-17	1.66E-17	1.59E-17	1.44E-17	1.42E-17
Rb-81m	8.51E-19	7.86E-19	7.36E-19	7.06E-19	6.42E-19	6.33E-19
Rb-82	4.25E-17	3.95E-17	3.71E-17	3.56E-17	3.24E-17	3.19E-17
Rb-82m	1.16E-16	1.08E-16	1.01E-16	9.70E-17	8.87E-17	8.77E-17
Rb-83	1.83E-17	1.70E-17	1.60E-17	1.53E-17	1.39E-17	1.37E-17
Rb-84	3.57E-17	3.30E-17	3.09E-17	2.97E-17	2.71E-17	2.68E-17
Rb-84m	1.33E-17	1.24E-17	1.16E-17	1.11E-17	1.00E-17	9.90E-18
Rb-86	3.96E-18	3.65E-18	3.41E-18	3.30E-18	3.03E-18	3.00E-18
Rb-86m	2.08E-17	1.93E-17	1.81E-17	1.74E-17	1.58E-17	1.56E-17
Rb-87	1.06E-21	9.18E-22	8.24E-22	7.72E-22	6.64E-22	6.52E-22
Rb-88	2.82E-17	2.63E-17	2.48E-17	2.41E-17	2.23E-17	2.21E-17
Rb-89	9.42E-17	8.74E-17	8.22E-17	7.96E-17	7.35E-17	7.28E-17
Rb-90	8.74E-17	8.30E-17	7.87E-17	7.67E-17	7.19E-17	7.11E-17
Rb-90m	1.37E-16	1.28E-16	1.21E-16	1.18E-16	1.09E-16	1.08E-16
Strontium						
Sr-79	4.41E-17	4.11E-17	3.86E-17	3.69E-17	3.35E-17	3.30E-17
Sr-80	1.61E-17	1.50E-17	1.41E-17	1.35E-17	1.22E-17	1.21E-17
Sr-81	5.17E-17	4.81E-17	4.51E-17	4.33E-17	3.93E-17	3.88E-17
Sr-82	2.21E-21	1.52E-21	1.28E-21	1.16E-21	4.00E-22	3.65E-22
Sr-83	3.16E-17	2.93E-17	2.75E-17	2.64E-17	2.41E-17	2.38E-17
Sr-85	1.85E-17	1.72E-17	1.62E-17	1.55E-17	1.41E-17	1.39E-17
Sr-85m	7.04E-18	6.60E-18	6.19E-18	5.91E-18	5.32E-18	5.25E-18
Sr-87m	1.15E-17	1.07E-17	1.01E-17	9.64E-18	8.73E-18	8.60E-18
Sr-89	9.56E-20	9.08E-20	8.70E-20	8.47E-20	7.97E-20	7.91E-20
Sr-90	4.75E-21	4.27E-21	3.91E-21	3.71E-21	3.27E-21	3.22E-21
Sr-91	2.87E-17	2.64E-17	2.47E-17	2.38E-17	2.18E-17	2.16E-17
Sr-92	5.60E-17	5.18E-17	4.86E-17	4.70E-17	4.33E-17	4.29E-17
Sr-93	9.18E-17	8.51E-17	7.99E-17	7.72E-17	7.09E-17	7.01E-17
Sr-94	6.01E-17	5.57E-17	5.23E-17	5.06E-17	4.67E-17	4.62E-17
Yttrium						
Y-81	4.34E-17	4.04E-17	3.80E-17	3.63E-17	3.30E-17	3.25E-17
Y-83	5.18E-17	4.81E-17	4.52E-17	4.33E-17	3.95E-17	3.90E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-83m	3.10E-17	2.89E-17	2.71E-17	2.60E-17	2.36E-17	2.32E-17
Y-84m	1.59E-16	1.47E-16	1.38E-16	1.33E-16	1.21E-16	1.20E-16
Y-85	4.08E-17	3.79E-17	3.56E-17	3.41E-17	3.10E-17	3.06E-17
Y-85m	5.24E-17	4.88E-17	4.59E-17	4.42E-17	4.05E-17	4.00E-17
Y-86	1.45E-16	1.35E-16	1.27E-16	1.22E-16	1.12E-16	1.11E-16
Y-86m	7.24E-18	6.77E-18	6.34E-18	6.07E-18	5.48E-18	5.40E-18
Y-87	1.63E-17	1.52E-17	1.43E-17	1.36E-17	1.24E-17	1.22E-17
Y-87m	1.10E-17	1.03E-17	9.65E-18	9.22E-18	8.35E-18	8.22E-18
Y-88	1.13E-16	1.05E-16	9.86E-17	9.55E-17	8.83E-17	8.74E-17
Y-89m	3.65E-17	3.36E-17	3.14E-17	3.02E-17	2.76E-17	2.74E-17
Y-90	2.50E-19	2.39E-19	2.29E-19	2.23E-19	2.11E-19	2.09E-19
Y-90m	2.26E-17	2.10E-17	1.98E-17	1.89E-17	1.71E-17	1.69E-17
Y-91	2.29E-19	2.14E-19	2.03E-19	1.97E-19	1.83E-19	1.81E-19
Y-91m	2.01E-17	1.87E-17	1.75E-17	1.68E-17	1.53E-17	1.50E-17
Y-92	1.09E-17	1.00E-17	9.42E-18	9.10E-18	8.35E-18	8.27E-18
Y-93	4.27E-18	3.98E-18	3.75E-18	3.62E-18	3.34E-18	3.30E-18
Y-94	3.25E-17	3.00E-17	2.81E-17	2.72E-17	2.50E-17	2.47E-17
Y-95	4.78E-17	4.49E-17	4.24E-17	4.12E-17	3.84E-17	3.80E-17
Zirconium						
Zr-85	5.65E-17	5.25E-17	4.93E-17	4.73E-17	4.31E-17	4.25E-17
Zr-86	9.25E-18	8.64E-18	8.11E-18	7.76E-18	6.99E-18	6.89E-18
Zr-87	3.54E-17	3.29E-17	3.09E-17	2.96E-17	2.69E-17	2.66E-17
Zr-88	1.38E-17	1.29E-17	1.21E-17	1.16E-17	1.05E-17	1.03E-17
Zr-89	4.60E-17	4.24E-17	3.96E-17	3.82E-17	3.49E-17	3.45E-17
Zr-89m	2.46E-17	2.29E-17	2.15E-17	2.06E-17	1.88E-17	1.85E-17
Zr-93	3.04E-24	2.12E-24	1.74E-24	1.57E-24	1.06E-24	1.02E-24
Zr-95	2.90E-17	2.67E-17	2.50E-17	2.40E-17	2.19E-17	2.17E-17
Zr-97	3.50E-17	3.23E-17	3.03E-17	2.91E-17	2.66E-17	2.63E-17
Niobium						
Nb-87	4.49E-17	4.18E-17	3.93E-17	3.76E-17	3.41E-17	3.36E-17
Nb-88	1.67E-16	1.54E-16	1.45E-16	1.39E-16	1.27E-16	1.26E-16
Nb-88m	1.64E-16	1.52E-16	1.43E-16	1.37E-16	1.26E-16	1.24E-16
Nb-89	5.46E-17	5.10E-17	4.80E-17	4.63E-17	4.26E-17	4.20E-17
Nb-89m	4.94E-17	4.59E-17	4.31E-17	4.13E-17	3.75E-17	3.70E-17
Nb-90	1.75E-16	1.63E-16	1.54E-16	1.49E-16	1.38E-16	1.36E-16
Nb-91	6.55E-20	5.97E-20	5.58E-20	5.33E-20	4.71E-20	4.63E-20
Nb-91m	1.03E-18	9.50E-19	8.89E-19	8.60E-19	7.88E-19	7.81E-19
Nb-92	5.93E-17	5.47E-17	5.12E-17	4.93E-17	4.50E-17	4.45E-17
Nb-92m	3.90E-17	3.58E-17	3.35E-17	3.23E-17	2.96E-17	2.93E-17
Nb-93m	1.18E-21	8.08E-22	6.91E-22	6.41E-22	3.05E-22	2.80E-22
Nb-94	6.21E-17	5.72E-17	5.35E-17	5.15E-17	4.70E-17	4.65E-17
Nb-94m	1.81E-19	1.66E-19	1.55E-19	1.49E-19	1.35E-19	1.34E-19
Nb-95	3.04E-17	2.80E-17	2.62E-17	2.52E-17	2.30E-17	2.27E-17
Nb-95m	2.07E-18	1.93E-18	1.82E-18	1.74E-18	1.56E-18	1.54E-18
Nb-96	9.82E-17	9.06E-17	8.48E-17	8.17E-17	7.47E-17	7.38E-17
Nb-97	2.60E-17	2.40E-17	2.25E-17	2.16E-17	1.97E-17	1.95E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-98m	1.14E-16	1.06E-16	9.92E-17	9.57E-17	8.78E-17	8.68E-17
Nb-99	5.02E-18	4.71E-18	4.38E-18	4.19E-18	3.79E-18	3.73E-18
Nb-99m	3.21E-17	3.01E-17	2.84E-17	2.76E-17	2.56E-17	2.53E-17
Molybdenum						
Mo-89	4.76E-17	4.43E-17	4.16E-17	3.99E-17	3.64E-17	3.59E-17
Mo-90	2.96E-17	2.75E-17	2.58E-17	2.48E-17	2.25E-17	2.22E-17
Mo-91	3.74E-17	3.48E-17	3.27E-17	3.13E-17	2.85E-17	2.81E-17
Mo-91m	5.54E-17	5.14E-17	4.82E-17	4.64E-17	4.25E-17	4.20E-17
Mo-93	6.63E-21	4.52E-21	3.87E-21	3.59E-21	1.71E-21	1.57E-21
Mo-93m	9.43E-17	8.74E-17	8.20E-17	7.92E-17	7.28E-17	7.20E-17
Mo-99	5.69E-18	5.26E-18	4.92E-18	4.73E-18	4.31E-18	4.26E-18
Mo-101	5.99E-17	5.55E-17	5.21E-17	5.03E-17	4.63E-17	4.57E-17
Mo-102	6.03E-19	5.65E-19	5.29E-19	5.06E-19	4.56E-19	4.50E-19
Technetium						
Tc-91	1.02E-16	9.50E-17	8.95E-17	8.65E-17	7.98E-17	7.88E-17
Tc-91m	5.52E-17	5.13E-17	4.82E-17	4.62E-17	4.21E-17	4.15E-17
Tc-92	1.52E-16	1.41E-16	1.33E-16	1.28E-16	1.17E-16	1.16E-16
Tc-93	6.51E-17	6.03E-17	5.66E-17	5.48E-17	5.05E-17	5.00E-17
Tc-93m	3.90E-17	3.66E-17	3.46E-17	3.36E-17	3.11E-17	3.08E-17
Tc-94	1.06E-16	9.74E-17	9.12E-17	8.78E-17	8.01E-17	7.93E-17
Tc-94m	7.80E-17	7.23E-17	6.78E-17	6.54E-17	5.99E-17	5.91E-17
Tc-95	3.12E-17	2.88E-17	2.69E-17	2.59E-17	2.36E-17	2.34E-17
Tc-95m	2.58E-17	2.38E-17	2.23E-17	2.14E-17	1.95E-17	1.93E-17
Tc-96	9.98E-17	9.19E-17	8.60E-17	8.28E-17	7.56E-17	7.48E-17
Tc-96m	1.69E-18	1.55E-18	1.45E-18	1.40E-18	1.28E-18	1.27E-18
Tc-97	8.53E-21	5.77E-21	4.91E-21	4.53E-21	2.35E-21	2.17E-21
Tc-97m	1.52E-20	1.19E-20	1.06E-20	9.94E-21	7.38E-21	7.11E-21
Tc-98	5.55E-17	5.12E-17	4.80E-17	4.61E-17	4.20E-17	4.15E-17
Tc-99	8.72E-22	7.51E-22	6.74E-22	6.32E-22	5.43E-22	5.33E-22
Tc-99m	3.52E-18	3.31E-18	3.06E-18	2.92E-18	2.64E-18	2.60E-18
Tc-101	1.19E-17	1.11E-17	1.04E-17	9.99E-18	9.02E-18	8.90E-18
Tc-102	4.21E-18	3.93E-18	3.70E-18	3.57E-18	3.29E-18	3.25E-18
Tc-102m	1.01E-16	9.43E-17	8.87E-17	8.57E-17	7.90E-17	7.80E-17
Tc-104	9.25E-17	8.64E-17	8.14E-17	7.88E-17	7.27E-17	7.19E-17
Tc-105	3.09E-17	2.87E-17	2.70E-17	2.60E-17	2.38E-17	2.35E-17
Ruthenium						
Ru-92	7.77E-17	7.23E-17	6.79E-17	6.53E-17	5.96E-17	5.88E-17
Ru-94	1.92E-17	1.78E-17	1.67E-17	1.60E-17	1.45E-17	1.44E-17
Ru-95	4.85E-17	4.49E-17	4.22E-17	4.06E-17	3.71E-17	3.67E-17
Ru-97	7.52E-18	7.03E-18	6.60E-18	6.31E-18	5.68E-18	5.60E-18
Ru-103	1.86E-17	1.73E-17	1.62E-17	1.55E-17	1.41E-17	1.39E-17
Ru-105	2.87E-17	2.66E-17	2.49E-17	2.39E-17	2.18E-17	2.15E-17
Ru-106	1.83E-25	1.23E-25	1.02E-25	9.27E-26	4.89E-26	4.56E-26
Ru-107	1.39E-17	1.29E-17	1.21E-17	1.16E-17	1.07E-17	1.05E-17
Ru-108	1.84E-18	1.73E-18	1.61E-18	1.54E-18	1.39E-18	1.37E-18

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rhodium						
Rh-94	1.54E-16	1.43E-16	1.35E-16	1.30E-16	1.19E-16	1.18E-16
Rh-95	1.04E-16	9.62E-17	9.03E-17	8.72E-17	8.01E-17	7.92E-17
Rh-95m	3.57E-17	3.35E-17	3.16E-17	3.05E-17	2.82E-17	2.78E-17
Rh-96	1.56E-16	1.45E-16	1.36E-16	1.31E-16	1.19E-16	1.18E-16
Rh-96m	5.17E-17	4.79E-17	4.50E-17	4.34E-17	3.99E-17	3.94E-17
Rh-97	5.58E-17	5.19E-17	4.87E-17	4.68E-17	4.27E-17	4.22E-17
Rh-97m	9.04E-17	8.44E-17	7.95E-17	7.70E-17	7.13E-17	7.04E-17
Rh-98	7.07E-17	6.56E-17	6.16E-17	5.92E-17	5.40E-17	5.33E-17
Rh-99	2.00E-17	1.85E-17	1.74E-17	1.67E-17	1.51E-17	1.49E-17
Rh-99m	2.43E-17	2.25E-17	2.11E-17	2.03E-17	1.85E-17	1.82E-17
Rh-100	1.13E-16	1.05E-16	9.91E-17	9.59E-17	8.85E-17	8.75E-17
Rh-100m	1.62E-18	1.49E-18	1.39E-18	1.34E-18	1.22E-18	1.20E-18
Rh-101	8.37E-18	7.83E-18	7.32E-18	6.99E-18	6.30E-18	6.20E-18
Rh-101m	9.60E-18	8.96E-18	8.42E-18	8.05E-18	7.27E-18	7.16E-18
Rh-102	1.89E-17	1.76E-17	1.65E-17	1.58E-17	1.44E-17	1.42E-17
Rh-102m	8.40E-17	7.76E-17	7.27E-17	6.99E-17	6.38E-17	6.30E-17
Rh-103m	2.19E-21	1.48E-21	1.23E-21	1.12E-21	7.12E-22	6.70E-22
Rh-104	7.47E-19	7.00E-19	6.62E-19	6.39E-19	5.90E-19	5.83E-19
Rh-104m	4.30E-19	3.63E-19	3.21E-19	2.99E-19	2.53E-19	2.49E-19
Rh-105	2.70E-18	2.52E-18	2.37E-18	2.27E-18	2.05E-18	2.02E-18
Rh-106	8.51E-18	7.91E-18	7.43E-18	7.14E-18	6.52E-18	6.43E-18
Rh-106m	1.14E-16	1.05E-16	9.87E-17	9.50E-17	8.70E-17	8.59E-17
Rh-107	1.11E-17	1.03E-17	9.72E-18	9.30E-18	8.40E-18	8.28E-18
Rh-108	1.28E-17	1.19E-17	1.12E-17	1.07E-17	9.77E-18	9.63E-18
Rh-109	1.06E-17	9.86E-18	9.27E-18	8.86E-18	8.01E-18	7.90E-18
Palladium						
Pd-96	5.53E-17	5.12E-17	4.79E-17	4.61E-17	4.20E-17	4.15E-17
Pd-97	9.53E-17	8.87E-17	8.34E-17	8.05E-17	7.39E-17	7.30E-17
Pd-98	1.43E-17	1.32E-17	1.23E-17	1.18E-17	1.08E-17	1.06E-17
Pd-99	4.92E-17	4.57E-17	4.29E-17	4.13E-17	3.78E-17	3.73E-17
Pd-100	1.94E-18	1.73E-18	1.58E-18	1.49E-18	1.30E-18	1.28E-18
Pd-101	1.24E-17	1.15E-17	1.08E-17	1.04E-17	9.44E-18	9.32E-18
Pd-103	2.27E-20	1.61E-20	1.38E-20	1.27E-20	8.80E-21	8.38E-21
Pd-107	1.12E-25	7.57E-26	6.31E-26	5.73E-26	2.78E-26	2.58E-26
Pd-109	1.32E-19	1.18E-19	1.09E-19	1.03E-19	9.13E-20	8.97E-20
Pd-109m	3.31E-18	3.10E-18	2.90E-18	2.77E-18	2.49E-18	2.46E-18
Pd-111	2.09E-18	1.94E-18	1.82E-18	1.76E-18	1.62E-18	1.60E-18
Pd-112	4.75E-21	3.27E-21	2.79E-21	2.57E-21	1.50E-21	1.40E-21
Pd-114	8.92E-19	8.35E-19	7.84E-19	7.50E-19	6.79E-19	6.69E-19
Silver						
Ag-99	9.13E-17	8.49E-17	7.97E-17	7.68E-17	7.03E-17	6.95E-17
Ag-100m	1.14E-16	1.05E-16	9.91E-17	9.54E-17	8.75E-17	8.64E-17
Ag-101	6.04E-17	5.62E-17	5.27E-17	5.07E-17	4.62E-17	4.56E-17
Ag-102	1.37E-16	1.27E-16	1.20E-16	1.15E-16	1.06E-16	1.05E-16
Ag-102m	8.23E-17	7.71E-17	7.27E-17	7.04E-17	6.52E-17	6.44E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-103	3.16E-17	2.93E-17	2.75E-17	2.64E-17	2.41E-17	2.38E-17
Ag-104	1.08E-16	9.97E-17	9.34E-17	9.00E-17	8.24E-17	8.14E-17
Ag-104m	7.14E-17	6.66E-17	6.27E-17	6.04E-17	5.54E-17	5.47E-17
Ag-105	1.81E-17	1.68E-17	1.58E-17	1.51E-17	1.37E-17	1.35E-17
Ag-105m	3.60E-20	3.35E-20	3.15E-20	3.01E-20	2.73E-20	2.69E-20
Ag-106	2.62E-17	2.44E-17	2.29E-17	2.19E-17	1.99E-17	1.96E-17
Ag-106m	1.11E-16	1.03E-16	9.64E-17	9.28E-17	8.49E-17	8.39E-17
Ag-108	7.98E-19	7.43E-19	6.99E-19	6.71E-19	6.14E-19	6.06E-19
Ag-108m	6.17E-17	5.72E-17	5.36E-17	5.14E-17	4.68E-17	4.62E-17
Ag-109m	7.98E-20	6.90E-20	6.28E-20	5.91E-20	5.06E-20	4.96E-20
Ag-110	1.59E-18	1.48E-18	1.40E-18	1.35E-18	1.24E-18	1.22E-18
Ag-110m	1.11E-16	1.03E-16	9.61E-17	9.27E-17	8.48E-17	8.39E-17
Ag-111	9.55E-19	8.92E-19	8.39E-19	8.02E-19	7.25E-19	7.14E-19
Ag-111m	1.24E-19	1.13E-19	1.05E-19	1.00E-19	8.97E-20	8.83E-20
Ag-112	2.87E-17	2.66E-17	2.50E-17	2.42E-17	2.23E-17	2.20E-17
Ag-113	2.80E-18	2.61E-18	2.45E-18	2.35E-18	2.14E-18	2.11E-18
Ag-113m	7.72E-18	7.18E-18	6.75E-18	6.46E-18	5.85E-18	5.77E-18
Ag-114	1.16E-17	1.09E-17	1.02E-17	9.87E-18	9.09E-18	8.98E-18
Ag-115	1.99E-17	1.85E-17	1.74E-17	1.68E-17	1.55E-17	1.54E-17
Ag-116	9.00E-17	8.42E-17	7.94E-17	7.69E-17	7.12E-17	7.04E-17
Ag-117	5.45E-17	5.10E-17	4.81E-17	4.66E-17	4.33E-17	4.28E-17
Cadmium						
Cd-101	9.97E-17	9.27E-17	8.71E-17	8.41E-17	7.73E-17	7.63E-17
Cd-102	3.15E-17	2.92E-17	2.74E-17	2.63E-17	2.40E-17	2.37E-17
Cd-103	8.57E-17	7.99E-17	7.52E-17	7.27E-17	6.72E-17	6.64E-17
Cd-104	8.18E-18	7.53E-18	7.03E-18	6.74E-18	6.12E-18	6.04E-18
Cd-105	5.26E-17	4.89E-17	4.60E-17	4.45E-17	4.09E-17	4.05E-17
Cd-107	3.16E-19	2.80E-19	2.59E-19	2.46E-19	2.17E-19	2.13E-19
Cd-109	1.07E-19	8.70E-20	7.76E-20	7.24E-20	5.95E-20	5.79E-20
Cd-111m	8.98E-18	8.40E-18	7.88E-18	7.53E-18	6.78E-18	6.69E-18
Cd-113	7.63E-22	6.57E-22	5.89E-22	5.52E-22	4.74E-22	4.66E-22
Cd-113m	6.44E-21	5.85E-21	5.41E-21	5.14E-21	4.57E-21	4.50E-21
Cd-115	7.22E-18	6.71E-18	6.30E-18	6.03E-18	5.48E-18	5.40E-18
Cd-115m	1.45E-18	1.33E-18	1.25E-18	1.21E-18	1.11E-18	1.10E-18
Cd-117	4.38E-17	4.05E-17	3.80E-17	3.67E-17	3.37E-17	3.34E-17
Cd-117m	8.54E-17	7.94E-17	7.47E-17	7.23E-17	6.68E-17	6.61E-17
Cd-118	3.11E-21	2.77E-21	2.53E-21	2.39E-21	2.10E-21	2.06E-21
Cd-119	6.79E-17	6.32E-17	5.95E-17	5.76E-17	5.32E-17	5.26E-17
Cd-119m	9.61E-17	8.92E-17	8.39E-17	8.12E-17	7.50E-17	7.42E-17
Indium						
In-103	1.10E-16	1.03E-16	9.65E-17	9.30E-17	8.55E-17	8.44E-17
In-105	7.55E-17	7.02E-17	6.60E-17	6.35E-17	5.82E-17	5.74E-17
In-106	1.40E-16	1.30E-16	1.22E-16	1.17E-16	1.07E-16	1.05E-16
In-106m	1.14E-16	1.07E-16	1.00E-16	9.69E-17	8.92E-17	8.81E-17
In-107	6.08E-17	5.66E-17	5.32E-17	5.14E-17	4.72E-17	4.66E-17
In-108	1.57E-16	1.45E-16	1.36E-16	1.31E-16	1.20E-16	1.19E-16

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-108m	1.13E-16	1.06E-16	1.00E-16	9.72E-17	9.00E-17	8.89E-17
In-109	2.38E-17	2.21E-17	2.07E-17	1.99E-17	1.82E-17	1.80E-17
In-109m	2.36E-17	2.19E-17	2.05E-17	1.97E-17	1.79E-17	1.77E-17
In-110	1.23E-16	1.13E-16	1.06E-16	1.02E-16	9.34E-17	9.23E-17
In-110m	6.16E-17	5.73E-17	5.39E-17	5.18E-17	4.74E-17	4.67E-17
In-111	1.24E-17	1.17E-17	1.09E-17	1.04E-17	9.39E-18	9.26E-18
In-111m	1.77E-17	1.65E-17	1.55E-17	1.48E-17	1.35E-17	1.33E-17
In-112	9.93E-18	9.23E-18	8.66E-18	8.30E-18	7.54E-18	7.43E-18
In-112m	6.34E-19	5.87E-19	5.42E-19	5.17E-19	4.64E-19	4.57E-19
In-113m	9.21E-18	8.58E-18	8.07E-18	7.71E-18	6.98E-18	6.88E-18
In-114	2.60E-19	2.45E-19	2.33E-19	2.27E-19	2.12E-19	2.10E-19
In-114m	2.56E-18	2.38E-18	2.23E-18	2.13E-18	1.93E-18	1.91E-18
In-115	2.71E-21	2.41E-21	2.19E-21	2.07E-21	1.81E-21	1.78E-21
In-115m	5.46E-18	5.10E-18	4.79E-18	4.58E-18	4.13E-18	4.07E-18
In-116m	1.02E-16	9.48E-17	8.89E-17	8.60E-17	7.92E-17	7.84E-17
In-117	2.51E-17	2.34E-17	2.19E-17	2.10E-17	1.91E-17	1.88E-17
In-117m	2.94E-18	2.75E-18	2.57E-18	2.46E-18	2.22E-18	2.19E-18
In-118	4.20E-18	3.90E-18	3.67E-18	3.55E-18	3.28E-18	3.25E-18
In-118m	1.14E-16	1.05E-16	9.85E-17	9.52E-17	8.73E-17	8.65E-17
In-119	3.05E-17	2.81E-17	2.63E-17	2.53E-17	2.31E-17	2.28E-17
In-119m	2.91E-18	2.69E-18	2.53E-18	2.44E-18	2.25E-18	2.22E-18
In-121	3.76E-17	3.46E-17	3.24E-17	3.12E-17	2.85E-17	2.83E-17
In-121m	2.55E-18	2.36E-18	2.21E-18	2.14E-18	1.97E-18	1.95E-18
Tin						
Sn-106	4.56E-17	4.22E-17	3.96E-17	3.80E-17	3.46E-17	3.42E-17
Sn-108	2.41E-17	2.24E-17	2.10E-17	2.01E-17	1.82E-17	1.80E-17
Sn-109	9.09E-17	8.44E-17	7.93E-17	7.68E-17	7.08E-17	7.01E-17
Sn-110	9.40E-18	8.78E-18	8.25E-18	7.89E-18	7.11E-18	7.00E-18
Sn-111	1.87E-17	1.74E-17	1.64E-17	1.57E-17	1.44E-17	1.42E-17
Sn-113	2.23E-19	1.97E-19	1.82E-19	1.72E-19	1.51E-19	1.49E-19
Sn-113m	4.03E-20	2.85E-20	2.37E-20	2.14E-20	1.60E-20	1.54E-20
Sn-117m	4.19E-18	3.93E-18	3.64E-18	3.48E-18	3.14E-18	3.09E-18
Sn-119m	3.52E-20	2.36E-20	1.91E-20	1.71E-20	1.20E-20	1.14E-20
Sn-121	1.36E-21	1.19E-21	1.08E-21	1.01E-21	8.77E-22	8.62E-22
Sn-121m	1.67E-20	1.16E-20	9.41E-21	8.42E-21	6.25E-21	5.99E-21
Sn-123	3.57E-19	3.31E-19	3.11E-19	3.01E-19	2.77E-19	2.75E-19
Sn-123m	4.15E-18	3.90E-18	3.62E-18	3.46E-18	3.13E-18	3.08E-18
Sn-125	1.39E-17	1.29E-17	1.21E-17	1.16E-17	1.07E-17	1.06E-17
Sn-125m	1.25E-17	1.17E-17	1.10E-17	1.05E-17	9.51E-18	9.38E-18
Sn-126	9.55E-19	8.52E-19	7.82E-19	7.38E-19	6.46E-19	6.35E-19
Sn-127	7.79E-17	7.21E-17	6.76E-17	6.53E-17	6.00E-17	5.94E-17
Sn-127m	2.22E-17	2.06E-17	1.94E-17	1.86E-17	1.70E-17	1.68E-17
Sn-128	2.07E-17	1.92E-17	1.80E-17	1.72E-17	1.56E-17	1.54E-17
Sn-129	4.07E-17	3.76E-17	3.53E-17	3.40E-17	3.11E-17	3.07E-17
Sn-130	3.45E-17	3.19E-17	2.98E-17	2.86E-17	2.60E-17	2.57E-17
Sn-130m	3.54E-17	3.27E-17	3.06E-17	2.96E-17	2.71E-17	2.68E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Antimony						
Sb-111	5.61E-17	5.21E-17	4.89E-17	4.69E-17	4.27E-17	4.21E-17
Sb-113	4.79E-17	4.45E-17	4.18E-17	4.01E-17	3.64E-17	3.59E-17
Sb-114	1.09E-16	1.01E-16	9.48E-17	9.14E-17	8.39E-17	8.30E-17
Sb-115	3.31E-17	3.08E-17	2.89E-17	2.77E-17	2.52E-17	2.48E-17
Sb-116	9.29E-17	8.62E-17	8.09E-17	7.82E-17	7.19E-17	7.11E-17
Sb-116m	1.24E-16	1.14E-16	1.07E-16	1.03E-16	9.47E-17	9.37E-17
Sb-117	5.18E-18	4.84E-18	4.50E-18	4.30E-18	3.89E-18	3.83E-18
Sb-118	3.05E-17	2.84E-17	2.66E-17	2.55E-17	2.32E-17	2.29E-17
Sb-118m	1.04E-16	9.63E-17	9.01E-17	8.70E-17	7.98E-17	7.90E-17
Sb-119	5.72E-20	3.83E-20	3.10E-20	2.77E-20	1.95E-20	1.86E-20
Sb-120	1.67E-17	1.55E-17	1.46E-17	1.40E-17	1.27E-17	1.25E-17
Sb-120m	9.77E-17	8.99E-17	8.41E-17	8.12E-17	7.44E-17	7.36E-17
Sb-122	1.71E-17	1.59E-17	1.49E-17	1.43E-17	1.30E-17	1.29E-17
Sb-122m	8.16E-19	6.89E-19	6.12E-19	5.70E-19	4.84E-19	4.77E-19
Sb-124	7.59E-17	7.05E-17	6.63E-17	6.40E-17	5.89E-17	5.82E-17
Sb-124m	1.69E-17	1.57E-17	1.47E-17	1.41E-17	1.28E-17	1.26E-17
Sb-124n	2.13E-24	1.42E-24	1.15E-24	1.02E-24	7.28E-25	6.92E-25
Sb-125	1.59E-17	1.47E-17	1.38E-17	1.32E-17	1.20E-17	1.18E-17
Sb-126	1.07E-16	9.92E-17	9.29E-17	8.92E-17	8.13E-17	8.03E-17
Sb-126m	5.98E-17	5.54E-17	5.19E-17	4.98E-17	4.54E-17	4.48E-17
Sb-127	2.67E-17	2.47E-17	2.31E-17	2.22E-17	2.02E-17	1.99E-17
Sb-128	1.21E-16	1.12E-16	1.05E-16	1.01E-16	9.18E-17	9.07E-17
Sb-128m	7.45E-17	6.89E-17	6.45E-17	6.20E-17	5.65E-17	5.58E-17
Sb-129	5.92E-17	5.47E-17	5.13E-17	4.95E-17	4.54E-17	4.49E-17
Sb-130	1.29E-16	1.19E-16	1.12E-16	1.08E-16	9.83E-17	9.72E-17
Sb-130m	1.09E-16	1.00E-16	9.38E-17	9.04E-17	8.27E-17	8.18E-17
Sb-131	8.52E-17	7.89E-17	7.40E-17	7.15E-17	6.58E-17	6.51E-17
Sb-133	1.15E-16	1.06E-16	1.00E-16	9.69E-17	8.95E-17	8.85E-17
Tellurium						
Te-113	8.95E-17	8.32E-17	7.81E-17	7.53E-17	6.91E-17	6.83E-17
Te-114	5.06E-17	4.70E-17	4.41E-17	4.26E-17	3.91E-17	3.87E-17
Te-115	8.98E-17	8.32E-17	7.80E-17	7.52E-17	6.89E-17	6.81E-17
Te-115m	1.05E-16	9.77E-17	9.18E-17	8.86E-17	8.13E-17	8.04E-17
Te-116	2.65E-18	2.42E-18	2.26E-18	2.15E-18	1.94E-18	1.91E-18
Te-117	6.23E-17	5.79E-17	5.44E-17	5.25E-17	4.82E-17	4.77E-17
Te-118	5.68E-20	3.82E-20	3.08E-20	2.74E-20	1.98E-20	1.88E-20
Te-119	2.95E-17	2.73E-17	2.56E-17	2.46E-17	2.25E-17	2.22E-17
Te-119m	5.98E-17	5.53E-17	5.17E-17	5.00E-17	4.59E-17	4.54E-17
Te-121	2.13E-17	1.97E-17	1.85E-17	1.77E-17	1.61E-17	1.59E-17
Te-121m	6.84E-18	6.37E-18	5.97E-18	5.71E-18	5.15E-18	5.09E-18
Te-123	9.87E-23	6.64E-23	5.35E-23	4.77E-23	3.43E-23	3.27E-23
Te-123m	3.99E-18	3.75E-18	3.47E-18	3.32E-18	2.99E-18	2.95E-18
Te-125m	1.26E-19	8.75E-20	7.14E-20	6.40E-20	4.81E-20	4.61E-20
Te-127	1.83E-19	1.70E-19	1.60E-19	1.53E-19	1.38E-19	1.36E-19
Te-127m	4.33E-20	3.13E-20	2.61E-20	2.36E-20	1.84E-20	1.77E-20

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-129	2.25E-18	2.09E-18	1.96E-18	1.88E-18	1.71E-18	1.68E-18
Te-129m	1.22E-18	1.12E-18	1.05E-18	1.01E-18	9.17E-19	9.06E-19
Te-131	1.54E-17	1.43E-17	1.34E-17	1.28E-17	1.17E-17	1.16E-17
Te-131m	5.76E-17	5.32E-17	4.98E-17	4.80E-17	4.39E-17	4.34E-17
Te-132	6.85E-18	6.38E-18	5.98E-18	5.71E-18	5.13E-18	5.06E-18
Te-133	4.80E-17	4.46E-17	4.19E-17	4.04E-17	3.71E-17	3.67E-17
Te-133m	7.45E-17	6.88E-17	6.45E-17	6.22E-17	5.70E-17	5.64E-17
Te-134	3.22E-17	2.98E-17	2.79E-17	2.68E-17	2.43E-17	2.40E-17
Iodine						
I-118	7.94E-17	7.37E-17	6.92E-17	6.65E-17	6.07E-17	5.99E-17
I-118m	1.47E-16	1.36E-16	1.28E-16	1.23E-16	1.12E-16	1.11E-16
I-119	3.33E-17	3.10E-17	2.91E-17	2.79E-17	2.53E-17	2.49E-17
I-120	1.08E-16	1.01E-16	9.51E-17	9.19E-17	8.47E-17	8.37E-17
I-120m	1.39E-16	1.30E-16	1.22E-16	1.17E-16	1.07E-16	1.06E-16
I-121	1.34E-17	1.25E-17	1.17E-17	1.12E-17	1.02E-17	1.00E-17
I-122	3.67E-17	3.41E-17	3.20E-17	3.07E-17	2.79E-17	2.75E-17
I-123	4.58E-18	4.28E-18	3.97E-18	3.80E-18	3.43E-18	3.37E-18
I-124	4.38E-17	4.06E-17	3.82E-17	3.68E-17	3.37E-17	3.33E-17
I-125	1.41E-19	9.63E-20	7.75E-20	6.91E-20	5.08E-20	4.86E-20
I-126	1.62E-17	1.50E-17	1.41E-17	1.35E-17	1.23E-17	1.21E-17
I-128	2.63E-18	2.45E-18	2.30E-18	2.20E-18	2.01E-18	1.98E-18
I-129	1.07E-19	7.52E-20	6.08E-20	5.43E-20	4.12E-20	3.97E-20
I-130	8.31E-17	7.69E-17	7.21E-17	6.92E-17	6.31E-17	6.23E-17
I-130m	4.07E-18	3.78E-18	3.55E-18	3.40E-18	3.10E-18	3.06E-18
I-131	1.38E-17	1.28E-17	1.21E-17	1.15E-17	1.04E-17	1.03E-17
I-132	9.01E-17	8.33E-17	7.80E-17	7.51E-17	6.86E-17	6.78E-17
I-132m	1.28E-17	1.18E-17	1.10E-17	1.06E-17	9.65E-18	9.53E-18
I-133	2.35E-17	2.19E-17	2.05E-17	1.97E-17	1.79E-17	1.77E-17
I-134	1.05E-16	9.67E-17	9.05E-17	8.73E-17	7.99E-17	7.90E-17
I-134m	9.24E-18	8.59E-18	8.05E-18	7.71E-18	6.95E-18	6.86E-18
I-135	6.58E-17	6.09E-17	5.72E-17	5.53E-17	5.09E-17	5.04E-17
Xenon						
Xe-120	1.36E-17	1.25E-17	1.17E-17	1.13E-17	1.02E-17	1.01E-17
Xe-121	5.83E-17	5.44E-17	5.13E-17	4.95E-17	4.55E-17	4.50E-17
Xe-122	1.63E-18	1.50E-18	1.40E-18	1.34E-18	1.20E-18	1.18E-18
Xe-123	2.35E-17	2.19E-17	2.05E-17	1.97E-17	1.80E-17	1.78E-17
Xe-125	8.19E-18	7.61E-18	7.12E-18	6.82E-18	6.15E-18	6.07E-18
Xe-127	8.35E-18	7.80E-18	7.30E-18	6.97E-18	6.28E-18	6.19E-18
Xe-127m	4.34E-18	4.06E-18	3.76E-18	3.59E-18	3.23E-18	3.18E-18
Xe-129m	4.60E-19	3.89E-19	3.49E-19	3.27E-19	2.82E-19	2.76E-19
Xe-131m	1.62E-19	1.36E-19	1.20E-19	1.13E-19	9.67E-20	9.46E-20
Xe-133	6.71E-19	5.83E-19	5.29E-19	4.97E-19	4.30E-19	4.23E-19
Xe-133m	8.37E-19	7.66E-19	7.13E-19	6.80E-19	6.06E-19	5.97E-19
Xe-135	8.38E-18	7.83E-18	7.35E-18	7.03E-18	6.34E-18	6.25E-18
Xe-135m	1.59E-17	1.48E-17	1.39E-17	1.33E-17	1.21E-17	1.19E-17
Xe-137	8.09E-18	7.54E-18	7.10E-18	6.83E-18	6.25E-18	6.17E-18

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Xe-138	4.62E-17	4.31E-17	4.07E-17	3.94E-17	3.64E-17	3.60E-17
Cesium						
Cs-121	4.47E-17	4.16E-17	3.91E-17	3.74E-17	3.41E-17	3.36E-17
Cs-121m	4.43E-17	4.12E-17	3.87E-17	3.71E-17	3.37E-17	3.32E-17
Cs-123	4.07E-17	3.78E-17	3.55E-17	3.40E-17	3.10E-17	3.05E-17
Cs-124	4.51E-17	4.19E-17	3.94E-17	3.78E-17	3.44E-17	3.39E-17
Cs-125	2.83E-17	2.63E-17	2.47E-17	2.37E-17	2.16E-17	2.13E-17
Cs-126	4.41E-17	4.10E-17	3.85E-17	3.69E-17	3.36E-17	3.31E-17
Cs-127	1.51E-17	1.40E-17	1.31E-17	1.26E-17	1.14E-17	1.12E-17
Cs-128	3.37E-17	3.13E-17	2.94E-17	2.82E-17	2.56E-17	2.53E-17
Cs-129	9.05E-18	8.40E-18	7.89E-18	7.54E-18	6.81E-18	6.71E-18
Cs-130	1.86E-17	1.73E-17	1.63E-17	1.56E-17	1.42E-17	1.40E-17
Cs-130m	1.10E-18	9.67E-19	8.79E-19	8.29E-19	7.26E-19	7.14E-19
Cs-131	8.95E-20	6.16E-20	4.96E-20	4.41E-20	3.30E-20	3.17E-20
Cs-132	2.71E-17	2.51E-17	2.35E-17	2.25E-17	2.05E-17	2.03E-17
Cs-134	6.11E-17	5.65E-17	5.29E-17	5.08E-17	4.63E-17	4.58E-17
Cs-134m	4.75E-19	4.35E-19	4.00E-19	3.80E-19	3.39E-19	3.33E-19
Cs-135	6.29E-22	5.36E-22	4.79E-22	4.48E-22	3.82E-22	3.75E-22
Cs-135m	6.39E-17	5.88E-17	5.50E-17	5.30E-17	4.83E-17	4.78E-17
Cs-136	8.49E-17	7.83E-17	7.32E-17	7.06E-17	6.46E-17	6.39E-17
Cs-137	6.03E-21	5.52E-21	5.14E-21	4.92E-21	4.45E-21	4.39E-21
Cs-138	9.88E-17	9.18E-17	8.63E-17	8.36E-17	7.72E-17	7.63E-17
Cs-138m	1.62E-17	1.50E-17	1.41E-17	1.36E-17	1.25E-17	1.23E-17
Cs-139	1.36E-17	1.27E-17	1.19E-17	1.16E-17	1.07E-17	1.06E-17
Cs-140	7.51E-17	7.02E-17	6.62E-17	6.42E-17	5.95E-17	5.88E-17
Barium						
Ba-124	2.10E-17	1.94E-17	1.82E-17	1.75E-17	1.59E-17	1.57E-17
Ba-126	2.15E-17	1.99E-17	1.86E-17	1.79E-17	1.63E-17	1.62E-17
Ba-127	2.72E-17	2.53E-17	2.37E-17	2.28E-17	2.08E-17	2.05E-17
Ba-128	1.53E-18	1.41E-18	1.31E-18	1.25E-18	1.12E-18	1.10E-18
Ba-129	1.19E-17	1.10E-17	1.04E-17	9.94E-18	9.06E-18	8.94E-18
Ba-129m	6.13E-17	5.68E-17	5.32E-17	5.12E-17	4.69E-17	4.63E-17
Ba-131	1.61E-17	1.49E-17	1.40E-17	1.34E-17	1.21E-17	1.20E-17
Ba-131m	1.56E-18	1.43E-18	1.33E-18	1.26E-18	1.13E-18	1.10E-18
Ba-133	1.25E-17	1.16E-17	1.09E-17	1.04E-17	9.38E-18	9.24E-18
Ba-133m	1.76E-18	1.63E-18	1.52E-18	1.45E-18	1.30E-18	1.28E-18
Ba-135m	1.50E-18	1.39E-18	1.30E-18	1.24E-18	1.11E-18	1.09E-18
Ba-137m	2.32E-17	2.14E-17	2.01E-17	1.93E-17	1.76E-17	1.73E-17
Ba-139	1.61E-18	1.51E-18	1.41E-18	1.36E-18	1.24E-18	1.22E-18
Ba-140	6.57E-18	6.11E-18	5.73E-18	5.48E-18	4.98E-18	4.90E-18
Ba-141	3.58E-17	3.32E-17	3.12E-17	3.00E-17	2.74E-17	2.71E-17
Ba-142	4.14E-17	3.82E-17	3.57E-17	3.45E-17	3.15E-17	3.12E-17
Lanthanum						
La-128	1.10E-16	1.02E-16	9.61E-17	9.24E-17	8.44E-17	8.33E-17
La-129	3.39E-17	3.15E-17	2.96E-17	2.83E-17	2.57E-17	2.54E-17
La-130	8.72E-17	8.10E-17	7.61E-17	7.32E-17	6.69E-17	6.60E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-131	2.35E-17	2.18E-17	2.05E-17	1.96E-17	1.78E-17	1.76E-17
La-132	7.92E-17	7.37E-17	6.94E-17	6.69E-17	6.14E-17	6.06E-17
La-132m	2.45E-17	2.27E-17	2.12E-17	2.04E-17	1.85E-17	1.83E-17
La-133	5.23E-18	4.84E-18	4.53E-18	4.34E-18	3.93E-18	3.88E-18
La-134	2.72E-17	2.53E-17	2.37E-17	2.27E-17	2.07E-17	2.04E-17
La-135	5.04E-19	4.42E-19	4.03E-19	3.82E-19	3.38E-19	3.32E-19
La-136	1.49E-17	1.38E-17	1.30E-17	1.24E-17	1.13E-17	1.11E-17
La-137	1.16E-19	8.21E-20	6.64E-20	5.92E-20	4.53E-20	4.36E-20
La-138	5.08E-17	4.70E-17	4.41E-17	4.26E-17	3.92E-17	3.88E-17
La-140	9.55E-17	8.87E-17	8.34E-17	8.06E-17	7.43E-17	7.35E-17
La-141	1.40E-18	1.31E-18	1.23E-18	1.20E-18	1.11E-18	1.10E-18
La-142	1.00E-16	9.41E-17	8.89E-17	8.62E-17	8.01E-17	7.92E-17
La-143	1.14E-17	1.06E-17	1.00E-17	9.70E-18	8.96E-18	8.86E-18
Cerium						
Ce-130	1.73E-17	1.60E-17	1.50E-17	1.44E-17	1.31E-17	1.29E-17
Ce-131	6.27E-17	5.82E-17	5.46E-17	5.25E-17	4.80E-17	4.74E-17
Ce-132	8.01E-18	7.47E-18	6.97E-18	6.66E-18	6.00E-18	5.91E-18
Ce-133	1.82E-17	1.69E-17	1.58E-17	1.52E-17	1.37E-17	1.35E-17
Ce-133m	6.78E-17	6.28E-17	5.89E-17	5.68E-17	5.21E-17	5.15E-17
Ce-134	1.83E-19	1.41E-19	1.20E-19	1.10E-19	9.02E-20	8.78E-20
Ce-135	3.00E-17	2.78E-17	2.61E-17	2.50E-17	2.27E-17	2.24E-17
Ce-137	5.45E-19	4.78E-19	4.36E-19	4.12E-19	3.65E-19	3.58E-19
Ce-137m	1.33E-18	1.22E-18	1.13E-18	1.08E-18	9.69E-19	9.56E-19
Ce-139	4.08E-18	3.80E-18	3.52E-18	3.36E-18	3.02E-18	2.98E-18
Ce-141	2.04E-18	1.91E-18	1.77E-18	1.69E-18	1.52E-18	1.50E-18
Ce-143	9.37E-18	8.67E-18	8.13E-18	7.78E-18	7.04E-18	6.94E-18
Ce-144	4.50E-19	4.17E-19	3.84E-19	3.66E-19	3.29E-19	3.23E-19
Ce-145	3.07E-17	2.83E-17	2.65E-17	2.55E-17	2.32E-17	2.30E-17
Praseodymium						
Pr-134	1.22E-16	1.13E-16	1.06E-16	1.02E-16	9.30E-17	9.18E-17
Pr-134m	9.15E-17	8.52E-17	8.01E-17	7.71E-17	7.07E-17	6.98E-17
Pr-135	3.21E-17	2.98E-17	2.80E-17	2.69E-17	2.44E-17	2.41E-17
Pr-136	8.45E-17	7.86E-17	7.39E-17	7.11E-17	6.51E-17	6.43E-17
Pr-137	1.35E-17	1.25E-17	1.17E-17	1.13E-17	1.03E-17	1.01E-17
Pr-138	3.10E-17	2.89E-17	2.71E-17	2.60E-17	2.36E-17	2.33E-17
Pr-138m	9.73E-17	8.98E-17	8.40E-17	8.09E-17	7.39E-17	7.31E-17
Pr-139	4.14E-18	3.82E-18	3.57E-18	3.42E-18	3.11E-18	3.07E-18
Pr-140	2.03E-17	1.89E-17	1.77E-17	1.70E-17	1.54E-17	1.52E-17
Pr-142	2.66E-18	2.47E-18	2.33E-18	2.26E-18	2.09E-18	2.07E-18
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	1.94E-20	1.81E-20	1.71E-20	1.65E-20	1.52E-20	1.50E-20
Pr-144	1.62E-18	1.52E-18	1.43E-18	1.39E-18	1.29E-18	1.28E-18
Pr-144m	1.35E-19	1.12E-19	9.94E-20	9.31E-20	8.06E-20	7.91E-20
Pr-145	8.58E-19	7.94E-19	7.46E-19	7.20E-19	6.61E-19	6.54E-19
Pr-146	4.17E-17	3.88E-17	3.65E-17	3.53E-17	3.25E-17	3.21E-17
Pr-147	1.77E-17	1.63E-17	1.53E-17	1.47E-17	1.34E-17	1.33E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pr-148	4.05E-17	3.76E-17	3.53E-17	3.41E-17	3.14E-17	3.10E-17
Pr-148m	3.58E-17	3.33E-17	3.13E-17	3.00E-17	2.73E-17	2.70E-17
Neodymium						
Nd-134	1.84E-17	1.71E-17	1.60E-17	1.53E-17	1.39E-17	1.37E-17
Nd-135	4.63E-17	4.30E-17	4.04E-17	3.87E-17	3.52E-17	3.46E-17
Nd-136	8.59E-18	7.92E-18	7.39E-18	7.07E-18	6.41E-18	6.32E-18
Nd-137	4.51E-17	4.17E-17	3.92E-17	3.77E-17	3.44E-17	3.40E-17
Nd-138	6.69E-19	5.90E-19	5.39E-19	5.09E-19	4.48E-19	4.40E-19
Nd-139	1.63E-17	1.51E-17	1.42E-17	1.36E-17	1.24E-17	1.22E-17
Nd-139m	6.17E-17	5.69E-17	5.33E-17	5.13E-17	4.70E-17	4.64E-17
Nd-140	1.73E-19	1.27E-19	1.04E-19	9.36E-20	7.33E-20	7.12E-20
Nd-141	2.05E-18	1.87E-18	1.74E-18	1.66E-18	1.51E-18	1.49E-18
Nd-141m	2.75E-17	2.53E-17	2.37E-17	2.28E-17	2.08E-17	2.06E-17
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	4.30E-18	3.97E-18	3.71E-18	3.54E-18	3.20E-18	3.15E-18
Nd-149	1.26E-17	1.17E-17	1.10E-17	1.05E-17	9.48E-18	9.35E-18
Nd-151	3.28E-17	3.04E-17	2.84E-17	2.74E-17	2.50E-17	2.48E-17
Nd-152	5.56E-18	5.19E-18	4.87E-18	4.66E-18	4.20E-18	4.14E-18
Promethium						
Pm-136	1.05E-16	9.77E-17	9.17E-17	8.80E-17	8.01E-17	7.90E-17
Pm-137m	6.62E-17	6.15E-17	5.77E-17	5.53E-17	5.03E-17	4.96E-17
Pm-139	3.58E-17	3.33E-17	3.12E-17	3.00E-17	2.73E-17	2.69E-17
Pm-140	4.10E-17	3.81E-17	3.58E-17	3.43E-17	3.13E-17	3.08E-17
Pm-140m	1.19E-16	1.10E-16	1.03E-16	9.93E-17	9.07E-17	8.96E-17
Pm-141	2.82E-17	2.62E-17	2.46E-17	2.36E-17	2.15E-17	2.12E-17
Pm-142	3.29E-17	3.06E-17	2.87E-17	2.75E-17	2.51E-17	2.47E-17
Pm-143	1.15E-17	1.06E-17	9.88E-18	9.49E-18	8.64E-18	8.54E-18
Pm-144	5.95E-17	5.51E-17	5.16E-17	4.95E-17	4.51E-17	4.45E-17
Pm-145	2.22E-19	1.69E-19	1.41E-19	1.28E-19	1.02E-19	9.99E-20
Pm-146	2.83E-17	2.62E-17	2.45E-17	2.35E-17	2.14E-17	2.11E-17
Pm-147	3.46E-22	2.96E-22	2.65E-22	2.48E-22	2.12E-22	2.08E-22
Pm-148	2.37E-17	2.19E-17	2.06E-17	1.99E-17	1.82E-17	1.80E-17
Pm-148m	7.70E-17	7.13E-17	6.68E-17	6.41E-17	5.84E-17	5.76E-17
Pm-149	4.48E-19	4.18E-19	3.92E-19	3.76E-19	3.41E-19	3.36E-19
Pm-150	5.96E-17	5.52E-17	5.18E-17	5.00E-17	4.59E-17	4.54E-17
Pm-151	1.14E-17	1.06E-17	9.89E-18	9.47E-18	8.57E-18	8.46E-18
Pm-152	1.18E-17	1.09E-17	1.02E-17	9.86E-18	9.06E-18	8.96E-18
Pm-152m	5.94E-17	5.50E-17	5.16E-17	4.97E-17	4.55E-17	4.50E-17
Pm-153	2.04E-18	1.89E-18	1.76E-18	1.68E-18	1.51E-18	1.49E-18
Pm-154	7.49E-17	6.96E-17	6.55E-17	6.34E-17	5.86E-17	5.80E-17
Pm-154m	7.23E-17	6.70E-17	6.29E-17	6.07E-17	5.58E-17	5.52E-17
Samarium						
Sm-139	5.54E-17	5.15E-17	4.84E-17	4.64E-17	4.23E-17	4.17E-17
Sm-140	2.11E-17	1.96E-17	1.83E-17	1.76E-17	1.61E-17	1.59E-17
Sm-141	5.46E-17	5.07E-17	4.76E-17	4.58E-17	4.19E-17	4.13E-17
Sm-141m	7.57E-17	7.01E-17	6.57E-17	6.33E-17	5.79E-17	5.72E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-142	3.28E-18	3.01E-18	2.81E-18	2.69E-18	2.43E-18	2.39E-18
Sm-143	1.97E-17	1.83E-17	1.72E-17	1.64E-17	1.49E-17	1.47E-17
Sm-143m	2.70E-17	2.49E-17	2.33E-17	2.24E-17	2.05E-17	2.02E-17
Sm-145	5.03E-19	3.91E-19	3.29E-19	2.99E-19	2.42E-19	2.37E-19
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.49E-23	1.01E-23	8.36E-24	7.56E-24	5.01E-24	4.74E-24
Sm-153	1.09E-18	9.77E-19	8.94E-19	8.44E-19	7.41E-19	7.27E-19
Sm-155	2.58E-18	2.39E-18	2.23E-18	2.12E-18	1.90E-18	1.87E-18
Sm-156	3.21E-18	2.99E-18	2.79E-18	2.66E-18	2.38E-18	2.35E-18
Sm-157	1.50E-17	1.39E-17	1.30E-17	1.25E-17	1.14E-17	1.13E-17
Europium						
Eu-142	4.80E-17	4.47E-17	4.20E-17	4.03E-17	3.68E-17	3.63E-17
Eu-142m	1.36E-16	1.26E-16	1.18E-16	1.13E-16	1.03E-16	1.02E-16
Eu-143	4.42E-17	4.11E-17	3.86E-17	3.71E-17	3.39E-17	3.35E-17
Eu-144	4.32E-17	4.02E-17	3.78E-17	3.62E-17	3.31E-17	3.26E-17
Eu-145	5.14E-17	4.75E-17	4.46E-17	4.31E-17	3.96E-17	3.91E-17
Eu-146	9.55E-17	8.83E-17	8.29E-17	7.98E-17	7.31E-17	7.23E-17
Eu-147	1.67E-17	1.54E-17	1.44E-17	1.38E-17	1.26E-17	1.24E-17
Eu-148	8.63E-17	8.00E-17	7.50E-17	7.21E-17	6.58E-17	6.49E-17
Eu-149	1.38E-18	1.25E-18	1.15E-18	1.10E-18	9.75E-19	9.60E-19
Eu-150	5.81E-17	5.39E-17	5.06E-17	4.85E-17	4.41E-17	4.35E-17
Eu-150m	1.78E-18	1.65E-18	1.55E-18	1.48E-18	1.35E-18	1.33E-18
Eu-152	4.60E-17	4.25E-17	3.98E-17	3.84E-17	3.51E-17	3.47E-17
Eu-152m	1.16E-17	1.07E-17	9.96E-18	9.60E-18	8.77E-18	8.68E-18
Eu-152n	1.43E-18	1.29E-18	1.19E-18	1.12E-18	9.86E-19	9.68E-19
Eu-154	4.98E-17	4.60E-17	4.30E-17	4.15E-17	3.80E-17	3.76E-17
Eu-154m	1.11E-18	9.78E-19	8.90E-19	8.37E-19	7.30E-19	7.17E-19
Eu-155	1.19E-18	1.08E-18	9.94E-19	9.40E-19	8.29E-19	8.14E-19
Eu-156	5.12E-17	4.75E-17	4.46E-17	4.32E-17	3.98E-17	3.94E-17
Eu-157	9.64E-18	8.92E-18	8.35E-18	7.98E-18	7.21E-18	7.11E-18
Eu-158	5.30E-17	4.89E-17	4.58E-17	4.42E-17	4.06E-17	4.02E-17
Eu-159	1.02E-17	9.35E-18	8.72E-18	8.38E-18	7.62E-18	7.53E-18
Gadolinium						
Gd-142	4.02E-17	3.73E-17	3.50E-17	3.36E-17	3.07E-17	3.03E-17
Gd-143m	8.22E-17	7.63E-17	7.16E-17	6.89E-17	6.29E-17	6.21E-17
Gd-144	3.56E-17	3.32E-17	3.13E-17	3.01E-17	2.77E-17	2.73E-17
Gd-145	1.01E-16	9.40E-17	8.87E-17	8.59E-17	7.96E-17	7.87E-17
Gd-145m	2.65E-17	2.45E-17	2.29E-17	2.20E-17	2.00E-17	1.98E-17
Gd-146	5.30E-18	4.86E-18	4.47E-18	4.25E-18	3.79E-18	3.72E-18
Gd-147	5.30E-17	4.90E-17	4.59E-17	4.41E-17	4.02E-17	3.98E-17
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	1.78E-17	1.65E-17	1.54E-17	1.48E-17	1.34E-17	1.32E-17
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	1.34E-18	1.21E-18	1.11E-18	1.06E-18	9.35E-19	9.21E-19

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	1.63E-18	1.44E-18	1.31E-18	1.23E-18	1.07E-18	1.05E-18
Gd-159	1.68E-18	1.55E-18	1.45E-18	1.39E-18	1.25E-18	1.23E-18
Gd-162	1.52E-17	1.41E-17	1.33E-17	1.27E-17	1.15E-17	1.13E-17
Terbium						
Tb-146	1.50E-16	1.39E-16	1.31E-16	1.26E-16	1.17E-16	1.15E-16
Tb-147	8.74E-17	8.08E-17	7.58E-17	7.31E-17	6.71E-17	6.64E-17
Tb-147m	7.85E-17	7.29E-17	6.85E-17	6.63E-17	6.11E-17	6.04E-17
Tb-148	9.47E-17	8.80E-17	8.27E-17	7.98E-17	7.33E-17	7.24E-17
Tb-148m	1.22E-16	1.13E-16	1.06E-16	1.02E-16	9.26E-17	9.15E-17
Tb-149	5.31E-17	4.93E-17	4.63E-17	4.46E-17	4.09E-17	4.05E-17
Tb-149m	5.32E-17	4.91E-17	4.60E-17	4.42E-17	4.03E-17	3.98E-17
Tb-150	9.94E-17	9.29E-17	8.75E-17	8.46E-17	7.82E-17	7.73E-17
Tb-150m	9.56E-17	8.86E-17	8.30E-17	7.96E-17	7.24E-17	7.15E-17
Tb-151	3.56E-17	3.30E-17	3.10E-17	2.97E-17	2.70E-17	2.66E-17
Tb-151m	2.56E-18	2.36E-18	2.20E-18	2.11E-18	1.91E-18	1.88E-18
Tb-152	5.88E-17	5.48E-17	5.15E-17	4.97E-17	4.57E-17	4.51E-17
Tb-152m	2.64E-17	2.45E-17	2.30E-17	2.20E-17	1.99E-17	1.97E-17
Tb-153	1.04E-17	9.62E-18	8.98E-18	8.60E-18	7.78E-18	7.68E-18
Tb-154	9.42E-17	8.78E-17	8.27E-17	8.02E-17	7.43E-17	7.35E-17
Tb-155	3.98E-18	3.64E-18	3.37E-18	3.20E-18	2.85E-18	2.80E-18
Tb-156	7.57E-17	7.00E-17	6.56E-17	6.32E-17	5.79E-17	5.73E-17
Tb-156m	3.93E-19	3.21E-19	2.76E-19	2.54E-19	2.10E-19	2.06E-19
Tb-156n	4.58E-20	3.89E-20	3.45E-20	3.21E-20	2.73E-20	2.68E-20
Tb-157	4.04E-20	3.18E-20	2.68E-20	2.45E-20	1.98E-20	1.94E-20
Tb-158	3.10E-17	2.84E-17	2.66E-17	2.56E-17	2.34E-17	2.31E-17
Tb-160	4.48E-17	4.13E-17	3.86E-17	3.73E-17	3.41E-17	3.37E-17
Tb-161	3.92E-19	3.28E-19	2.89E-19	2.68E-19	2.26E-19	2.23E-19
Tb-162	4.25E-17	3.92E-17	3.67E-17	3.53E-17	3.22E-17	3.18E-17
Tb-163	2.88E-17	2.68E-17	2.52E-17	2.41E-17	2.19E-17	2.15E-17
Tb-164	9.71E-17	9.00E-17	8.44E-17	8.14E-17	7.46E-17	7.37E-17
Tb-165	3.47E-17	3.21E-17	3.01E-17	2.91E-17	2.68E-17	2.65E-17
Dysprosium						
Dy-148	2.67E-17	2.47E-17	2.31E-17	2.22E-17	2.02E-17	1.99E-17
Dy-149	6.44E-17	5.96E-17	5.60E-17	5.40E-17	4.97E-17	4.91E-17
Dy-150	9.44E-18	8.78E-18	8.23E-18	7.86E-18	7.11E-18	7.00E-18
Dy-151	5.38E-17	4.97E-17	4.66E-17	4.49E-17	4.12E-17	4.07E-17
Dy-152	8.76E-18	8.14E-18	7.63E-18	7.29E-18	6.54E-18	6.45E-18
Dy-153	3.15E-17	2.91E-17	2.72E-17	2.62E-17	2.39E-17	2.36E-17
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	2.44E-17	2.26E-17	2.11E-17	2.03E-17	1.85E-17	1.83E-17
Dy-157	1.11E-17	1.04E-17	9.71E-18	9.27E-18	8.35E-18	8.23E-18
Dy-159	4.18E-19	3.34E-19	2.84E-19	2.60E-19	2.12E-19	2.08E-19
Dy-165	8.79E-19	8.10E-19	7.56E-19	7.24E-19	6.56E-19	6.47E-19
Dy-165m	5.04E-19	4.63E-19	4.31E-19	4.11E-19	3.70E-19	3.64E-19
Dy-166	6.61E-19	5.75E-19	5.19E-19	4.86E-19	4.22E-19	4.15E-19

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Dy-167	1.94E-17	1.80E-17	1.69E-17	1.62E-17	1.47E-17	1.45E-17
Dy-168	1.38E-17	1.28E-17	1.20E-17	1.15E-17	1.04E-17	1.03E-17
Holmium						
Ho-150	7.41E-17	6.86E-17	6.43E-17	6.18E-17	5.63E-17	5.56E-17
Ho-153	3.82E-17	3.54E-17	3.32E-17	3.19E-17	2.90E-17	2.86E-17
Ho-153m	3.87E-17	3.60E-17	3.37E-17	3.23E-17	2.93E-17	2.89E-17
Ho-154	7.26E-17	6.74E-17	6.32E-17	6.08E-17	5.54E-17	5.47E-17
Ho-154m	9.15E-17	8.49E-17	7.97E-17	7.64E-17	6.95E-17	6.85E-17
Ho-155	2.21E-17	2.05E-17	1.92E-17	1.84E-17	1.68E-17	1.66E-17
Ho-156	8.22E-17	7.64E-17	7.17E-17	6.91E-17	6.34E-17	6.26E-17
Ho-157	1.96E-17	1.81E-17	1.69E-17	1.62E-17	1.47E-17	1.45E-17
Ho-159	1.11E-17	1.02E-17	9.50E-18	9.08E-18	8.18E-18	8.07E-18
Ho-160	6.58E-17	6.06E-17	5.66E-17	5.45E-17	4.98E-17	4.92E-17
Ho-161	6.19E-19	5.19E-19	4.56E-19	4.23E-19	3.58E-19	3.51E-19
Ho-162	5.12E-18	4.69E-18	4.37E-18	4.19E-18	3.82E-18	3.77E-18
Ho-162m	2.07E-17	1.90E-17	1.78E-17	1.71E-17	1.57E-17	1.55E-17
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	3.28E-19	2.71E-19	2.36E-19	2.19E-19	1.83E-19	1.80E-19
Ho-164m	4.49E-19	3.64E-19	3.12E-19	2.87E-19	2.37E-19	2.33E-19
Ho-166	1.08E-18	9.92E-19	9.29E-19	8.96E-19	8.22E-19	8.13E-19
Ho-166m	6.16E-17	5.69E-17	5.33E-17	5.12E-17	4.66E-17	4.61E-17
Ho-167	1.26E-17	1.17E-17	1.10E-17	1.05E-17	9.50E-18	9.36E-18
Ho-168	3.47E-17	3.20E-17	2.99E-17	2.88E-17	2.63E-17	2.60E-17
Ho-168m	6.37E-20	5.17E-20	4.44E-20	4.08E-20	3.36E-20	3.31E-20
Ho-170	6.68E-17	6.15E-17	5.75E-17	5.54E-17	5.06E-17	5.01E-17
Erbium						
Er-154	1.47E-18	1.32E-18	1.21E-18	1.15E-18	1.02E-18	1.00E-18
Er-156	9.26E-19	8.03E-19	7.21E-19	6.77E-19	5.87E-19	5.77E-19
Er-159	3.69E-17	3.41E-17	3.20E-17	3.08E-17	2.82E-17	2.78E-17
Er-161	3.82E-17	3.52E-17	3.29E-17	3.17E-17	2.90E-17	2.87E-17
Er-163	4.36E-19	3.59E-19	3.11E-19	2.87E-19	2.40E-19	2.36E-19
Er-165	3.82E-19	3.10E-19	2.66E-19	2.45E-19	2.02E-19	1.98E-19
Er-167m	2.88E-18	2.68E-18	2.51E-18	2.40E-18	2.15E-18	2.12E-18
Er-169	9.90E-22	8.60E-22	7.74E-22	7.27E-22	6.28E-22	6.16E-22
Er-171	1.21E-17	1.13E-17	1.06E-17	1.01E-17	9.14E-18	9.00E-18
Er-172	1.84E-17	1.71E-17	1.60E-17	1.53E-17	1.39E-17	1.37E-17
Er-173	3.03E-17	2.79E-17	2.61E-17	2.51E-17	2.28E-17	2.26E-17
Thulium						
Tm-161	4.88E-17	4.52E-17	4.24E-17	4.10E-17	3.77E-17	3.72E-17
Tm-162	7.74E-17	7.21E-17	6.78E-17	6.56E-17	6.05E-17	5.98E-17
Tm-163	5.10E-17	4.72E-17	4.42E-17	4.27E-17	3.92E-17	3.87E-17
Tm-164	2.98E-17	2.77E-17	2.60E-17	2.50E-17	2.29E-17	2.26E-17
Tm-165	1.92E-17	1.77E-17	1.66E-17	1.59E-17	1.44E-17	1.42E-17
Tm-166	7.96E-17	7.39E-17	6.94E-17	6.71E-17	6.18E-17	6.11E-17
Tm-167	3.66E-18	3.36E-18	3.12E-18	2.97E-18	2.65E-18	2.61E-18
Tm-168	4.63E-17	4.27E-17	3.99E-17	3.84E-17	3.49E-17	3.45E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-170	8.35E-20	7.42E-20	6.78E-20	6.41E-20	5.64E-20	5.56E-20
Tm-171	7.52E-21	6.28E-21	5.49E-21	5.09E-21	4.28E-21	4.22E-21
Tm-172	1.96E-17	1.81E-17	1.70E-17	1.65E-17	1.52E-17	1.50E-17
Tm-173	1.40E-17	1.30E-17	1.22E-17	1.17E-17	1.06E-17	1.04E-17
Tm-174	6.70E-17	6.20E-17	5.81E-17	5.58E-17	5.08E-17	5.03E-17
Tm-175	4.23E-17	3.92E-17	3.67E-17	3.53E-17	3.22E-17	3.18E-17
Tm-176	7.91E-17	7.36E-17	6.92E-17	6.69E-17	6.16E-17	6.09E-17
Ytterbium						
Yb-162	7.21E-18	6.66E-18	6.19E-18	5.91E-18	5.33E-18	5.25E-18
Yb-163	2.76E-17	2.56E-17	2.40E-17	2.31E-17	2.11E-17	2.08E-17
Yb-164	9.08E-19	7.94E-19	7.17E-19	6.75E-19	5.90E-19	5.81E-19
Yb-165	1.06E-17	9.70E-18	9.03E-18	8.67E-18	7.86E-18	7.77E-18
Yb-166	1.07E-18	8.97E-19	7.88E-19	7.31E-19	6.17E-19	6.07E-19
Yb-167	5.84E-18	5.31E-18	4.89E-18	4.65E-18	4.14E-18	4.07E-18
Yb-169	7.46E-18	6.80E-18	6.28E-18	5.96E-18	5.30E-18	5.22E-18
Yb-175	1.32E-18	1.23E-18	1.15E-18	1.10E-18	9.93E-19	9.78E-19
Yb-177	7.38E-18	6.81E-18	6.36E-18	6.13E-18	5.61E-18	5.55E-18
Yb-178	1.36E-18	1.26E-18	1.19E-18	1.14E-18	1.03E-18	1.01E-18
Yb-179	3.70E-17	3.43E-17	3.22E-17	3.09E-17	2.81E-17	2.77E-17
Lutetium						
Lu-165	4.15E-17	3.85E-17	3.61E-17	3.47E-17	3.18E-17	3.14E-17
Lu-167	6.75E-17	6.27E-17	5.89E-17	5.70E-17	5.25E-17	5.19E-17
Lu-169	5.18E-17	4.78E-17	4.48E-17	4.33E-17	3.97E-17	3.93E-17
Lu-169m	1.17E-23	7.27E-24	5.63E-24	4.76E-24	1.69E-24	1.57E-24
Lu-170	1.07E-16	9.94E-17	9.36E-17	9.08E-17	8.42E-17	8.33E-17
Lu-171	2.33E-17	2.15E-17	2.00E-17	1.92E-17	1.75E-17	1.73E-17
Lu-171m	4.56E-21	3.88E-21	3.45E-21	3.21E-21	2.73E-21	2.69E-21
Lu-172	7.70E-17	7.10E-17	6.64E-17	6.40E-17	5.86E-17	5.80E-17
Lu-172m	1.64E-23	1.21E-23	9.94E-24	8.90E-24	6.36E-24	6.18E-24
Lu-173	4.14E-18	3.76E-18	3.47E-18	3.29E-18	2.92E-18	2.88E-18
Lu-174	3.31E-18	3.00E-18	2.78E-18	2.67E-18	2.43E-18	2.40E-18
Lu-174m	9.38E-19	8.11E-19	7.27E-19	6.84E-19	5.93E-19	5.86E-19
Lu-176	1.56E-17	1.45E-17	1.36E-17	1.30E-17	1.17E-17	1.16E-17
Lu-176m	2.88E-19	2.57E-19	2.37E-19	2.24E-19	1.98E-19	1.95E-19
Lu-177	1.01E-18	9.39E-19	8.77E-19	8.38E-19	7.51E-19	7.40E-19
Lu-177m	3.18E-17	2.96E-17	2.77E-17	2.65E-17	2.39E-17	2.35E-17
Lu-178	5.17E-18	4.77E-18	4.48E-18	4.33E-18	3.99E-18	3.95E-18
Lu-178m	3.51E-17	3.26E-17	3.06E-17	2.93E-17	2.64E-17	2.60E-17
Lu-179	1.03E-18	9.60E-19	9.00E-19	8.62E-19	7.79E-19	7.69E-19
Lu-180	6.07E-17	5.61E-17	5.26E-17	5.08E-17	4.66E-17	4.61E-17
Lu-181	2.11E-17	1.95E-17	1.83E-17	1.75E-17	1.59E-17	1.57E-17
Hafnium						
Hf-167	2.20E-17	2.05E-17	1.92E-17	1.84E-17	1.67E-17	1.64E-17
Hf-169	2.27E-17	2.11E-17	1.98E-17	1.89E-17	1.72E-17	1.69E-17
Hf-170	1.42E-17	1.31E-17	1.23E-17	1.17E-17	1.06E-17	1.05E-17
Hf-172	1.55E-18	1.35E-18	1.22E-18	1.14E-18	9.88E-19	9.72E-19

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-173	1.15E-17	1.07E-17	9.93E-18	9.49E-18	8.54E-18	8.41E-18
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Hf-175	1.12E-17	1.04E-17	9.77E-18	9.33E-18	8.40E-18	8.27E-18
Hf-177m	7.58E-17	7.06E-17	6.62E-17	6.33E-17	5.71E-17	5.63E-17
Hf-178m	7.87E-17	7.32E-17	6.87E-17	6.57E-17	5.95E-17	5.86E-17
Hf-179m	3.04E-17	2.83E-17	2.65E-17	2.54E-17	2.29E-17	2.26E-17
Hf-180m	3.37E-17	3.14E-17	2.95E-17	2.81E-17	2.54E-17	2.51E-17
Hf-181	1.86E-17	1.73E-17	1.62E-17	1.55E-17	1.41E-17	1.38E-17
Hf-182	7.88E-18	7.36E-18	6.91E-18	6.60E-18	5.94E-18	5.86E-18
Hf-182m	3.23E-17	2.99E-17	2.80E-17	2.68E-17	2.43E-17	2.40E-17
Hf-183	2.94E-17	2.72E-17	2.54E-17	2.44E-17	2.22E-17	2.20E-17
Hf-184	7.11E-18	6.62E-18	6.18E-18	5.90E-18	5.32E-18	5.24E-18
Tantalum						
Ta-170	4.03E-17	3.74E-17	3.51E-17	3.36E-17	3.06E-17	3.02E-17
Ta-172	6.62E-17	6.13E-17	5.74E-17	5.53E-17	5.07E-17	5.01E-17
Ta-173	2.08E-17	1.92E-17	1.80E-17	1.73E-17	1.58E-17	1.57E-17
Ta-174	3.67E-17	3.41E-17	3.20E-17	3.08E-17	2.82E-17	2.78E-17
Ta-175	4.26E-17	3.94E-17	3.69E-17	3.56E-17	3.27E-17	3.23E-17
Ta-176	9.16E-17	8.51E-17	8.00E-17	7.75E-17	7.16E-17	7.08E-17
Ta-177	1.20E-18	1.06E-18	9.57E-19	9.02E-19	7.91E-19	7.80E-19
Ta-178	3.43E-18	3.12E-18	2.89E-18	2.77E-18	2.51E-18	2.48E-18
Ta-178m	3.78E-17	3.51E-17	3.29E-17	3.14E-17	2.84E-17	2.79E-17
Ta-179	3.10E-19	2.60E-19	2.29E-19	2.12E-19	1.79E-19	1.76E-19
Ta-180	6.51E-19	5.55E-19	4.93E-19	4.59E-19	3.91E-19	3.85E-19
Ta-182	5.12E-17	4.71E-17	4.41E-17	4.26E-17	3.91E-17	3.87E-17
Ta-182m	6.98E-18	6.48E-18	6.00E-18	5.72E-18	5.13E-18	5.06E-18
Ta-183	8.36E-18	7.74E-18	7.22E-18	6.89E-18	6.17E-18	6.08E-18
Ta-184	5.89E-17	5.45E-17	5.11E-17	4.91E-17	4.46E-17	4.41E-17
Ta-185	4.44E-18	4.12E-18	3.83E-18	3.66E-18	3.30E-18	3.25E-18
Ta-186	5.30E-17	4.91E-17	4.60E-17	4.42E-17	4.02E-17	3.97E-17
Tungsten						
W-177	3.21E-17	2.96E-17	2.77E-17	2.66E-17	2.42E-17	2.39E-17
W-178	1.95E-19	1.64E-19	1.45E-19	1.34E-19	1.14E-19	1.12E-19
W-179	6.49E-19	5.44E-19	4.79E-19	4.44E-19	3.75E-19	3.69E-19
W-179m	1.14E-18	1.03E-18	9.44E-19	8.93E-19	7.87E-19	7.76E-19
W-181	5.19E-19	4.38E-19	3.86E-19	3.58E-19	3.03E-19	2.99E-19
W-185	2.77E-21	2.47E-21	2.24E-21	2.12E-21	1.85E-21	1.82E-21
W-185m	5.57E-19	5.11E-19	4.70E-19	4.47E-19	3.98E-19	3.92E-19
W-187	1.66E-17	1.53E-17	1.44E-17	1.38E-17	1.25E-17	1.24E-17
W-188	6.11E-20	5.69E-20	5.33E-20	5.09E-20	4.57E-20	4.51E-20
W-190	3.36E-18	3.07E-18	2.81E-18	2.67E-18	2.38E-18	2.34E-18
Rhenium						
Re-178	6.78E-17	6.34E-17	5.97E-17	5.77E-17	5.33E-17	5.26E-17
Re-179	4.05E-17	3.76E-17	3.53E-17	3.40E-17	3.10E-17	3.07E-17
Re-180	4.65E-17	4.28E-17	4.00E-17	3.85E-17	3.52E-17	3.48E-17
Re-181	2.87E-17	2.65E-17	2.48E-17	2.38E-17	2.16E-17	2.13E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-182	6.69E-17	6.18E-17	5.78E-17	5.57E-17	5.09E-17	5.03E-17
Re-182m	4.74E-17	4.37E-17	4.09E-17	3.95E-17	3.62E-17	3.58E-17
Re-183	3.32E-18	3.01E-18	2.76E-18	2.62E-18	2.32E-18	2.29E-18
Re-184	3.40E-17	3.12E-17	2.92E-17	2.81E-17	2.56E-17	2.53E-17
Re-184m	1.29E-17	1.19E-17	1.11E-17	1.07E-17	9.68E-18	9.56E-18
Re-186	5.09E-19	4.70E-19	4.33E-19	4.12E-19	3.70E-19	3.64E-19
Re-186m	1.95E-19	1.65E-19	1.46E-19	1.36E-19	1.16E-19	1.14E-19
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	2.25E-18	2.10E-18	1.96E-18	1.88E-18	1.72E-18	1.70E-18
Re-188m	1.14E-18	9.98E-19	9.03E-19	8.48E-19	7.36E-19	7.24E-19
Re-189	1.78E-18	1.66E-18	1.56E-18	1.49E-18	1.34E-18	1.32E-18
Re-190	5.03E-17	4.66E-17	4.37E-17	4.20E-17	3.82E-17	3.77E-17
Re-190m	3.40E-17	3.15E-17	2.95E-17	2.83E-17	2.57E-17	2.54E-17
Osmium						
Os-180	3.28E-18	2.98E-18	2.77E-18	2.64E-18	2.36E-18	2.33E-18
Os-181	5.31E-17	4.90E-17	4.59E-17	4.43E-17	4.05E-17	4.01E-17
Os-182	1.42E-17	1.32E-17	1.23E-17	1.18E-17	1.07E-17	1.05E-17
Os-183	2.07E-17	1.92E-17	1.79E-17	1.71E-17	1.55E-17	1.53E-17
Os-183m	4.00E-17	3.67E-17	3.43E-17	3.32E-17	3.04E-17	3.01E-17
Os-185	2.58E-17	2.38E-17	2.23E-17	2.14E-17	1.95E-17	1.92E-17
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	5.09E-23	3.23E-23	2.53E-23	2.17E-23	6.74E-24	6.20E-24
Os-190m	5.84E-17	5.43E-17	5.10E-17	4.88E-17	4.43E-17	4.37E-17
Os-191	1.67E-18	1.51E-18	1.38E-18	1.31E-18	1.16E-18	1.14E-18
Os-191m	8.49E-20	7.26E-20	6.47E-20	6.03E-20	5.15E-20	5.08E-20
Os-193	2.16E-18	2.01E-18	1.88E-18	1.79E-18	1.62E-18	1.59E-18
Os-194	2.09E-20	1.64E-20	1.38E-20	1.26E-20	1.02E-20	9.95E-21
Os-196	2.64E-18	2.45E-18	2.29E-18	2.19E-18	1.98E-18	1.95E-18
Iridium						
Ir-180	6.02E-17	5.58E-17	5.23E-17	5.01E-17	4.56E-17	4.50E-17
Ir-182	5.31E-17	4.92E-17	4.61E-17	4.43E-17	4.03E-17	3.98E-17
Ir-183	4.58E-17	4.25E-17	3.99E-17	3.85E-17	3.53E-17	3.49E-17
Ir-184	7.57E-17	7.02E-17	6.58E-17	6.34E-17	5.80E-17	5.74E-17
Ir-185	3.28E-17	3.04E-17	2.86E-17	2.76E-17	2.54E-17	2.51E-17
Ir-186	6.36E-17	5.90E-17	5.54E-17	5.34E-17	4.89E-17	4.83E-17
Ir-186m	4.93E-17	4.57E-17	4.28E-17	4.13E-17	3.79E-17	3.75E-17
Ir-187	1.12E-17	1.03E-17	9.59E-18	9.20E-18	8.35E-18	8.25E-18
Ir-188	8.59E-17	8.01E-17	7.54E-17	7.31E-17	6.76E-17	6.68E-17
Ir-189	1.51E-18	1.35E-18	1.23E-18	1.16E-18	1.02E-18	1.01E-18
Ir-190	5.37E-17	4.98E-17	4.67E-17	4.47E-17	4.06E-17	4.01E-17
Ir-190m	5.76E-23	3.70E-23	2.93E-23	2.53E-23	7.75E-24	7.12E-24
Ir-190n	9.07E-19	7.90E-19	7.11E-19	6.67E-19	5.77E-19	5.69E-19
Ir-191m	1.50E-18	1.36E-18	1.25E-18	1.18E-18	1.05E-18	1.03E-18
Ir-192	2.92E-17	2.72E-17	2.56E-17	2.45E-17	2.21E-17	2.18E-17
Ir-192m	1.78E-21	1.58E-21	1.45E-21	1.38E-21	1.18E-21	1.16E-21
Ir-192n	1.16E-20	1.03E-20	9.28E-21	8.73E-21	7.55E-21	7.44E-21

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-193m	4.75E-21	4.06E-21	3.63E-21	3.39E-21	2.89E-21	2.85E-21
Ir-194	3.59E-18	3.34E-18	3.14E-18	3.01E-18	2.75E-18	2.71E-18
Ir-194m	8.71E-17	8.09E-17	7.59E-17	7.27E-17	6.61E-17	6.51E-17
Ir-195	1.08E-18	9.62E-19	8.79E-19	8.29E-19	7.26E-19	7.15E-19
Ir-195m	1.29E-17	1.20E-17	1.12E-17	1.07E-17	9.71E-18	9.57E-18
Ir-196	9.29E-18	8.62E-18	8.09E-18	7.78E-18	7.10E-18	7.01E-18
Ir-196m	9.19E-17	8.54E-17	8.02E-17	7.68E-17	6.97E-17	6.88E-17
Platinum						
Pt-184	2.29E-17	2.12E-17	1.98E-17	1.89E-17	1.71E-17	1.68E-17
Pt-186	2.47E-17	2.28E-17	2.13E-17	2.04E-17	1.86E-17	1.83E-17
Pt-187	2.11E-17	1.95E-17	1.82E-17	1.75E-17	1.59E-17	1.57E-17
Pt-188	5.50E-18	5.07E-18	4.71E-18	4.49E-18	4.02E-18	3.96E-18
Pt-189	1.62E-17	1.50E-17	1.40E-17	1.34E-17	1.21E-17	1.20E-17
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	8.58E-18	7.89E-18	7.35E-18	7.00E-18	6.30E-18	6.21E-18
Pt-193	1.41E-22	9.19E-23	7.34E-23	6.39E-23	1.99E-23	1.82E-23
Pt-193m	1.65E-19	1.42E-19	1.28E-19	1.20E-19	1.03E-19	1.02E-19
Pt-195m	1.24E-18	1.09E-18	9.90E-19	9.30E-19	8.10E-19	7.97E-19
Pt-197	5.29E-19	4.79E-19	4.41E-19	4.18E-19	3.70E-19	3.64E-19
Pt-197m	2.13E-18	1.95E-18	1.82E-18	1.73E-18	1.54E-18	1.52E-18
Pt-199	7.43E-18	6.90E-18	6.47E-18	6.20E-18	5.63E-18	5.55E-18
Pt-200	1.43E-18	1.31E-18	1.21E-18	1.15E-18	1.02E-18	1.01E-18
Pt-202	1.19E-19	1.14E-19	1.09E-19	1.06E-19	1.00E-19	9.95E-20
Gold						
Au-186	5.70E-17	5.29E-17	4.97E-17	4.77E-17	4.35E-17	4.30E-17
Au-187	4.19E-17	3.88E-17	3.64E-17	3.52E-17	3.23E-17	3.20E-17
Au-190	9.67E-17	9.05E-17	8.54E-17	8.28E-17	7.66E-17	7.57E-17
Au-191	2.03E-17	1.88E-17	1.76E-17	1.68E-17	1.52E-17	1.50E-17
Au-192	7.83E-17	7.31E-17	6.88E-17	6.66E-17	6.15E-17	6.08E-17
Au-193	4.21E-18	3.85E-18	3.57E-18	3.40E-18	3.03E-18	2.99E-18
Au-193m	6.25E-18	5.83E-18	5.47E-18	5.23E-18	4.70E-18	4.64E-18
Au-194	4.03E-17	3.74E-17	3.51E-17	3.39E-17	3.11E-17	3.07E-17
Au-195	1.34E-18	1.17E-18	1.06E-18	9.96E-19	8.63E-19	8.50E-19
Au-195m	6.37E-18	5.94E-18	5.58E-18	5.33E-18	4.79E-18	4.72E-18
Au-196	1.58E-17	1.46E-17	1.37E-17	1.31E-17	1.18E-17	1.17E-17
Au-196m	6.38E-18	5.91E-18	5.48E-18	5.22E-18	4.68E-18	4.61E-18
Au-198	1.47E-17	1.37E-17	1.28E-17	1.23E-17	1.11E-17	1.10E-17
Au-198m	1.54E-17	1.44E-17	1.34E-17	1.28E-17	1.15E-17	1.13E-17
Au-199	2.67E-18	2.50E-18	2.32E-18	2.21E-18	1.99E-18	1.96E-18
Au-200	1.11E-17	1.03E-17	9.67E-18	9.33E-18	8.56E-18	8.46E-18
Au-200m	7.35E-17	6.82E-17	6.39E-17	6.13E-17	5.57E-17	5.49E-17
Au-201	1.30E-18	1.20E-18	1.13E-18	1.08E-18	9.84E-19	9.70E-19
Au-202	7.19E-18	6.66E-18	6.25E-18	6.02E-18	5.52E-18	5.46E-18
Mercury						
Hg-190	4.83E-18	4.45E-18	4.10E-18	3.90E-18	3.49E-18	3.44E-18
Hg-191m	5.60E-17	5.19E-17	4.87E-17	4.68E-17	4.27E-17	4.22E-17

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-192	7.71E-18	7.13E-18	6.65E-18	6.34E-18	5.68E-18	5.60E-18
Hg-193	3.18E-17	2.94E-17	2.76E-17	2.66E-17	2.43E-17	2.41E-17
Hg-193m	3.94E-17	3.65E-17	3.42E-17	3.29E-17	3.01E-17	2.98E-17
Hg-194	2.23E-22	1.49E-22	1.21E-22	1.07E-22	3.41E-23	3.12E-23
Hg-195	6.30E-18	5.76E-18	5.36E-18	5.14E-18	4.66E-18	4.60E-18
Hg-195m	6.35E-18	5.87E-18	5.50E-18	5.25E-18	4.74E-18	4.67E-18
Hg-197	1.18E-18	1.03E-18	9.33E-19	8.75E-19	7.57E-19	7.46E-19
Hg-197m	2.35E-18	2.17E-18	2.01E-18	1.91E-18	1.71E-18	1.68E-18
Hg-199m	5.06E-18	4.70E-18	4.36E-18	4.16E-18	3.74E-18	3.68E-18
Hg-203	7.95E-18	7.42E-18	6.98E-18	6.67E-18	6.00E-18	5.92E-18
Hg-205	2.42E-19	2.27E-19	2.14E-19	2.06E-19	1.88E-19	1.86E-19
Hg-206	4.19E-18	3.90E-18	3.66E-18	3.50E-18	3.16E-18	3.12E-18
Hg-207	1.10E-16	1.02E-16	9.58E-17	9.27E-17	8.55E-17	8.46E-17
Thallium						
Tl-190	4.94E-17	4.59E-17	4.31E-17	4.13E-17	3.76E-17	3.70E-17
Tl-190m	9.39E-17	8.70E-17	8.16E-17	7.83E-17	7.13E-17	7.04E-17
Tl-194	3.39E-17	3.14E-17	2.95E-17	2.83E-17	2.57E-17	2.53E-17
Tl-194m	9.53E-17	8.83E-17	8.28E-17	7.94E-17	7.23E-17	7.14E-17
Tl-195	4.87E-17	4.52E-17	4.24E-17	4.10E-17	3.78E-17	3.73E-17
Tl-196	7.47E-17	6.94E-17	6.53E-17	6.30E-17	5.79E-17	5.72E-17
Tl-197	1.63E-17	1.50E-17	1.41E-17	1.35E-17	1.23E-17	1.22E-17
Tl-198	8.08E-17	7.51E-17	7.06E-17	6.83E-17	6.29E-17	6.21E-17
Tl-198m	4.44E-17	4.12E-17	3.86E-17	3.70E-17	3.36E-17	3.31E-17
Tl-199	7.60E-18	7.00E-18	6.53E-18	6.24E-18	5.62E-18	5.54E-18
Tl-200	5.06E-17	4.68E-17	4.38E-17	4.22E-17	3.86E-17	3.81E-17
Tl-201	1.78E-18	1.59E-18	1.45E-18	1.37E-18	1.20E-18	1.19E-18
Tl-202	1.59E-17	1.47E-17	1.38E-17	1.32E-17	1.19E-17	1.18E-17
Tl-204	3.03E-20	2.69E-20	2.46E-20	2.32E-20	2.05E-20	2.02E-20
Tl-206	8.05E-20	7.64E-20	7.31E-20	7.11E-20	6.68E-20	6.63E-20
Tl-206m	9.18E-17	8.50E-17	7.97E-17	7.65E-17	6.97E-17	6.88E-17
Tl-207	1.59E-19	1.48E-19	1.40E-19	1.35E-19	1.25E-19	1.24E-19
Tl-208	1.41E-16	1.33E-16	1.26E-16	1.22E-16	1.14E-16	1.12E-16
Tl-209	8.64E-17	8.03E-17	7.54E-17	7.29E-17	6.71E-17	6.63E-17
Tl-210	1.13E-16	1.05E-16	9.84E-17	9.51E-17	8.75E-17	8.65E-17
Lead						
Pb-194	4.13E-17	3.82E-17	3.59E-17	3.46E-17	3.16E-17	3.13E-17
Pb-195m	6.20E-17	5.74E-17	5.38E-17	5.16E-17	4.70E-17	4.64E-17
Pb-196	1.63E-17	1.51E-17	1.41E-17	1.35E-17	1.22E-17	1.20E-17
Pb-197	6.06E-17	5.62E-17	5.27E-17	5.09E-17	4.67E-17	4.62E-17
Pb-197m	4.31E-17	3.99E-17	3.74E-17	3.59E-17	3.27E-17	3.23E-17
Pb-198	1.42E-17	1.31E-17	1.23E-17	1.18E-17	1.06E-17	1.05E-17
Pb-199	4.03E-17	3.74E-17	3.50E-17	3.38E-17	3.10E-17	3.06E-17
Pb-200	5.34E-18	4.92E-18	4.56E-18	4.34E-18	3.89E-18	3.83E-18
Pb-201	2.73E-17	2.52E-17	2.36E-17	2.27E-17	2.06E-17	2.04E-17
Pb-201m	1.36E-17	1.26E-17	1.18E-17	1.13E-17	1.03E-17	1.02E-17
Pb-202	2.38E-22	1.52E-22	1.21E-22	1.04E-22	3.25E-23	2.98E-23

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-202m	7.80E-17	7.20E-17	6.74E-17	6.48E-17	5.91E-17	5.85E-17
Pb-203	9.56E-18	8.87E-18	8.31E-18	7.92E-18	7.12E-18	7.02E-18
Pb-204m	8.18E-17	7.54E-17	7.05E-17	6.79E-17	6.20E-17	6.13E-17
Pb-205	2.41E-22	1.54E-22	1.22E-22	1.06E-22	3.29E-23	3.02E-23
Pb-209	5.42E-21	4.91E-21	4.52E-21	4.30E-21	3.83E-21	3.77E-21
Pb-210	1.97E-20	1.57E-20	1.34E-20	1.22E-20	9.87E-21	9.68E-21
Pb-211	2.53E-18	2.34E-18	2.19E-18	2.10E-18	1.92E-18	1.89E-18
Pb-212	4.34E-18	4.04E-18	3.78E-18	3.61E-18	3.24E-18	3.19E-18
Pb-214	8.60E-18	8.01E-18	7.52E-18	7.19E-18	6.49E-18	6.40E-18
Bismuth						
Bi-197	6.74E-17	6.22E-17	5.83E-17	5.62E-17	5.15E-17	5.09E-17
Bi-200	9.26E-17	8.56E-17	8.02E-17	7.71E-17	7.02E-17	6.94E-17
Bi-201	6.97E-17	6.44E-17	6.04E-17	5.84E-17	5.37E-17	5.31E-17
Bi-202	1.08E-16	9.97E-17	9.34E-17	8.99E-17	8.22E-17	8.13E-17
Bi-203	9.70E-17	8.99E-17	8.44E-17	8.16E-17	7.51E-17	7.43E-17
Bi-204	1.16E-16	1.07E-16	1.00E-16	9.64E-17	8.83E-17	8.73E-17
Bi-205	6.86E-17	6.35E-17	5.97E-17	5.77E-17	5.32E-17	5.26E-17
Bi-206	1.29E-16	1.20E-16	1.12E-16	1.08E-16	9.89E-17	9.78E-17
Bi-207	6.03E-17	5.56E-17	5.21E-17	5.02E-17	4.59E-17	4.54E-17
Bi-208	1.13E-16	1.07E-16	1.01E-16	9.85E-17	9.22E-17	9.11E-17
Bi-210	3.52E-20	3.32E-20	3.16E-20	3.06E-20	2.86E-20	2.83E-20
Bi-210m	8.86E-18	8.26E-18	7.76E-18	7.42E-18	6.69E-18	6.60E-18
Bi-211	1.64E-18	1.53E-18	1.44E-18	1.37E-18	1.24E-18	1.22E-18
Bi-212	4.25E-18	3.93E-18	3.69E-18	3.56E-18	3.27E-18	3.23E-18
Bi-212n	7.66E-20	7.28E-20	6.97E-20	6.78E-20	6.38E-20	6.33E-20
Bi-213	4.70E-18	4.38E-18	4.11E-18	3.93E-18	3.57E-18	3.52E-18
Bi-214	6.13E-17	5.69E-17	5.35E-17	5.17E-17	4.77E-17	4.71E-17
Bi-215	9.34E-18	8.66E-18	8.13E-18	7.80E-18	7.09E-18	7.01E-18
Bi-216	2.82E-17	2.62E-17	2.46E-17	2.36E-17	2.14E-17	2.11E-17
Polonium						
Po-203	6.46E-17	5.96E-17	5.58E-17	5.38E-17	4.93E-17	4.88E-17
Po-204	4.27E-17	3.93E-17	3.68E-17	3.54E-17	3.22E-17	3.18E-17
Po-205	6.27E-17	5.78E-17	5.41E-17	5.22E-17	4.79E-17	4.74E-17
Po-206	4.48E-17	4.14E-17	3.87E-17	3.72E-17	3.39E-17	3.35E-17
Po-207	5.02E-17	4.62E-17	4.32E-17	4.17E-17	3.81E-17	3.77E-17
Po-208	7.70E-22	7.13E-22	6.67E-22	6.40E-22	5.81E-22	5.74E-22
Po-209	2.28E-19	2.11E-19	1.97E-19	1.89E-19	1.72E-19	1.70E-19
Po-210	3.88E-22	3.58E-22	3.34E-22	3.22E-22	2.94E-22	2.91E-22
Po-211	3.23E-19	2.98E-19	2.79E-19	2.68E-19	2.45E-19	2.42E-19
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	3.36E-18	3.17E-18	3.00E-18	2.91E-18	2.72E-18	2.68E-18
Po-213	1.49E-21	1.37E-21	1.28E-21	1.24E-21	1.13E-21	1.11E-21
Po-214	3.31E-21	3.05E-21	2.85E-21	2.75E-21	2.51E-21	2.48E-21
Po-215	6.46E-21	6.02E-21	5.66E-21	5.41E-21	4.91E-21	4.83E-21
Po-216	6.11E-22	5.63E-22	5.26E-22	5.07E-22	4.63E-22	4.58E-22
Po-218	7.57E-26	6.38E-26	5.67E-26	5.28E-26	4.48E-26	4.39E-26

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Astatine						
At-204	8.80E-17	8.16E-17	7.65E-17	7.33E-17	6.67E-17	6.58E-17
At-205	4.40E-17	4.07E-17	3.82E-17	3.67E-17	3.36E-17	3.32E-17
At-206	9.53E-17	8.83E-17	8.28E-17	7.95E-17	7.25E-17	7.16E-17
At-207	7.96E-17	7.38E-17	6.92E-17	6.68E-17	6.13E-17	6.06E-17
At-208	1.19E-16	1.10E-16	1.03E-16	9.97E-17	9.12E-17	9.02E-17
At-209	8.77E-17	8.10E-17	7.58E-17	7.29E-17	6.65E-17	6.57E-17
At-210	1.20E-16	1.11E-16	1.04E-16	1.01E-16	9.29E-17	9.19E-17
At-211	6.94E-19	6.21E-19	5.70E-19	5.39E-19	4.73E-19	4.66E-19
At-215	6.12E-21	5.70E-21	5.35E-21	5.12E-21	4.63E-21	4.56E-21
At-216	5.87E-20	5.36E-20	4.97E-20	4.72E-20	4.19E-20	4.13E-20
At-217	8.13E-21	7.55E-21	7.09E-21	6.77E-21	6.11E-21	6.03E-21
At-218	3.49E-22	3.32E-22	3.18E-22	3.10E-22	2.92E-22	2.90E-22
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	1.61E-17	1.51E-17	1.41E-17	1.35E-17	1.23E-17	1.21E-17
Radon						
Rn-207	3.68E-17	3.41E-17	3.19E-17	3.07E-17	2.79E-17	2.75E-17
Rn-209	4.59E-17	4.26E-17	4.00E-17	3.85E-17	3.52E-17	3.48E-17
Rn-210	2.26E-18	2.09E-18	1.95E-18	1.87E-18	1.71E-18	1.69E-18
Rn-211	7.42E-17	6.85E-17	6.42E-17	6.19E-17	5.66E-17	5.60E-17
Rn-212	1.32E-20	1.22E-20	1.15E-20	1.10E-20	1.00E-20	9.91E-21
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	2.92E-20	2.70E-20	2.53E-20	2.43E-20	2.21E-20	2.18E-20
Rn-219	2.03E-18	1.89E-18	1.78E-18	1.70E-18	1.53E-18	1.51E-18
Rn-220	2.38E-20	2.22E-20	2.08E-20	1.99E-20	1.81E-20	1.78E-20
Rn-222	1.46E-20	1.36E-20	1.27E-20	1.22E-20	1.11E-20	1.09E-20
Rn-223	1.28E-17	1.18E-17	1.11E-17	1.06E-17	9.68E-18	9.56E-18
Francium						
Fr-212	4.47E-17	4.12E-17	3.86E-17	3.73E-17	3.42E-17	3.38E-17
Fr-219	1.26E-19	1.17E-19	1.10E-19	1.05E-19	9.52E-20	9.37E-20
Fr-220	2.09E-19	1.91E-19	1.76E-19	1.67E-19	1.49E-19	1.46E-19
Fr-221	9.14E-19	8.54E-19	8.00E-19	7.65E-19	6.87E-19	6.78E-19
Fr-222	5.94E-18	5.54E-18	5.19E-18	4.97E-18	4.50E-18	4.44E-18
Fr-223	1.26E-18	1.14E-18	1.06E-18	1.00E-18	8.94E-19	8.82E-19
Fr-224	2.17E-17	2.01E-17	1.89E-17	1.82E-17	1.67E-17	1.65E-17
Fr-227	1.56E-17	1.45E-17	1.36E-17	1.30E-17	1.18E-17	1.16E-17
Radium						
Ra-219	5.71E-18	5.32E-18	4.99E-18	4.77E-18	4.30E-18	4.24E-18
Ra-220	1.73E-19	1.61E-19	1.51E-19	1.45E-19	1.31E-19	1.29E-19
Ra-221	9.51E-19	8.86E-19	8.21E-19	7.83E-19	7.03E-19	6.92E-19
Ra-222	3.20E-19	2.99E-19	2.81E-19	2.69E-19	2.43E-19	2.39E-19
Ra-223	4.01E-18	3.72E-18	3.48E-18	3.32E-18	2.98E-18	2.93E-18
Ra-224	3.39E-19	3.17E-19	2.97E-19	2.84E-19	2.56E-19	2.52E-19
Ra-225	8.91E-20	6.75E-20	5.60E-20	5.06E-20	4.01E-20	3.91E-20

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-226	2.20E-19	2.06E-19	1.93E-19	1.84E-19	1.66E-19	1.63E-19
Ra-227	4.87E-18	4.53E-18	4.25E-18	4.06E-18	3.67E-18	3.62E-18
Ra-228	1.18E-21	8.11E-22	6.93E-22	6.43E-22	2.72E-22	2.49E-22
Ra-230	2.39E-18	2.21E-18	2.07E-18	1.97E-18	1.78E-18	1.75E-18
Actinium						
Ac-223	5.36E-19	4.98E-19	4.67E-19	4.45E-19	4.01E-19	3.95E-19
Ac-224	6.28E-18	5.85E-18	5.46E-18	5.20E-18	4.66E-18	4.59E-18
Ac-225	3.71E-19	3.43E-19	3.19E-19	3.04E-19	2.72E-19	2.68E-19
Ac-226	3.99E-18	3.73E-18	3.49E-18	3.33E-18	3.00E-18	2.96E-18
Ac-227	2.06E-21	1.81E-21	1.65E-21	1.56E-21	1.32E-21	1.30E-21
Ac-228	3.44E-17	3.18E-17	2.98E-17	2.87E-17	2.63E-17	2.60E-17
Ac-230	2.26E-17	2.10E-17	1.97E-17	1.91E-17	1.76E-17	1.74E-17
Ac-231	1.37E-17	1.28E-17	1.20E-17	1.15E-17	1.04E-17	1.02E-17
Ac-232	4.84E-17	4.50E-17	4.24E-17	4.11E-17	3.80E-17	3.76E-17
Ac-233	1.90E-17	1.77E-17	1.66E-17	1.59E-17	1.45E-17	1.43E-17
Thorium						
Th-223	1.68E-18	1.54E-18	1.43E-18	1.36E-18	1.21E-18	1.19E-18
Th-224	7.05E-19	6.60E-19	6.16E-19	5.89E-19	5.31E-19	5.23E-19
Th-226	2.11E-19	1.96E-19	1.83E-19	1.75E-19	1.56E-19	1.54E-19
Th-227	3.88E-18	3.61E-18	3.39E-18	3.24E-18	2.91E-18	2.87E-18
Th-228	5.13E-20	4.71E-20	4.37E-20	4.16E-20	3.69E-20	3.63E-20
Th-229	2.04E-18	1.88E-18	1.74E-18	1.66E-18	1.48E-18	1.45E-18
Th-230	8.32E-21	7.36E-21	6.70E-21	6.32E-21	5.45E-21	5.36E-21
Th-231	2.42E-19	2.15E-19	1.98E-19	1.87E-19	1.63E-19	1.60E-19
Th-232	3.87E-21	3.31E-21	2.96E-21	2.78E-21	2.30E-21	2.26E-21
Th-233	1.26E-18	1.16E-18	1.09E-18	1.05E-18	9.49E-19	9.36E-19
Th-234	1.70E-19	1.52E-19	1.40E-19	1.32E-19	1.16E-19	1.14E-19
Th-235	2.17E-18	2.01E-18	1.89E-18	1.82E-18	1.66E-18	1.64E-18
Th-236	1.16E-18	1.07E-18	1.01E-18	9.63E-19	8.73E-19	8.60E-19
Protactinium						
Pa-227	3.96E-19	3.58E-19	3.30E-19	3.13E-19	2.76E-19	2.71E-19
Pa-228	5.27E-17	4.87E-17	4.56E-17	4.39E-17	4.02E-17	3.97E-17
Pa-229	1.34E-18	1.23E-18	1.14E-18	1.08E-18	9.60E-19	9.42E-19
Pa-230	2.53E-17	2.33E-17	2.18E-17	2.10E-17	1.91E-17	1.89E-17
Pa-231	1.11E-18	1.03E-18	9.65E-19	9.21E-19	8.29E-19	8.17E-19
Pa-232	3.68E-17	3.39E-17	3.17E-17	3.05E-17	2.79E-17	2.76E-17
Pa-233	6.98E-18	6.51E-18	6.11E-18	5.84E-18	5.26E-18	5.18E-18
Pa-234	5.68E-17	5.24E-17	4.91E-17	4.72E-17	4.32E-17	4.27E-17
Pa-234m	8.41E-19	7.81E-19	7.36E-19	7.12E-19	6.57E-19	6.50E-19
Pa-235	5.87E-20	5.57E-20	5.33E-20	5.18E-20	4.86E-20	4.82E-20
Pa-236	3.72E-17	3.45E-17	3.25E-17	3.13E-17	2.88E-17	2.85E-17
Pa-237	2.42E-17	2.23E-17	2.09E-17	2.01E-17	1.83E-17	1.81E-17
Uranium						
U-227	3.41E-18	3.18E-18	2.97E-18	2.84E-18	2.55E-18	2.51E-18
U-228	1.03E-19	9.52E-20	8.88E-20	8.46E-20	7.55E-20	7.43E-20
U-230	2.84E-20	2.59E-20	2.39E-20	2.27E-20	2.00E-20	1.97E-20

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-231	1.54E-18	1.41E-18	1.31E-18	1.24E-18	1.10E-18	1.08E-18
U-232	5.79E-21	5.05E-21	4.58E-21	4.33E-21	3.63E-21	3.56E-21
U-233	6.74E-21	6.10E-21	5.65E-21	5.37E-21	4.70E-21	4.62E-21
U-234	3.05E-21	2.57E-21	2.30E-21	2.16E-21	1.72E-21	1.68E-21
U-235	4.86E-18	4.56E-18	4.25E-18	4.06E-18	3.66E-18	3.60E-18
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	1.76E-21	1.41E-21	1.25E-21	1.17E-21	8.57E-22	8.31E-22
U-237	3.38E-18	3.12E-18	2.90E-18	2.76E-18	2.47E-18	2.43E-18
U-238	1.60E-21	1.31E-21	1.17E-21	1.10E-21	8.45E-22	8.22E-22
U-239	1.12E-18	9.98E-19	9.17E-19	8.70E-19	7.71E-19	7.61E-19
U-240	1.08E-19	9.91E-20	9.18E-20	8.73E-20	7.73E-20	7.58E-20
U-242	1.34E-18	1.24E-18	1.16E-18	1.10E-18	9.99E-19	9.85E-19
Neptunium						
Np-232	4.49E-17	4.15E-17	3.88E-17	3.73E-17	3.40E-17	3.36E-17
Np-233	2.07E-18	1.92E-18	1.79E-18	1.70E-18	1.52E-18	1.49E-18
Np-234	4.49E-17	4.16E-17	3.90E-17	3.78E-17	3.48E-17	3.44E-17
Np-235	1.52E-20	1.33E-20	1.22E-20	1.15E-20	9.63E-21	9.40E-21
Np-236	3.53E-18	3.28E-18	3.05E-18	2.91E-18	2.61E-18	2.56E-18
Np-236m	1.19E-18	1.10E-18	1.03E-18	9.78E-19	8.77E-19	8.61E-19
Np-237	4.88E-19	4.41E-19	4.07E-19	3.86E-19	3.40E-19	3.34E-19
Np-238	2.38E-17	2.18E-17	2.04E-17	1.97E-17	1.80E-17	1.79E-17
Np-239	5.03E-18	4.68E-18	4.39E-18	4.19E-18	3.76E-18	3.70E-18
Np-240	4.02E-17	3.71E-17	3.48E-17	3.34E-17	3.05E-17	3.01E-17
Np-240m	1.25E-17	1.16E-17	1.09E-17	1.05E-17	9.56E-18	9.43E-18
Np-241	1.04E-18	9.67E-19	9.03E-19	8.62E-19	7.76E-19	7.63E-19
Np-242	1.12E-17	1.04E-17	9.74E-18	9.42E-18	8.68E-18	8.59E-18
Np-242m	3.55E-17	3.27E-17	3.06E-17	2.95E-17	2.69E-17	2.66E-17
Plutonium						
Pu-232	1.37E-18	1.27E-18	1.18E-18	1.13E-18	1.01E-18	9.86E-19
Pu-234	1.49E-18	1.37E-18	1.28E-18	1.22E-18	1.09E-18	1.07E-18
Pu-235	2.16E-18	2.00E-18	1.86E-18	1.77E-18	1.59E-18	1.56E-18
Pu-236	1.93E-21	1.47E-21	1.29E-21	1.20E-21	8.19E-22	7.87E-22
Pu-237	1.05E-18	9.72E-19	9.05E-19	8.60E-19	7.66E-19	7.51E-19
Pu-238	1.42E-21	1.04E-21	8.96E-22	8.29E-22	5.12E-22	4.86E-22
Pu-239	2.22E-21	1.93E-21	1.77E-21	1.67E-21	1.40E-21	1.37E-21
Pu-240	1.41E-21	1.03E-21	8.94E-22	8.29E-22	5.24E-22	4.99E-22
Pu-241	3.72E-23	3.44E-23	3.20E-23	3.04E-23	2.72E-23	2.67E-23
Pu-242	4.29E-21	3.77E-21	3.48E-21	3.34E-21	2.89E-21	2.84E-21
Pu-243	5.13E-19	4.63E-19	4.28E-19	4.05E-19	3.57E-19	3.51E-19
Pu-244	8.16E-19	7.62E-19	7.17E-19	6.95E-19	6.42E-19	6.35E-19
Pu-245	1.49E-17	1.38E-17	1.29E-17	1.24E-17	1.13E-17	1.11E-17
Pu-246	3.66E-18	3.40E-18	3.17E-18	3.03E-18	2.71E-18	2.67E-18
Americium						
Am-237	1.18E-17	1.10E-17	1.03E-17	9.84E-18	8.88E-18	8.75E-18
Am-238	3.48E-17	3.21E-17	3.01E-17	2.90E-17	2.65E-17	2.62E-17
Am-239	6.23E-18	5.80E-18	5.43E-18	5.17E-18	4.64E-18	4.56E-18

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-240	4.04E-17	3.72E-17	3.47E-17	3.35E-17	3.06E-17	3.03E-17
Am-241	3.02E-19	2.54E-19	2.24E-19	2.08E-19	1.75E-19	1.73E-19
Am-242	3.22E-19	2.97E-19	2.77E-19	2.63E-19	2.34E-19	2.30E-19
Am-242m	9.71E-21	7.94E-21	7.10E-21	6.66E-21	5.26E-21	5.11E-21
Am-243	9.53E-19	8.33E-19	7.55E-19	7.08E-19	6.13E-19	6.04E-19
Am-244	3.08E-17	2.84E-17	2.66E-17	2.56E-17	2.33E-17	2.31E-17
Am-244m	6.47E-19	5.97E-19	5.59E-19	5.40E-19	4.96E-19	4.91E-19
Am-245	9.19E-19	8.57E-19	8.03E-19	7.67E-19	6.89E-19	6.78E-19
Am-246	2.71E-17	2.51E-17	2.35E-17	2.26E-17	2.05E-17	2.03E-17
Am-246m	3.97E-17	3.66E-17	3.42E-17	3.30E-17	3.02E-17	2.99E-17
Am-247	3.99E-18	3.72E-18	3.49E-18	3.33E-18	3.00E-18	2.95E-18
Curium						
Cm-238	1.85E-18	1.72E-18	1.60E-18	1.53E-18	1.37E-18	1.34E-18
Cm-239	7.12E-18	6.66E-18	6.21E-18	5.93E-18	5.33E-18	5.25E-18
Cm-240	1.94E-21	1.41E-21	1.22E-21	1.13E-21	7.34E-22	6.99E-22
Cm-241	1.68E-17	1.57E-17	1.47E-17	1.41E-17	1.27E-17	1.25E-17
Cm-242	1.64E-21	1.18E-21	1.02E-21	9.39E-22	5.93E-22	5.64E-22
Cm-243	3.71E-18	3.46E-18	3.24E-18	3.09E-18	2.78E-18	2.73E-18
Cm-244	2.00E-21	1.56E-21	1.39E-21	1.31E-21	9.77E-22	9.46E-22
Cm-245	2.49E-18	2.32E-18	2.16E-18	2.06E-18	1.84E-18	1.81E-18
Cm-246	1.50E-19	1.39E-19	1.31E-19	1.27E-19	1.17E-19	1.16E-19
Cm-247	1.13E-17	1.05E-17	9.90E-18	9.46E-18	8.57E-18	8.44E-18
Cm-248	5.40E-17	5.04E-17	4.75E-17	4.60E-17	4.25E-17	4.20E-17
Cm-249	7.37E-19	6.84E-19	6.41E-19	6.15E-19	5.59E-19	5.52E-19
Cm-250	5.49E-16	5.13E-16	4.83E-16	4.68E-16	4.33E-16	4.28E-16
Cm-251	4.12E-18	3.83E-18	3.59E-18	3.44E-18	3.13E-18	3.08E-18
Berkelium						
Bk-245	6.29E-18	5.87E-18	5.49E-18	5.24E-18	4.71E-18	4.63E-18
Bk-246	3.27E-17	3.01E-17	2.81E-17	2.71E-17	2.47E-17	2.45E-17
Bk-247	4.10E-18	3.81E-18	3.56E-18	3.40E-18	3.04E-18	3.00E-18
Bk-248m	1.64E-18	1.52E-18	1.42E-18	1.36E-18	1.23E-18	1.21E-18
Bk-249	5.29E-23	4.41E-23	3.93E-23	3.67E-23	3.09E-23	3.03E-23
Bk-250	3.65E-17	3.36E-17	3.14E-17	3.03E-17	2.78E-17	2.75E-17
Bk-251	2.18E-18	2.03E-18	1.89E-18	1.81E-18	1.62E-18	1.59E-18
Californium						
Cf-244	1.70E-21	1.14E-21	9.57E-22	8.73E-22	5.03E-22	4.70E-22
Cf-246	2.60E-21	2.11E-21	1.90E-21	1.80E-21	1.44E-21	1.40E-21
Cf-247	2.28E-18	2.12E-18	1.98E-18	1.88E-18	1.69E-18	1.66E-18
Cf-248	1.50E-20	1.37E-20	1.28E-20	1.23E-20	1.11E-20	1.09E-20
Cf-249	1.15E-17	1.07E-17	1.01E-17	9.66E-18	8.74E-18	8.60E-18
Cf-250	4.05E-19	3.78E-19	3.56E-19	3.45E-19	3.18E-19	3.15E-19
Cf-251	3.22E-18	3.01E-18	2.81E-18	2.68E-18	2.41E-18	2.37E-18
Cf-252	1.88E-17	1.75E-17	1.65E-17	1.60E-17	1.48E-17	1.46E-17
Cf-253	7.44E-21	5.35E-21	4.49E-21	4.10E-21	2.87E-21	2.76E-21
Cf-254	6.94E-16	6.48E-16	6.10E-16	5.91E-16	5.46E-16	5.40E-16
Cf-255	7.28E-21	6.65E-21	6.17E-21	5.89E-21	5.29E-21	5.22E-21

Table 4-5. Reference person effective dose rate coefficients for soil to infinite depth. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Einsteinium						
Es-249	1.40E-17	1.30E-17	1.22E-17	1.17E-17	1.06E-17	1.04E-17
Es-250	4.31E-17	3.99E-17	3.73E-17	3.58E-17	3.26E-17	3.22E-17
Es-250m	2.09E-17	1.93E-17	1.81E-17	1.74E-17	1.59E-17	1.58E-17
Es-251	2.26E-18	2.10E-18	1.96E-18	1.87E-18	1.68E-18	1.64E-18
Es-253	1.12E-20	1.03E-20	9.60E-21	9.16E-21	8.20E-21	8.07E-21
Es-254	8.47E-20	7.33E-20	6.68E-20	6.30E-20	5.37E-20	5.28E-20
Es-254m	1.83E-17	1.69E-17	1.58E-17	1.52E-17	1.38E-17	1.37E-17
Es-255	2.85E-20	2.66E-20	2.50E-20	2.42E-20	2.24E-20	2.21E-20
Es-256	9.45E-20	8.88E-20	8.47E-20	8.23E-20	7.70E-20	7.63E-20
Fermium						
Fm-251	4.64E-18	4.31E-18	4.02E-18	3.85E-18	3.49E-18	3.43E-18
Fm-252	1.22E-20	1.09E-20	1.02E-20	9.78E-21	8.76E-21	8.63E-21
Fm-253	1.50E-18	1.40E-18	1.30E-18	1.24E-18	1.11E-18	1.09E-18
Fm-254	2.90E-19	2.70E-19	2.55E-19	2.46E-19	2.27E-19	2.25E-19
Fm-255	4.61E-20	3.83E-20	3.43E-20	3.21E-20	2.62E-20	2.56E-20
Fm-256	5.11E-16	4.78E-16	4.50E-16	4.35E-16	4.03E-16	3.98E-16
Fm-257	4.28E-18	4.00E-18	3.74E-18	3.58E-18	3.25E-18	3.20E-18

Table 4-6. Reference person effective dose rate coefficients for air submersion.

Explanation of entries

For each radionuclide, values for the reference person effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. The coefficients are for air at a density of 1.2 kg m^{-3}. Reference person organ equivalent dose coefficients h_T are provided electronically.[16]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^3), that is, the effective dose per unit time-integrated exposure to a radionuclide

w_T: The tissue weighting factor

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^3) for tissue *T*.

The dose rate coefficients provided in Table 4-6 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

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

To convert from SI units (Sv Bq^{-1} s^{-1} m^3) to conventional units (mrem μCi^{-1} y^{-1} cm^3), multiply table entries by 1.168×10^{23}.

To convert from SI units for a source per unit volume (Sv Bq^{-1} s^{-1} m^3) to conventional units for a source per unit mass basis (mrem μCi^{-1} y^{-1} g), 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 $(1.2/\rho)$, where ρ is the air density in kg m^{-3}.

[16] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-6. Reference person effective dose rate coefficients for air submersion.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	1.59E-23	1.11E-23	9.27E-24	8.34E-24	2.74E-24	2.55E-24
Beryllium						
Be-7	2.98E-15	2.75E-15	2.54E-15	2.45E-15	2.23E-15	2.20E-15
Be-10	1.45E-16	1.42E-16	1.41E-16	1.40E-16	1.39E-16	1.39E-16
Carbon						
C-10	1.06E-13	9.76E-14	9.05E-14	8.73E-14	7.97E-14	7.87E-14
C-11	6.12E-14	5.67E-14	5.24E-14	5.05E-14	4.60E-14	4.55E-14
C-14	2.75E-18	2.67E-18	2.64E-18	2.62E-18	2.58E-18	2.57E-18
Nitrogen						
N-13	6.14E-14	5.68E-14	5.25E-14	5.06E-14	4.62E-14	4.56E-14
N-16	3.05E-13	2.87E-13	2.77E-13	2.71E-13	2.58E-13	2.56E-13
Oxygen						
O-14	2.07E-13	1.94E-13	1.83E-13	1.76E-13	1.65E-13	1.63E-13
O-15	6.17E-14	5.71E-14	5.28E-14	5.09E-14	4.64E-14	4.58E-14
O-19	5.99E-14	5.55E-14	5.22E-14	5.03E-14	4.65E-14	4.59E-14
Fluorine						
F-17	6.17E-14	5.71E-14	5.28E-14	5.09E-14	4.64E-14	4.58E-14
F-18	5.93E-14	5.49E-14	5.06E-14	4.89E-14	4.45E-14	4.40E-14
Neon						
Ne-19	6.19E-14	5.74E-14	5.30E-14	5.12E-14	4.67E-14	4.61E-14
Ne-24	3.32E-14	3.07E-14	2.84E-14	2.74E-14	2.50E-14	2.47E-14
Sodium						
Na-22	1.34E-13	1.24E-13	1.16E-13	1.12E-13	1.03E-13	1.02E-13
Na-24	2.60E-13	2.45E-13	2.32E-13	2.25E-13	2.11E-13	2.09E-13
Magnesium						
Mg-27	5.51E-14	5.08E-14	4.77E-14	4.59E-14	4.22E-14	4.16E-14
Mg-28	8.35E-14	7.74E-14	7.27E-14	6.99E-14	6.46E-14	6.38E-14
Aluminum						
Al-26	1.65E-13	1.55E-13	1.45E-13	1.40E-13	1.30E-13	1.28E-13
Al-28	1.12E-13	1.06E-13	9.97E-14	9.62E-14	9.02E-14	8.90E-14
Al-29	8.64E-14	8.05E-14	7.60E-14	7.32E-14	6.81E-14	6.72E-14
Silicon						
Si-31	5.24E-16	5.09E-16	4.99E-16	4.94E-16	4.82E-16	4.81E-16
Si-32	1.08E-17	1.06E-17	1.06E-17	1.05E-17	1.04E-17	1.04E-17
Phosphorus						
P-30	6.27E-14	5.81E-14	5.37E-14	5.18E-14	4.73E-14	4.67E-14
P-32	5.75E-16	5.60E-16	5.51E-16	5.46E-16	5.35E-16	5.34E-16
P-33	1.49E-17	1.47E-17	1.46E-17	1.45E-17	1.44E-17	1.43E-17
Sulfur						
S-35	3.23E-18	3.15E-18	3.11E-18	3.09E-18	3.05E-18	3.04E-18
S-37	1.88E-13	1.79E-13	1.70E-13	1.65E-13	1.56E-13	1.54E-13
S-38	1.06E-13	1.01E-13	9.49E-14	9.16E-14	8.60E-14	8.49E-14
Chlorine						
Cl-34	6.36E-14	5.90E-14	5.46E-14	5.27E-14	4.81E-14	4.75E-14
Cl-34m	1.32E-13	1.24E-13	1.16E-13	1.12E-13	1.05E-13	1.03E-13

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	1.75E-16	1.72E-16	1.69E-16	1.68E-16	1.66E-16	1.66E-16
Cl-38	9.23E-14	8.71E-14	8.23E-14	7.95E-14	7.47E-14	7.37E-14
Cl-39	9.04E-14	8.40E-14	7.91E-14	7.62E-14	7.07E-14	6.98E-14
Cl-40	2.60E-13	2.45E-13	2.33E-13	2.25E-13	2.12E-13	2.09E-13
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	1.19E-16	1.17E-16	1.16E-16	1.16E-16	1.15E-16	1.15E-16
Ar-41	7.97E-14	7.41E-14	6.99E-14	6.72E-14	6.24E-14	6.16E-14
Ar-42	1.31E-16	1.29E-16	1.28E-16	1.27E-16	1.26E-16	1.26E-16
Ar-43	9.67E-14	9.04E-14	8.52E-14	8.22E-14	7.65E-14	7.55E-14
Ar-44	1.21E-13	1.13E-13	1.07E-13	1.03E-13	9.59E-14	9.47E-14
Potassium						
K-38	1.98E-13	1.87E-13	1.75E-13	1.69E-13	1.58E-13	1.56E-13
K-40	1.01E-14	9.48E-15	8.95E-15	8.63E-15	8.05E-15	7.95E-15
K-42	1.89E-14	1.77E-14	1.67E-14	1.62E-14	1.51E-14	1.49E-14
K-43	5.81E-14	5.36E-14	4.96E-14	4.78E-14	4.36E-14	4.30E-14
K-44	1.51E-13	1.42E-13	1.34E-13	1.29E-13	1.21E-13	1.19E-13
K-45	1.15E-13	1.08E-13	1.02E-13	9.82E-14	9.17E-14	9.05E-14
K-46	1.84E-13	1.73E-13	1.64E-13	1.59E-13	1.49E-13	1.47E-13
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	1.57E-17	1.55E-17	1.54E-17	1.53E-17	1.52E-17	1.52E-17
Ca-47	6.52E-14	6.06E-14	5.71E-14	5.49E-14	5.09E-14	5.02E-14
Ca-49	2.03E-13	1.93E-13	1.84E-13	1.78E-13	1.69E-13	1.67E-13
Scandium						
Sc-42m	2.59E-13	2.40E-13	2.25E-13	2.17E-13	2.00E-13	1.98E-13
Sc-43	5.92E-14	5.47E-14	5.05E-14	4.88E-14	4.44E-14	4.39E-14
Sc-44	1.30E-13	1.21E-13	1.13E-13	1.09E-13	9.98E-14	9.85E-14
Sc-44m	1.66E-14	1.50E-14	1.40E-14	1.34E-14	1.22E-14	1.20E-14
Sc-46	1.23E-13	1.14E-13	1.07E-13	1.03E-13	9.49E-14	9.37E-14
Sc-47	6.48E-15	5.91E-15	5.46E-15	5.23E-15	4.71E-15	4.63E-15
Sc-48	2.07E-13	1.91E-13	1.80E-13	1.73E-13	1.60E-13	1.58E-13
Sc-49	7.80E-16	7.56E-16	7.40E-16	7.31E-16	7.13E-16	7.10E-16
Sc-50	1.99E-13	1.86E-13	1.74E-13	1.68E-13	1.56E-13	1.54E-13
Titanium						
Ti-44	7.13E-15	6.05E-15	5.46E-15	5.13E-15	4.46E-15	4.30E-15
Ti-45	5.23E-14	4.84E-14	4.47E-14	4.32E-14	3.93E-14	3.88E-14
Ti-51	2.30E-14	2.11E-14	1.96E-14	1.88E-14	1.72E-14	1.69E-14
Ti-52	7.93E-15	7.20E-15	6.65E-15	6.38E-15	5.74E-15	5.65E-15
Vanadium						
V-47	6.02E-14	5.58E-14	5.15E-14	4.98E-14	4.54E-14	4.48E-14
V-48	1.79E-13	1.66E-13	1.55E-13	1.50E-13	1.38E-13	1.36E-13
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	8.82E-14	8.25E-14	7.77E-14	7.49E-14	6.98E-14	6.89E-14
V-52	9.06E-14	8.46E-14	7.98E-14	7.69E-14	7.16E-14	7.07E-14
V-53	6.47E-14	5.98E-14	5.63E-14	5.42E-14	5.00E-14	4.93E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Chromium						
Cr-48	2.60E-14	2.35E-14	2.17E-14	2.08E-14	1.88E-14	1.85E-14
Cr-49	6.32E-14	5.83E-14	5.38E-14	5.18E-14	4.71E-14	4.65E-14
Cr-51	1.91E-15	1.74E-15	1.61E-15	1.54E-15	1.40E-15	1.38E-15
Cr-55	1.11E-15	1.07E-15	1.04E-15	1.03E-15	1.00E-15	9.99E-16
Cr-56	4.93E-15	4.28E-15	3.91E-15	3.71E-15	3.28E-15	3.20E-15
Manganese						
Mn-50m	2.86E-13	2.65E-13	2.48E-13	2.39E-13	2.20E-13	2.18E-13
Mn-51	6.05E-14	5.61E-14	5.18E-14	5.00E-14	4.56E-14	4.50E-14
Mn-52	2.12E-13	1.97E-13	1.85E-13	1.78E-13	1.64E-13	1.62E-13
Mn-52m	1.48E-13	1.38E-13	1.29E-13	1.24E-13	1.15E-13	1.13E-13
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	5.09E-14	4.69E-14	4.39E-14	4.23E-14	3.88E-14	3.83E-14
Mn-56	1.05E-13	9.83E-14	9.25E-14	8.92E-14	8.28E-14	8.18E-14
Mn-57	6.88E-15	6.38E-15	5.99E-15	5.78E-15	5.34E-15	5.28E-15
Mn-58m	1.49E-13	1.38E-13	1.30E-13	1.25E-13	1.16E-13	1.15E-13
Iron						
Fe-52	4.43E-14	4.08E-14	3.77E-14	3.63E-14	3.30E-14	3.26E-14
Fe-53	7.16E-14	6.63E-14	6.13E-14	5.91E-14	5.40E-14	5.33E-14
Fe-53m	1.88E-13	1.75E-13	1.64E-13	1.58E-13	1.46E-13	1.44E-13
Fe-55	9.44E-24	8.53E-24	7.84E-24	7.49E-24	6.68E-24	6.57E-24
Fe-59	7.33E-14	6.79E-14	6.40E-14	6.16E-14	5.69E-14	5.62E-14
Fe-60	7.21E-18	7.06E-18	6.99E-18	6.96E-18	6.88E-18	6.87E-18
Fe-61	8.69E-14	8.06E-14	7.59E-14	7.31E-14	6.77E-14	6.68E-14
Fe-62	3.10E-14	2.87E-14	2.65E-14	2.56E-14	2.34E-14	2.31E-14
Cobalt						
Co-54m	2.43E-13	2.25E-13	2.11E-13	2.03E-13	1.87E-13	1.85E-13
Co-55	1.22E-13	1.12E-13	1.05E-13	1.01E-13	9.28E-14	9.16E-14
Co-56	2.26E-13	2.11E-13	1.99E-13	1.92E-13	1.79E-13	1.76E-13
Co-57	7.05E-15	6.36E-15	5.84E-15	5.58E-15	4.97E-15	4.89E-15
Co-58	5.91E-14	5.45E-14	5.09E-14	4.90E-14	4.49E-14	4.43E-14
Co-58m	1.38E-19	8.99E-20	7.46E-20	6.74E-20	4.68E-20	4.48E-20
Co-60	1.55E-13	1.44E-13	1.35E-13	1.30E-13	1.21E-13	1.19E-13
Co-60m	2.61E-16	2.36E-16	2.20E-16	2.10E-16	1.92E-16	1.89E-16
Co-61	5.59E-15	4.92E-15	4.54E-15	4.32E-15	3.88E-15	3.79E-15
Co-62	1.02E-13	9.48E-14	8.95E-14	8.63E-14	8.03E-14	7.93E-14
Co-62m	1.68E-13	1.56E-13	1.47E-13	1.42E-13	1.32E-13	1.30E-13
Nickel						
Ni-56	1.04E-13	9.61E-14	8.97E-14	8.63E-14	7.91E-14	7.80E-14
Ni-57	1.19E-13	1.11E-13	1.04E-13	1.00E-13	9.31E-14	9.19E-14
Ni-59	9.29E-19	8.60E-19	7.94E-19	7.66E-19	6.98E-19	6.89E-19
Ni-63	1.21E-20	8.26E-21	6.94E-21	6.34E-21	4.07E-21	3.89E-21
Ni-65	3.50E-14	3.27E-14	3.08E-14	2.96E-14	2.75E-14	2.72E-14
Ni-66	1.41E-17	1.38E-17	1.37E-17	1.37E-17	1.36E-17	1.35E-17
Copper						
Cu-57	7.48E-14	6.94E-14	6.44E-14	6.22E-14	5.70E-14	5.63E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cu-59	8.87E-14	8.22E-14	7.64E-14	7.37E-14	6.75E-14	6.66E-14
Cu-60	2.42E-13	2.26E-13	2.12E-13	2.05E-13	1.90E-13	1.88E-13
Cu-61	4.96E-14	4.58E-14	4.24E-14	4.09E-14	3.73E-14	3.68E-14
Cu-62	6.15E-14	5.70E-14	5.27E-14	5.09E-14	4.64E-14	4.58E-14
Cu-64	1.11E-14	1.03E-14	9.50E-15	9.17E-15	8.36E-15	8.26E-15
Cu-66	7.04E-15	6.54E-15	6.19E-15	5.98E-15	5.56E-15	5.50E-15
Cu-67	6.85E-15	6.15E-15	5.69E-15	5.43E-15	4.88E-15	4.80E-15
Cu-69	3.32E-14	3.07E-14	2.88E-14	2.78E-14	2.56E-14	2.53E-14
Zinc						
Zn-60	9.26E-14	8.55E-14	7.92E-14	7.64E-14	6.97E-14	6.88E-14
Zn-61	9.51E-14	8.85E-14	8.23E-14	7.95E-14	7.31E-14	7.22E-14
Zn-62	2.61E-14	2.41E-14	2.22E-14	2.14E-14	1.95E-14	1.93E-14
Zn-63	6.66E-14	6.17E-14	5.71E-14	5.51E-14	5.03E-14	4.97E-14
Zn-65	3.56E-14	3.29E-14	3.10E-14	2.98E-14	2.75E-14	2.72E-14
Zn-69	2.09E-16	2.05E-16	2.03E-16	2.02E-16	1.99E-16	1.99E-16
Zn-69m	2.49E-14	2.29E-14	2.12E-14	2.04E-14	1.85E-14	1.83E-14
Zn-71	2.00E-14	1.86E-14	1.73E-14	1.67E-14	1.53E-14	1.51E-14
Zn-71m	9.42E-14	8.71E-14	8.07E-14	7.78E-14	7.10E-14	7.01E-14
Zn-72	8.60E-15	7.80E-15	7.19E-15	6.88E-15	6.17E-15	6.06E-15
Gallium						
Ga-64	2.11E-13	1.97E-13	1.85E-13	1.79E-13	1.66E-13	1.64E-13
Ga-65	7.03E-14	6.49E-14	6.00E-14	5.79E-14	5.28E-14	5.21E-14
Ga-66	1.57E-13	1.47E-13	1.39E-13	1.34E-13	1.26E-13	1.24E-13
Ga-67	9.14E-15	8.23E-15	7.59E-15	7.26E-15	6.53E-15	6.42E-15
Ga-68	5.74E-14	5.32E-14	4.92E-14	4.75E-14	4.33E-14	4.27E-14
Ga-70	9.70E-16	9.22E-16	8.89E-16	8.70E-16	8.30E-16	8.24E-16
Ga-72	1.68E-13	1.57E-13	1.48E-13	1.43E-13	1.33E-13	1.31E-13
Ga-73	2.11E-14	1.92E-14	1.78E-14	1.71E-14	1.56E-14	1.53E-14
Ga-74	1.97E-13	1.85E-13	1.74E-13	1.68E-13	1.57E-13	1.55E-13
Germanium						
Ge-66	4.01E-14	3.68E-14	3.41E-14	3.28E-14	2.98E-14	2.94E-14
Ge-67	8.70E-14	8.06E-14	7.48E-14	7.21E-14	6.60E-14	6.51E-14
Ge-68	5.98E-19	4.10E-19	3.38E-19	2.94E-19	8.83E-20	8.23E-20
Ge-69	5.78E-14	5.35E-14	5.01E-14	4.82E-14	4.43E-14	4.38E-14
Ge-71	6.07E-19	4.16E-19	3.43E-19	2.98E-19	8.96E-20	8.35E-20
Ge-75	2.42E-15	2.21E-15	2.07E-15	1.99E-15	1.82E-15	1.80E-15
Ge-77	6.60E-14	6.07E-14	5.66E-14	5.45E-14	4.99E-14	4.92E-14
Ge-78	1.69E-14	1.53E-14	1.42E-14	1.36E-14	1.23E-14	1.21E-14
Arsenic						
As-68	2.30E-13	2.14E-13	2.00E-13	1.93E-13	1.78E-13	1.76E-13
As-69	6.99E-14	6.48E-14	6.00E-14	5.79E-14	5.29E-14	5.23E-14
As-70	2.61E-13	2.43E-13	2.27E-13	2.19E-13	2.02E-13	2.00E-13
As-71	3.44E-14	3.17E-14	2.93E-14	2.83E-14	2.57E-14	2.54E-14
As-72	1.09E-13	1.01E-13	9.39E-14	9.05E-14	8.30E-14	8.19E-14
As-73	2.55E-16	2.05E-16	1.79E-16	1.64E-16	1.36E-16	1.32E-16
As-74	4.56E-14	4.22E-14	3.90E-14	3.77E-14	3.44E-14	3.39E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-76	2.63E-14	2.44E-14	2.27E-14	2.20E-14	2.02E-14	1.99E-14
As-77	6.25E-16	5.78E-16	5.43E-16	5.26E-16	4.86E-16	4.81E-16
As-78	8.15E-14	7.59E-14	7.12E-14	6.87E-14	6.35E-14	6.27E-14
As-79	2.83E-15	2.64E-15	2.50E-15	2.42E-15	2.26E-15	2.24E-15
Selenium						
Se-70	4.25E-14	3.91E-14	3.61E-14	3.47E-14	3.16E-14	3.12E-14
Se-71	9.84E-14	9.11E-14	8.47E-14	8.16E-14	7.48E-14	7.38E-14
Se-72	1.09E-15	8.43E-16	7.22E-16	6.56E-16	5.30E-16	5.14E-16
Se-73	6.50E-14	5.98E-14	5.52E-14	5.31E-14	4.83E-14	4.76E-14
Se-73m	1.58E-14	1.46E-14	1.35E-14	1.30E-14	1.19E-14	1.17E-14
Se-75	2.29E-14	2.07E-14	1.92E-14	1.84E-14	1.66E-14	1.63E-14
Se-77m	5.11E-15	4.65E-15	4.29E-15	4.12E-15	3.70E-15	3.64E-15
Se-79	3.22E-18	3.13E-18	3.09E-18	3.07E-18	3.02E-18	3.02E-18
Se-79m	5.28E-16	4.65E-16	4.24E-16	4.02E-16	3.53E-16	3.45E-16
Se-81	9.72E-16	9.19E-16	8.80E-16	8.61E-16	8.17E-16	8.11E-16
Se-81m	8.06E-16	7.15E-16	6.55E-16	6.22E-16	5.49E-16	5.39E-16
Se-83	1.61E-13	1.50E-13	1.40E-13	1.35E-13	1.25E-13	1.23E-13
Se-83m	6.20E-14	5.76E-14	5.42E-14	5.22E-14	4.84E-14	4.78E-14
Se-84	2.55E-14	2.35E-14	2.17E-14	2.10E-14	1.91E-14	1.88E-14
Bromine						
Br-72	1.85E-13	1.72E-13	1.60E-13	1.55E-13	1.42E-13	1.41E-13
Br-73	8.72E-14	8.05E-14	7.46E-14	7.19E-14	6.57E-14	6.48E-14
Br-74	2.90E-13	2.72E-13	2.57E-13	2.48E-13	2.32E-13	2.30E-13
Br-74m	2.57E-13	2.41E-13	2.26E-13	2.18E-13	2.02E-13	2.00E-13
Br-75	7.22E-14	6.65E-14	6.15E-14	5.93E-14	5.40E-14	5.33E-14
Br-76	1.73E-13	1.62E-13	1.52E-13	1.46E-13	1.36E-13	1.34E-13
Br-76m	1.56E-15	1.28E-15	1.13E-15	1.05E-15	8.86E-16	8.65E-16
Br-77	1.89E-14	1.74E-14	1.61E-14	1.55E-14	1.41E-14	1.39E-14
Br-77m	8.67E-16	7.71E-16	7.06E-16	6.71E-16	5.92E-16	5.82E-16
Br-78	6.28E-14	5.82E-14	5.38E-14	5.19E-14	4.74E-14	4.68E-14
Br-80	5.18E-15	4.82E-15	4.50E-15	4.35E-15	4.01E-15	3.97E-15
Br-80m	4.78E-16	3.46E-16	2.90E-16	2.59E-16	2.00E-16	1.93E-16
Br-82	1.61E-13	1.49E-13	1.39E-13	1.34E-13	1.23E-13	1.22E-13
Br-82m	2.13E-16	1.95E-16	1.83E-16	1.76E-16	1.60E-16	1.58E-16
Br-83	6.25E-16	5.90E-16	5.59E-16	5.45E-16	5.12E-16	5.08E-16
Br-84	1.12E-13	1.05E-13	9.93E-14	9.60E-14	8.99E-14	8.88E-14
Br-84m	1.71E-13	1.59E-13	1.49E-13	1.43E-13	1.32E-13	1.31E-13
Br-85	5.04E-15	4.70E-15	4.45E-15	4.31E-15	4.02E-15	3.98E-15
Krypton						
Kr-74	6.34E-14	5.84E-14	5.39E-14	5.19E-14	4.72E-14	4.66E-14
Kr-75	7.82E-14	7.23E-14	6.70E-14	6.46E-14	5.89E-14	5.82E-14
Kr-76	2.50E-14	2.28E-14	2.11E-14	2.02E-14	1.83E-14	1.81E-14
Kr-77	6.24E-14	5.76E-14	5.32E-14	5.13E-14	4.66E-14	4.60E-14
Kr-79	1.50E-14	1.38E-14	1.27E-14	1.23E-14	1.12E-14	1.10E-14
Kr-81	6.18E-17	5.34E-17	4.87E-17	4.63E-17	3.81E-17	3.74E-17
Kr-81m	7.73E-15	6.95E-15	6.45E-15	6.17E-15	5.56E-15	5.47E-15

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-83m	5.00E-18	3.51E-18	2.97E-18	2.72E-18	1.03E-18	9.61E-19
Kr-85	2.81E-16	2.69E-16	2.58E-16	2.53E-16	2.42E-16	2.40E-16
Kr-85m	9.40E-15	8.57E-15	7.92E-15	7.60E-15	6.85E-15	6.74E-15
Kr-87	5.05E-14	4.74E-14	4.46E-14	4.31E-14	4.02E-14	3.97E-14
Kr-88	1.22E-13	1.15E-13	1.09E-13	1.05E-13	9.85E-14	9.73E-14
Kr-89	1.22E-13	1.14E-13	1.07E-13	1.04E-13	9.68E-14	9.56E-14
Rubidium						
Rb-77	9.45E-14	8.73E-14	8.10E-14	7.81E-14	7.14E-14	7.05E-14
Rb-78	2.57E-13	2.42E-13	2.28E-13	2.20E-13	2.06E-13	2.03E-13
Rb-78m	1.98E-13	1.85E-13	1.72E-13	1.66E-13	1.53E-13	1.52E-13
Rb-79	8.74E-14	8.08E-14	7.48E-14	7.21E-14	6.58E-14	6.49E-14
Rb-80	7.38E-14	6.84E-14	6.33E-14	6.11E-14	5.58E-14	5.51E-14
Rb-81	3.02E-14	2.80E-14	2.59E-14	2.49E-14	2.27E-14	2.24E-14
Rb-81m	1.45E-15	1.33E-15	1.23E-15	1.18E-15	1.07E-15	1.05E-15
Rb-82	6.79E-14	6.29E-14	5.82E-14	5.62E-14	5.13E-14	5.07E-14
Rb-82m	1.78E-13	1.64E-13	1.54E-13	1.48E-13	1.36E-13	1.34E-13
Rb-83	2.90E-14	2.68E-14	2.48E-14	2.39E-14	2.18E-14	2.15E-14
Rb-84	5.50E-14	5.07E-14	4.74E-14	4.56E-14	4.18E-14	4.13E-14
Rb-84m	2.29E-14	2.08E-14	1.93E-14	1.85E-14	1.68E-14	1.66E-14
Rb-86	6.29E-15	5.83E-15	5.51E-15	5.32E-15	4.93E-15	4.88E-15
Rb-86m	3.27E-14	3.03E-14	2.80E-14	2.70E-14	2.47E-14	2.43E-14
Rb-87	3.69E-17	3.64E-17	3.61E-17	3.60E-17	3.57E-17	3.56E-17
Rb-88	4.25E-14	4.00E-14	3.78E-14	3.65E-14	3.42E-14	3.38E-14
Rb-89	1.40E-13	1.31E-13	1.23E-13	1.19E-13	1.11E-13	1.09E-13
Rb-90	1.33E-13	1.25E-13	1.19E-13	1.15E-13	1.09E-13	1.08E-13
Rb-90m	2.05E-13	1.92E-13	1.82E-13	1.76E-13	1.65E-13	1.63E-13
Strontium						
Sr-79	7.23E-14	6.67E-14	6.17E-14	5.95E-14	5.42E-14	5.35E-14
Sr-80	2.58E-14	2.38E-14	2.20E-14	2.13E-14	1.94E-14	1.91E-14
Sr-81	8.39E-14	7.75E-14	7.18E-14	6.92E-14	6.31E-14	6.23E-14
Sr-82	2.15E-17	1.51E-17	1.28E-17	1.19E-17	4.40E-18	4.09E-18
Sr-83	4.92E-14	4.55E-14	4.23E-14	4.08E-14	3.74E-14	3.69E-14
Sr-85	2.95E-14	2.73E-14	2.52E-14	2.43E-14	2.21E-14	2.18E-14
Sr-85m	1.30E-14	1.17E-14	1.09E-14	1.04E-14	9.38E-15	9.24E-15
Sr-87m	1.91E-14	1.75E-14	1.62E-14	1.56E-14	1.42E-14	1.40E-14
Sr-89	4.69E-16	4.58E-16	4.50E-16	4.46E-16	4.38E-16	4.37E-16
Sr-90	1.02E-16	1.00E-16	9.95E-17	9.91E-17	9.81E-17	9.79E-17
Sr-91	4.38E-14	4.04E-14	3.79E-14	3.65E-14	3.36E-14	3.32E-14
Sr-92	8.28E-14	7.71E-14	7.27E-14	7.00E-14	6.50E-14	6.42E-14
Sr-93	1.39E-13	1.30E-13	1.22E-13	1.17E-13	1.08E-13	1.07E-13
Sr-94	8.91E-14	8.32E-14	7.84E-14	7.55E-14	7.03E-14	6.94E-14
Yttrium						
Y-81	7.18E-14	6.63E-14	6.13E-14	5.91E-14	5.39E-14	5.31E-14
Y-83	8.19E-14	7.59E-14	7.04E-14	6.79E-14	6.22E-14	6.14E-14
Y-83m	5.07E-14	4.68E-14	4.33E-14	4.17E-14	3.80E-14	3.75E-14
Y-84m	2.43E-13	2.25E-13	2.11E-13	2.03E-13	1.86E-13	1.84E-13

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-85	6.49E-14	6.01E-14	5.56E-14	5.36E-14	4.89E-14	4.83E-14
Y-85m	8.10E-14	7.54E-14	7.03E-14	6.78E-14	6.25E-14	6.17E-14
Y-86	2.19E-13	2.04E-13	1.91E-13	1.84E-13	1.70E-13	1.68E-13
Y-86m	1.32E-14	1.19E-14	1.11E-14	1.06E-14	9.59E-15	9.45E-15
Y-87	2.62E-14	2.42E-14	2.23E-14	2.15E-14	1.96E-14	1.93E-14
Y-87m	1.83E-14	1.68E-14	1.55E-14	1.49E-14	1.36E-14	1.34E-14
Y-88	1.67E-13	1.56E-13	1.47E-13	1.42E-13	1.32E-13	1.30E-13
Y-89m	5.52E-14	5.08E-14	4.77E-14	4.59E-14	4.21E-14	4.16E-14
Y-90	8.62E-16	8.36E-16	8.19E-16	8.10E-16	7.90E-16	7.87E-16
Y-90m	3.80E-14	3.48E-14	3.22E-14	3.10E-14	2.81E-14	2.77E-14
Y-91	6.77E-16	6.51E-16	6.33E-16	6.23E-16	6.02E-16	5.99E-16
Y-91m	3.17E-14	2.93E-14	2.71E-14	2.61E-14	2.38E-14	2.35E-14
Y-92	1.70E-14	1.58E-14	1.49E-14	1.44E-14	1.33E-14	1.32E-14
Y-93	7.11E-15	6.64E-15	6.28E-15	6.07E-15	5.68E-15	5.61E-15
Y-94	4.97E-14	4.61E-14	4.34E-14	4.18E-14	3.86E-14	3.82E-14
Y-95	7.14E-14	6.73E-14	6.37E-14	6.16E-14	5.79E-14	5.72E-14
Zirconium						
Zr-85	8.98E-14	8.32E-14	7.71E-14	7.44E-14	6.81E-14	6.72E-14
Zr-86	1.66E-14	1.49E-14	1.38E-14	1.33E-14	1.20E-14	1.18E-14
Zr-87	5.63E-14	5.22E-14	4.83E-14	4.66E-14	4.26E-14	4.20E-14
Zr-88	2.29E-14	2.10E-14	1.94E-14	1.87E-14	1.70E-14	1.67E-14
Zr-89	7.02E-14	6.47E-14	6.06E-14	5.83E-14	5.35E-14	5.28E-14
Zr-89m	3.82E-14	3.55E-14	3.29E-14	3.17E-14	2.91E-14	2.87E-14
Zr-93	1.47E-20	1.02E-20	8.69E-21	8.00E-21	5.33E-21	5.13E-21
Zr-95	4.44E-14	4.10E-14	3.83E-14	3.68E-14	3.37E-14	3.33E-14
Zr-97	5.40E-14	4.99E-14	4.66E-14	4.49E-14	4.12E-14	4.07E-14
Niobium						
Nb-87	7.45E-14	6.87E-14	6.35E-14	6.13E-14	5.58E-14	5.50E-14
Nb-88	2.58E-13	2.38E-13	2.22E-13	2.14E-13	1.96E-13	1.94E-13
Nb-88m	2.52E-13	2.33E-13	2.18E-13	2.10E-13	1.93E-13	1.91E-13
Nb-89	8.45E-14	7.89E-14	7.37E-14	7.12E-14	6.58E-14	6.49E-14
Nb-89m	7.88E-14	7.30E-14	6.74E-14	6.51E-14	5.93E-14	5.86E-14
Nb-90	2.61E-13	2.45E-13	2.31E-13	2.23E-13	2.08E-13	2.05E-13
Nb-91	1.39E-16	1.18E-16	1.07E-16	1.03E-16	8.31E-17	8.14E-17
Nb-91m	1.59E-15	1.46E-15	1.37E-15	1.32E-15	1.21E-15	1.19E-15
Nb-92	9.09E-14	8.39E-14	7.84E-14	7.55E-14	6.92E-14	6.83E-14
Nb-92m	5.88E-14	5.41E-14	5.09E-14	4.89E-14	4.50E-14	4.44E-14
Nb-93m	9.24E-18	6.24E-18	5.36E-18	5.14E-18	2.49E-18	2.33E-18
Nb-94	9.49E-14	8.75E-14	8.18E-14	7.87E-14	7.22E-14	7.12E-14
Nb-94m	3.05E-16	2.72E-16	2.54E-16	2.44E-16	2.16E-16	2.12E-16
Nb-95	4.64E-14	4.28E-14	4.00E-14	3.85E-14	3.53E-14	3.48E-14
Nb-95m	3.89E-15	3.50E-15	3.25E-15	3.12E-15	2.82E-15	2.78E-15
Nb-96	1.50E-13	1.39E-13	1.30E-13	1.25E-13	1.15E-13	1.13E-13
Nb-97	4.05E-14	3.74E-14	3.48E-14	3.36E-14	3.07E-14	3.03E-14
Nb-98m	1.73E-13	1.61E-13	1.51E-13	1.45E-13	1.34E-13	1.32E-13
Nb-99	1.13E-14	1.03E-14	9.55E-15	9.17E-15	8.28E-15	8.15E-15

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-99m	4.87E-14	4.58E-14	4.32E-14	4.18E-14	3.91E-14	3.86E-14
Molybdenum						
Mo-89	7.57E-14	7.02E-14	6.51E-14	6.29E-14	5.76E-14	5.68E-14
Mo-90	4.95E-14	4.53E-14	4.21E-14	4.05E-14	3.68E-14	3.63E-14
Mo-91	6.01E-14	5.57E-14	5.15E-14	4.97E-14	4.54E-14	4.48E-14
Mo-91m	8.49E-14	7.88E-14	7.36E-14	7.09E-14	6.53E-14	6.45E-14
Mo-93	5.17E-17	3.49E-17	3.00E-17	2.88E-17	1.39E-17	1.30E-17
Mo-93m	1.42E-13	1.32E-13	1.24E-13	1.19E-13	1.10E-13	1.09E-13
Mo-99	9.20E-15	8.48E-15	7.92E-15	7.63E-15	6.99E-15	6.90E-15
Mo-101	9.07E-14	8.43E-14	7.92E-14	7.63E-14	7.06E-14	6.96E-14
Mo-102	1.34E-15	1.22E-15	1.15E-15	1.11E-15	1.02E-15	1.00E-15
Technetium						
Tc-91	1.55E-13	1.45E-13	1.36E-13	1.31E-13	1.22E-13	1.20E-13
Tc-91m	8.78E-14	8.14E-14	7.54E-14	7.28E-14	6.66E-14	6.57E-14
Tc-92	2.35E-13	2.19E-13	2.04E-13	1.97E-13	1.81E-13	1.79E-13
Tc-93	9.64E-14	8.99E-14	8.47E-14	8.15E-14	7.57E-14	7.48E-14
Tc-93m	5.91E-14	5.55E-14	5.23E-14	5.05E-14	4.72E-14	4.66E-14
Tc-94	1.61E-13	1.49E-13	1.39E-13	1.34E-13	1.23E-13	1.21E-13
Tc-94m	1.20E-13	1.11E-13	1.04E-13	1.00E-13	9.21E-14	9.10E-14
Tc-95	4.78E-14	4.40E-14	4.11E-14	3.96E-14	3.63E-14	3.58E-14
Tc-95m	4.10E-14	3.77E-14	3.51E-14	3.38E-14	3.08E-14	3.04E-14
Tc-96	1.52E-13	1.40E-13	1.31E-13	1.26E-13	1.16E-13	1.14E-13
Tc-96m	2.58E-15	2.37E-15	2.22E-15	2.14E-15	1.96E-15	1.94E-15
Tc-97	6.26E-17	4.18E-17	3.58E-17	3.44E-17	1.77E-17	1.67E-17
Tc-97m	7.83E-17	5.66E-17	4.97E-17	4.76E-17	3.19E-17	3.07E-17
Tc-98	8.55E-14	7.90E-14	7.35E-14	7.08E-14	6.48E-14	6.40E-14
Tc-99	2.97E-17	2.93E-17	2.91E-17	2.89E-17	2.87E-17	2.87E-17
Tc-99m	7.34E-15	6.67E-15	6.14E-15	5.88E-15	5.26E-15	5.17E-15
Tc-101	2.06E-14	1.88E-14	1.74E-14	1.67E-14	1.52E-14	1.50E-14
Tc-102	7.32E-15	6.87E-15	6.49E-15	6.30E-15	5.89E-15	5.83E-15
Tc-102m	1.53E-13	1.43E-13	1.34E-13	1.29E-13	1.20E-13	1.18E-13
Tc-104	1.41E-13	1.32E-13	1.24E-13	1.19E-13	1.11E-13	1.10E-13
Tc-105	4.96E-14	4.59E-14	4.29E-14	4.14E-14	3.81E-14	3.76E-14
Ruthenium						
Ru-92	1.26E-13	1.16E-13	1.08E-13	1.04E-13	9.50E-14	9.38E-14
Ru-94	3.07E-14	2.82E-14	2.62E-14	2.52E-14	2.30E-14	2.27E-14
Ru-95	7.52E-14	6.94E-14	6.49E-14	6.25E-14	5.74E-14	5.67E-14
Ru-97	1.38E-14	1.24E-14	1.15E-14	1.10E-14	9.92E-15	9.78E-15
Ru-103	2.97E-14	2.75E-14	2.53E-14	2.45E-14	2.23E-14	2.20E-14
Ru-105	4.53E-14	4.18E-14	3.89E-14	3.75E-14	3.42E-14	3.38E-14
Ru-106	1.07E-21	7.22E-22	6.10E-22	5.67E-22	2.79E-22	2.63E-22
Ru-107	2.21E-14	2.04E-14	1.92E-14	1.85E-14	1.70E-14	1.68E-14
Ru-108	3.94E-15	3.60E-15	3.34E-15	3.21E-15	2.91E-15	2.87E-15
Rhodium						
Rh-94	2.35E-13	2.19E-13	2.05E-13	1.98E-13	1.83E-13	1.80E-13
Rh-95	1.58E-13	1.47E-13	1.37E-13	1.33E-13	1.22E-13	1.21E-13

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rh-95m	5.53E-14	5.17E-14	4.83E-14	4.68E-14	4.33E-14	4.28E-14
Rh-96	2.39E-13	2.22E-13	2.07E-13	2.00E-13	1.83E-13	1.81E-13
Rh-96m	7.87E-14	7.32E-14	6.85E-14	6.61E-14	6.10E-14	6.02E-14
Rh-97	8.76E-14	8.11E-14	7.54E-14	7.27E-14	6.67E-14	6.58E-14
Rh-97m	1.36E-13	1.27E-13	1.20E-13	1.16E-13	1.08E-13	1.06E-13
Rh-98	1.11E-13	1.03E-13	9.53E-14	9.20E-14	8.43E-14	8.32E-14
Rh-99	3.27E-14	3.01E-14	2.78E-14	2.68E-14	2.44E-14	2.40E-14
Rh-99m	3.87E-14	3.56E-14	3.31E-14	3.19E-14	2.91E-14	2.87E-14
Rh-100	1.69E-13	1.58E-13	1.49E-13	1.43E-13	1.33E-13	1.32E-13
Rh-100m	2.78E-15	2.51E-15	2.32E-15	2.22E-15	2.01E-15	1.98E-15
Rh-101	1.63E-14	1.47E-14	1.36E-14	1.30E-14	1.17E-14	1.15E-14
Rh-101m	1.66E-14	1.50E-14	1.39E-14	1.34E-14	1.21E-14	1.19E-14
Rh-102	3.00E-14	2.78E-14	2.57E-14	2.48E-14	2.26E-14	2.23E-14
Rh-102m	1.30E-13	1.20E-13	1.12E-13	1.08E-13	9.85E-14	9.72E-14
Rh-103m	1.35E-17	8.87E-18	7.48E-18	7.04E-18	4.34E-18	4.13E-18
Rh-104	1.66E-15	1.58E-15	1.51E-15	1.48E-15	1.40E-15	1.39E-15
Rh-104m	1.51E-15	1.22E-15	1.07E-15	9.89E-16	8.19E-16	7.95E-16
Rh-105	4.71E-15	4.29E-15	3.97E-15	3.82E-15	3.46E-15	3.42E-15
Rh-106	1.39E-14	1.30E-14	1.21E-14	1.17E-14	1.08E-14	1.06E-14
Rh-106m	1.74E-13	1.61E-13	1.51E-13	1.45E-13	1.33E-13	1.32E-13
Rh-107	1.91E-14	1.74E-14	1.62E-14	1.55E-14	1.41E-14	1.39E-14
Rh-108	2.12E-14	1.96E-14	1.83E-14	1.76E-14	1.62E-14	1.60E-14
Rh-109	1.87E-14	1.71E-14	1.58E-14	1.52E-14	1.38E-14	1.37E-14
Palladium						
Pd-96	8.67E-14	8.01E-14	7.46E-14	7.18E-14	6.58E-14	6.49E-14
Pd-97	1.46E-13	1.36E-13	1.27E-13	1.23E-13	1.14E-13	1.12E-13
Pd-98	2.40E-14	2.19E-14	2.03E-14	1.95E-14	1.78E-14	1.75E-14
Pd-99	7.77E-14	7.21E-14	6.71E-14	6.47E-14	5.94E-14	5.86E-14
Pd-100	5.37E-15	4.59E-15	4.15E-15	3.92E-15	3.40E-15	3.31E-15
Pd-101	1.99E-14	1.83E-14	1.70E-14	1.63E-14	1.49E-14	1.47E-14
Pd-103	1.24E-16	8.29E-17	7.04E-17	6.66E-17	4.17E-17	3.98E-17
Pd-107	7.02E-22	4.77E-22	4.04E-22	3.76E-22	1.72E-22	1.61E-22
Pd-109	5.44E-16	4.85E-16	4.57E-16	4.43E-16	4.07E-16	4.02E-16
Pd-109m	6.39E-15	5.74E-15	5.33E-15	5.09E-15	4.58E-15	4.51E-15
Pd-111	3.65E-15	3.41E-15	3.22E-15	3.12E-15	2.91E-15	2.88E-15
Pd-112	4.63E-17	3.59E-17	3.28E-17	3.21E-17	2.44E-17	2.39E-17
Pd-114	1.94E-15	1.79E-15	1.68E-15	1.62E-15	1.49E-15	1.47E-15
Silver						
Ag-99	1.42E-13	1.32E-13	1.23E-13	1.19E-13	1.09E-13	1.08E-13
Ag-100m	1.74E-13	1.62E-13	1.51E-13	1.46E-13	1.35E-13	1.33E-13
Ag-101	9.55E-14	8.83E-14	8.21E-14	7.92E-14	7.25E-14	7.16E-14
Ag-102	2.09E-13	1.95E-13	1.82E-13	1.76E-13	1.62E-13	1.60E-13
Ag-102m	1.24E-13	1.16E-13	1.09E-13	1.06E-13	9.84E-14	9.72E-14
Ag-103	5.05E-14	4.66E-14	4.34E-14	4.18E-14	3.82E-14	3.77E-14
Ag-104	1.64E-13	1.52E-13	1.42E-13	1.37E-13	1.26E-13	1.24E-13
Ag-104m	1.10E-13	1.03E-13	9.60E-14	9.27E-14	8.55E-14	8.44E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-105	2.99E-14	2.74E-14	2.54E-14	2.44E-14	2.22E-14	2.19E-14
Ag-105m	6.00E-17	5.47E-17	5.07E-17	4.88E-17	4.43E-17	4.37E-17
Ag-106	4.20E-14	3.89E-14	3.59E-14	3.46E-14	3.16E-14	3.12E-14
Ag-106m	1.70E-13	1.58E-13	1.47E-13	1.42E-13	1.30E-13	1.29E-13
Ag-108	1.58E-15	1.49E-15	1.41E-15	1.37E-15	1.28E-15	1.27E-15
Ag-108m	9.68E-14	8.94E-14	8.29E-14	7.99E-14	7.30E-14	7.20E-14
Ag-109m	2.60E-16	2.08E-16	1.86E-16	1.75E-16	1.44E-16	1.40E-16
Ag-110	3.03E-15	2.85E-15	2.71E-15	2.63E-15	2.47E-15	2.45E-15
Ag-110m	1.69E-13	1.56E-13	1.46E-13	1.41E-13	1.29E-13	1.28E-13
Ag-111	1.83E-15	1.68E-15	1.57E-15	1.51E-15	1.39E-15	1.37E-15
Ag-111m	2.49E-16	2.14E-16	1.96E-16	1.87E-16	1.63E-16	1.60E-16
Ag-112	4.39E-14	4.09E-14	3.84E-14	3.71E-14	3.43E-14	3.39E-14
Ag-113	5.00E-15	4.61E-15	4.32E-15	4.17E-15	3.84E-15	3.79E-15
Ag-113m	1.29E-14	1.18E-14	1.09E-14	1.05E-14	9.58E-15	9.46E-15
Ag-114	1.86E-14	1.74E-14	1.64E-14	1.58E-14	1.47E-14	1.46E-14
Ag-115	3.09E-14	2.88E-14	2.71E-14	2.61E-14	2.43E-14	2.40E-14
Ag-116	1.35E-13	1.27E-13	1.20E-13	1.16E-13	1.08E-13	1.07E-13
Ag-117	8.24E-14	7.74E-14	7.29E-14	7.04E-14	6.58E-14	6.50E-14
Cadmium						
Cd-101	1.53E-13	1.42E-13	1.33E-13	1.28E-13	1.19E-13	1.17E-13
Cd-102	4.98E-14	4.60E-14	4.27E-14	4.12E-14	3.76E-14	3.71E-14
Cd-103	1.29E-13	1.20E-13	1.13E-13	1.09E-13	1.01E-13	1.00E-13
Cd-104	1.38E-14	1.25E-14	1.16E-14	1.12E-14	1.01E-14	9.95E-15
Cd-105	7.95E-14	7.42E-14	6.95E-14	6.70E-14	6.21E-14	6.13E-14
Cd-107	7.86E-16	6.44E-16	5.79E-16	5.49E-16	4.62E-16	4.51E-16
Cd-109	4.23E-16	3.14E-16	2.74E-16	2.57E-16	1.98E-16	1.91E-16
Cd-111m	1.66E-14	1.50E-14	1.39E-14	1.33E-14	1.20E-14	1.18E-14
Cd-113	2.57E-17	2.53E-17	2.51E-17	2.50E-17	2.48E-17	2.48E-17
Cd-113m	9.72E-17	9.53E-17	9.43E-17	9.38E-17	9.26E-17	9.24E-17
Cd-115	1.17E-14	1.08E-14	1.00E-14	9.65E-15	8.81E-15	8.69E-15
Cd-115m	2.51E-15	2.34E-15	2.22E-15	2.15E-15	2.01E-15	1.99E-15
Cd-117	6.66E-14	6.18E-14	5.81E-14	5.59E-14	5.17E-14	5.10E-14
Cd-117m	1.27E-13	1.19E-13	1.12E-13	1.08E-13	1.00E-13	9.90E-14
Cd-118	7.50E-17	7.39E-17	7.33E-17	7.30E-17	7.23E-17	7.22E-17
Cd-119	1.02E-13	9.55E-14	8.99E-14	8.67E-14	8.07E-14	7.96E-14
Cd-119m	1.43E-13	1.34E-13	1.26E-13	1.21E-13	1.13E-13	1.12E-13
Indium						
In-103	1.70E-13	1.58E-13	1.48E-13	1.43E-13	1.32E-13	1.30E-13
In-105	1.18E-13	1.10E-13	1.02E-13	9.86E-14	9.06E-14	8.95E-14
In-106	2.17E-13	2.00E-13	1.87E-13	1.80E-13	1.65E-13	1.63E-13
In-106m	1.75E-13	1.63E-13	1.53E-13	1.48E-13	1.37E-13	1.35E-13
In-107	9.35E-14	8.71E-14	8.15E-14	7.86E-14	7.26E-14	7.17E-14
In-108	2.39E-13	2.21E-13	2.07E-13	1.99E-13	1.84E-13	1.81E-13
In-108m	1.72E-13	1.61E-13	1.52E-13	1.46E-13	1.36E-13	1.35E-13
In-109	3.83E-14	3.52E-14	3.28E-14	3.15E-14	2.89E-14	2.85E-14
In-109m	3.67E-14	3.39E-14	3.15E-14	3.03E-14	2.77E-14	2.74E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-110	1.88E-13	1.73E-13	1.62E-13	1.56E-13	1.43E-13	1.41E-13
In-110m	9.59E-14	8.91E-14	8.28E-14	7.99E-14	7.34E-14	7.25E-14
In-111	2.34E-14	2.10E-14	1.95E-14	1.87E-14	1.68E-14	1.65E-14
In-111m	2.81E-14	2.60E-14	2.40E-14	2.32E-14	2.11E-14	2.09E-14
In-112	1.59E-14	1.47E-14	1.36E-14	1.31E-14	1.20E-14	1.18E-14
In-112m	1.43E-15	1.25E-15	1.15E-15	1.10E-15	9.67E-16	9.50E-16
In-113m	1.54E-14	1.41E-14	1.30E-14	1.25E-14	1.14E-14	1.12E-14
In-114	8.09E-16	7.80E-16	7.60E-16	7.50E-16	7.27E-16	7.24E-16
In-114m	4.46E-15	4.05E-15	3.76E-15	3.61E-15	3.27E-15	3.22E-15
In-115	6.83E-17	6.73E-17	6.68E-17	6.65E-17	6.59E-17	6.58E-17
In-115m	9.46E-15	8.61E-15	7.96E-15	7.65E-15	6.93E-15	6.84E-15
In-116m	1.53E-13	1.42E-13	1.34E-13	1.29E-13	1.19E-13	1.18E-13
In-117	4.15E-14	3.83E-14	3.54E-14	3.41E-14	3.10E-14	3.06E-14
In-117m	5.52E-15	5.03E-15	4.67E-15	4.49E-15	4.07E-15	4.02E-15
In-118	7.10E-15	6.66E-15	6.34E-15	6.14E-15	5.77E-15	5.71E-15
In-118m	1.71E-13	1.59E-13	1.49E-13	1.44E-13	1.33E-13	1.31E-13
In-119	4.70E-14	4.34E-14	4.05E-14	3.90E-14	3.58E-14	3.53E-14
In-119m	4.93E-15	4.59E-15	4.35E-15	4.21E-15	3.93E-15	3.88E-15
In-121	5.76E-14	5.31E-14	4.99E-14	4.80E-14	4.41E-14	4.35E-14
In-121m	4.97E-15	4.57E-15	4.32E-15	4.17E-15	3.89E-15	3.84E-15
Tin						
Sn-106	7.23E-14	6.66E-14	6.20E-14	5.96E-14	5.45E-14	5.38E-14
Sn-108	4.01E-14	3.67E-14	3.40E-14	3.27E-14	2.97E-14	2.93E-14
Sn-109	1.36E-13	1.27E-13	1.19E-13	1.15E-13	1.07E-13	1.05E-13
Sn-110	1.67E-14	1.51E-14	1.39E-14	1.34E-14	1.21E-14	1.19E-14
Sn-111	2.93E-14	2.71E-14	2.52E-14	2.43E-14	2.23E-14	2.21E-14
Sn-113	5.72E-16	4.54E-16	4.05E-16	3.81E-16	3.19E-16	3.12E-16
Sn-113m	2.17E-16	1.46E-16	1.23E-16	1.11E-16	8.10E-17	7.77E-17
Sn-117m	8.57E-15	7.73E-15	7.12E-15	6.82E-15	6.11E-15	6.00E-15
Sn-119m	2.08E-16	1.36E-16	1.13E-16	1.02E-16	7.13E-17	6.82E-17
Sn-121	4.11E-17	4.05E-17	4.02E-17	4.00E-17	3.97E-17	3.96E-17
Sn-121m	1.03E-16	7.27E-17	6.20E-17	5.63E-17	4.42E-17	4.29E-17
Sn-123	8.27E-16	7.85E-16	7.56E-16	7.39E-16	7.05E-16	7.00E-16
Sn-123m	8.50E-15	7.75E-15	7.17E-15	6.89E-15	6.21E-15	6.11E-15
Sn-125	2.13E-14	1.98E-14	1.86E-14	1.79E-14	1.66E-14	1.64E-14
Sn-125m	2.15E-14	1.97E-14	1.83E-14	1.76E-14	1.60E-14	1.58E-14
Sn-126	2.71E-15	2.31E-15	2.09E-15	1.97E-15	1.72E-15	1.67E-15
Sn-127	1.18E-13	1.09E-13	1.03E-13	9.89E-14	9.14E-14	9.02E-14
Sn-127m	3.53E-14	3.28E-14	3.05E-14	2.94E-14	2.70E-14	2.66E-14
Sn-128	3.43E-14	3.14E-14	2.89E-14	2.79E-14	2.53E-14	2.49E-14
Sn-129	6.27E-14	5.81E-14	5.43E-14	5.24E-14	4.82E-14	4.76E-14
Sn-130	5.61E-14	5.13E-14	4.78E-14	4.59E-14	4.19E-14	4.13E-14
Sn-130m	5.51E-14	5.10E-14	4.78E-14	4.60E-14	4.24E-14	4.19E-14
Antimony						
Sb-111	9.04E-14	8.36E-14	7.74E-14	7.47E-14	6.82E-14	6.73E-14
Sb-113	7.64E-14	7.07E-14	6.54E-14	6.31E-14	5.76E-14	5.69E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sb-114	1.66E-13	1.54E-13	1.44E-13	1.39E-13	1.28E-13	1.27E-13
Sb-115	5.29E-14	4.89E-14	4.52E-14	4.36E-14	3.97E-14	3.92E-14
Sb-116	1.40E-13	1.30E-13	1.22E-13	1.18E-13	1.09E-13	1.08E-13
Sb-116m	1.89E-13	1.75E-13	1.64E-13	1.57E-13	1.45E-13	1.43E-13
Sb-117	1.01E-14	9.11E-15	8.39E-15	8.05E-15	7.22E-15	7.10E-15
Sb-118	4.88E-14	4.52E-14	4.18E-14	4.03E-14	3.68E-14	3.64E-14
Sb-118m	1.59E-13	1.46E-13	1.38E-13	1.32E-13	1.22E-13	1.20E-13
Sb-119	3.39E-16	2.22E-16	1.84E-16	1.65E-16	1.17E-16	1.12E-16
Sb-120	2.68E-14	2.48E-14	2.29E-14	2.21E-14	2.01E-14	1.99E-14
Sb-120m	1.50E-13	1.38E-13	1.30E-13	1.25E-13	1.15E-13	1.13E-13
Sb-122	2.72E-14	2.52E-14	2.33E-14	2.25E-14	2.06E-14	2.03E-14
Sb-122m	2.78E-15	2.25E-15	2.00E-15	1.86E-15	1.57E-15	1.51E-15
Sb-124	1.14E-13	1.07E-13	9.98E-14	9.62E-14	8.92E-14	8.80E-14
Sb-124m	2.65E-14	2.45E-14	2.27E-14	2.19E-14	2.00E-14	1.98E-14
Sb-124n	1.26E-20	8.25E-21	6.83E-21	6.12E-21	4.36E-21	4.17E-21
Sb-125	2.56E-14	2.36E-14	2.18E-14	2.10E-14	1.91E-14	1.88E-14
Sb-126	1.67E-13	1.54E-13	1.43E-13	1.38E-13	1.26E-13	1.25E-13
Sb-126m	9.39E-14	8.67E-14	8.05E-14	7.76E-14	7.09E-14	7.00E-14
Sb-127	4.20E-14	3.87E-14	3.60E-14	3.47E-14	3.17E-14	3.13E-14
Sb-128	1.88E-13	1.73E-13	1.61E-13	1.55E-13	1.42E-13	1.40E-13
Sb-128m	1.16E-13	1.07E-13	1.00E-13	9.63E-14	8.82E-14	8.70E-14
Sb-129	8.97E-14	8.31E-14	7.79E-14	7.50E-14	6.92E-14	6.83E-14
Sb-130	2.00E-13	1.84E-13	1.72E-13	1.66E-13	1.52E-13	1.50E-13
Sb-130m	1.66E-13	1.53E-13	1.44E-13	1.38E-13	1.27E-13	1.26E-13
Sb-131	1.28E-13	1.19E-13	1.12E-13	1.08E-13	9.98E-14	9.85E-14
Sb-133	1.71E-13	1.59E-13	1.50E-13	1.45E-13	1.35E-13	1.33E-13
Tellurium						
Te-113	1.38E-13	1.28E-13	1.20E-13	1.15E-13	1.06E-13	1.05E-13
Te-114	7.74E-14	7.19E-14	6.73E-14	6.48E-14	5.99E-14	5.91E-14
Te-115	1.37E-13	1.28E-13	1.19E-13	1.15E-13	1.06E-13	1.05E-13
Te-115m	1.60E-13	1.49E-13	1.39E-13	1.34E-13	1.24E-13	1.22E-13
Te-116	5.26E-15	4.64E-15	4.24E-15	4.04E-15	3.60E-15	3.54E-15
Te-117	9.45E-14	8.80E-14	8.24E-14	7.94E-14	7.34E-14	7.25E-14
Te-118	3.35E-16	2.21E-16	1.83E-16	1.63E-16	1.18E-16	1.13E-16
Te-119	4.56E-14	4.22E-14	3.92E-14	3.78E-14	3.46E-14	3.42E-14
Te-119m	9.16E-14	8.46E-14	7.95E-14	7.65E-14	7.05E-14	6.96E-14
Te-121	3.37E-14	3.11E-14	2.88E-14	2.77E-14	2.53E-14	2.49E-14
Te-121m	1.25E-14	1.12E-14	1.04E-14	9.95E-15	8.99E-15	8.86E-15
Te-123	5.82E-19	3.84E-19	3.18E-19	2.84E-19	2.06E-19	1.97E-19
Te-123m	8.13E-15	7.34E-15	6.76E-15	6.47E-15	5.79E-15	5.69E-15
Te-125m	7.09E-16	4.82E-16	4.02E-16	3.59E-16	2.70E-16	2.60E-16
Te-127	4.16E-16	3.91E-16	3.69E-16	3.59E-16	3.36E-16	3.33E-16
Te-127m	2.27E-16	1.57E-16	1.33E-16	1.19E-16	9.16E-17	8.84E-17
Te-129	3.94E-15	3.64E-15	3.38E-15	3.27E-15	3.00E-15	2.96E-15
Te-129m	2.11E-15	1.92E-15	1.79E-15	1.72E-15	1.57E-15	1.55E-15
Te-131	2.57E-14	2.37E-14	2.20E-14	2.12E-14	1.94E-14	1.91E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-131m	8.86E-14	8.17E-14	7.65E-14	7.36E-14	6.77E-14	6.68E-14
Te-132	1.31E-14	1.17E-14	1.08E-14	1.03E-14	9.24E-15	9.10E-15
Te-133	7.42E-14	6.88E-14	6.45E-14	6.21E-14	5.73E-14	5.66E-14
Te-133m	1.14E-13	1.05E-13	9.86E-14	9.49E-14	8.74E-14	8.63E-14
Te-134	5.22E-14	4.78E-14	4.44E-14	4.28E-14	3.90E-14	3.84E-14
Iodine						
I-118	1.24E-13	1.15E-13	1.07E-13	1.03E-13	9.48E-14	9.36E-14
I-118m	2.28E-13	2.11E-13	1.96E-13	1.89E-13	1.73E-13	1.71E-13
I-119	5.47E-14	5.02E-14	4.65E-14	4.48E-14	4.08E-14	4.02E-14
I-120	1.65E-13	1.54E-13	1.44E-13	1.39E-13	1.29E-13	1.28E-13
I-120m	2.15E-13	2.00E-13	1.86E-13	1.79E-13	1.65E-13	1.63E-13
I-121	2.32E-14	2.11E-14	1.95E-14	1.87E-14	1.70E-14	1.67E-14
I-122	5.86E-14	5.43E-14	5.02E-14	4.85E-14	4.43E-14	4.37E-14
I-123	9.20E-15	8.27E-15	7.61E-15	7.28E-15	6.51E-15	6.40E-15
I-124	6.72E-14	6.25E-14	5.82E-14	5.62E-14	5.17E-14	5.10E-14
I-125	8.19E-16	5.49E-16	4.54E-16	4.04E-16	3.00E-16	2.88E-16
I-126	2.58E-14	2.38E-14	2.21E-14	2.12E-14	1.94E-14	1.91E-14
I-128	4.64E-15	4.30E-15	4.01E-15	3.88E-15	3.57E-15	3.53E-15
I-129	5.93E-16	4.10E-16	3.42E-16	3.04E-16	2.33E-16	2.25E-16
I-130	1.29E-13	1.19E-13	1.11E-13	1.07E-13	9.78E-14	9.66E-14
I-130m	6.52E-15	6.02E-15	5.58E-15	5.38E-15	4.92E-15	4.86E-15
I-131	2.30E-14	2.11E-14	1.95E-14	1.87E-14	1.70E-14	1.68E-14
I-132	1.38E-13	1.28E-13	1.19E-13	1.15E-13	1.05E-13	1.04E-13
I-132m	2.02E-14	1.86E-14	1.72E-14	1.66E-14	1.52E-14	1.50E-14
I-133	3.71E-14	3.44E-14	3.19E-14	3.07E-14	2.81E-14	2.77E-14
I-134	1.59E-13	1.47E-13	1.38E-13	1.33E-13	1.22E-13	1.21E-13
I-134m	1.64E-14	1.48E-14	1.37E-14	1.31E-14	1.18E-14	1.16E-14
I-135	9.79E-14	9.12E-14	8.59E-14	8.27E-14	7.68E-14	7.58E-14
Xenon						
Xe-120	2.25E-14	2.05E-14	1.90E-14	1.82E-14	1.66E-14	1.63E-14
Xe-121	9.02E-14	8.41E-14	7.87E-14	7.59E-14	7.02E-14	6.93E-14
Xe-122	3.16E-15	2.77E-15	2.53E-15	2.41E-15	2.14E-15	2.11E-15
Xe-123	3.80E-14	3.51E-14	3.26E-14	3.14E-14	2.88E-14	2.84E-14
Xe-125	1.51E-14	1.35E-14	1.25E-14	1.19E-14	1.08E-14	1.06E-14
Xe-127	1.57E-14	1.41E-14	1.30E-14	1.25E-14	1.12E-14	1.10E-14
Xe-127m	9.32E-15	8.35E-15	7.67E-15	7.33E-15	6.53E-15	6.42E-15
Xe-129m	1.58E-15	1.22E-15	1.07E-15	9.88E-16	8.28E-16	8.09E-16
Xe-131m	6.10E-16	4.71E-16	4.14E-16	3.83E-16	3.22E-16	3.14E-16
Xe-133	2.08E-15	1.73E-15	1.55E-15	1.46E-15	1.26E-15	1.22E-15
Xe-133m	1.88E-15	1.61E-15	1.48E-15	1.40E-15	1.25E-15	1.23E-15
Xe-135	1.51E-14	1.36E-14	1.27E-14	1.21E-14	1.10E-14	1.08E-14
Xe-135m	2.53E-14	2.34E-14	2.16E-14	2.09E-14	1.90E-14	1.88E-14
Xe-137	1.35E-14	1.26E-14	1.17E-14	1.14E-14	1.05E-14	1.04E-14
Xe-138	7.00E-14	6.56E-14	6.16E-14	5.94E-14	5.54E-14	5.47E-14
Cesium						
Cs-121	7.22E-14	6.68E-14	6.19E-14	5.97E-14	5.45E-14	5.38E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cs-121m	7.22E-14	6.66E-14	6.17E-14	5.94E-14	5.42E-14	5.35E-14
Cs-123	6.55E-14	6.05E-14	5.60E-14	5.40E-14	4.93E-14	4.87E-14
Cs-124	7.22E-14	6.69E-14	6.20E-14	5.99E-14	5.48E-14	5.41E-14
Cs-125	4.51E-14	4.17E-14	3.86E-14	3.73E-14	3.40E-14	3.36E-14
Cs-126	7.06E-14	6.54E-14	6.05E-14	5.84E-14	5.34E-14	5.27E-14
Cs-127	2.50E-14	2.29E-14	2.12E-14	2.04E-14	1.85E-14	1.82E-14
Cs-128	5.40E-14	5.00E-14	4.62E-14	4.46E-14	4.07E-14	4.02E-14
Cs-129	1.55E-14	1.41E-14	1.29E-14	1.24E-14	1.12E-14	1.11E-14
Cs-130	3.00E-14	2.77E-14	2.56E-14	2.47E-14	2.25E-14	2.22E-14
Cs-130m	3.09E-15	2.58E-15	2.31E-15	2.16E-15	1.86E-15	1.81E-15
Cs-131	5.09E-16	3.46E-16	2.87E-16	2.54E-16	1.93E-16	1.86E-16
Cs-132	4.23E-14	3.90E-14	3.62E-14	3.49E-14	3.18E-14	3.14E-14
Cs-134	9.42E-14	8.70E-14	8.11E-14	7.81E-14	7.15E-14	7.06E-14
Cs-134m	1.20E-15	1.03E-15	9.35E-16	8.86E-16	7.77E-16	7.62E-16
Cs-135	2.24E-17	2.21E-17	2.19E-17	2.19E-17	2.17E-17	2.16E-17
Cs-135m	9.73E-14	8.96E-14	8.39E-14	8.07E-14	7.40E-14	7.31E-14
Cs-136	1.30E-13	1.20E-13	1.12E-13	1.08E-13	9.92E-14	9.79E-14
Cs-137	9.77E-17	9.62E-17	9.53E-17	9.48E-17	9.38E-17	9.37E-17
Cs-138	1.48E-13	1.38E-13	1.30E-13	1.25E-13	1.17E-13	1.15E-13
Cs-138m	2.52E-14	2.33E-14	2.18E-14	2.10E-14	1.94E-14	1.91E-14
Cs-139	2.08E-14	1.96E-14	1.85E-14	1.79E-14	1.68E-14	1.66E-14
Cs-140	1.13E-13	1.06E-13	9.97E-14	9.64E-14	9.00E-14	8.89E-14
Barium						
Ba-124	3.38E-14	3.10E-14	2.88E-14	2.77E-14	2.53E-14	2.50E-14
Ba-126	3.44E-14	3.14E-14	2.93E-14	2.82E-14	2.58E-14	2.54E-14
Ba-127	4.37E-14	4.04E-14	3.75E-14	3.61E-14	3.30E-14	3.26E-14
Ba-128	3.10E-15	2.68E-15	2.45E-15	2.32E-15	2.06E-15	2.03E-15
Ba-129	1.94E-14	1.78E-14	1.65E-14	1.59E-14	1.45E-14	1.43E-14
Ba-129m	9.55E-14	8.81E-14	8.23E-14	7.92E-14	7.27E-14	7.18E-14
Ba-131	2.74E-14	2.50E-14	2.30E-14	2.21E-14	2.00E-14	1.98E-14
Ba-131m	3.95E-15	3.44E-15	3.13E-15	2.96E-15	2.60E-15	2.55E-15
Ba-133	2.25E-14	2.03E-14	1.86E-14	1.79E-14	1.61E-14	1.58E-14
Ba-133m	3.53E-15	3.11E-15	2.86E-15	2.72E-15	2.44E-15	2.41E-15
Ba-135m	3.08E-15	2.70E-15	2.48E-15	2.36E-15	2.11E-15	2.08E-15
Ba-137m	3.59E-14	3.32E-14	3.08E-14	2.97E-14	2.72E-14	2.68E-14
Ba-139	3.47E-15	3.20E-15	3.00E-15	2.90E-15	2.67E-15	2.64E-15
Ba-140	1.08E-14	1.00E-14	9.24E-15	8.91E-15	8.11E-15	8.01E-15
Ba-141	5.72E-14	5.28E-14	4.93E-14	4.75E-14	4.36E-14	4.30E-14
Ba-142	6.40E-14	5.89E-14	5.53E-14	5.32E-14	4.89E-14	4.82E-14
Lanthanum						
La-128	1.73E-13	1.60E-13	1.49E-13	1.43E-13	1.32E-13	1.30E-13
La-129	5.53E-14	5.09E-14	4.71E-14	4.54E-14	4.14E-14	4.08E-14
La-130	1.36E-13	1.26E-13	1.18E-13	1.13E-13	1.04E-13	1.03E-13
La-131	3.90E-14	3.58E-14	3.30E-14	3.18E-14	2.89E-14	2.85E-14
La-132	1.22E-13	1.14E-13	1.06E-13	1.02E-13	9.44E-14	9.32E-14
La-132m	3.98E-14	3.65E-14	3.39E-14	3.26E-14	2.97E-14	2.93E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-133	8.78E-15	7.96E-15	7.34E-15	7.05E-15	6.38E-15	6.30E-15
La-134	4.35E-14	4.03E-14	3.73E-14	3.60E-14	3.28E-14	3.24E-14
La-135	1.26E-15	1.02E-15	9.01E-16	8.40E-16	7.18E-16	7.04E-16
La-136	2.41E-14	2.22E-14	2.05E-14	1.98E-14	1.80E-14	1.78E-14
La-137	6.32E-16	4.40E-16	3.66E-16	3.25E-16	2.51E-16	2.42E-16
La-138	7.55E-14	7.03E-14	6.61E-14	6.36E-14	5.90E-14	5.82E-14
La-140	1.43E-13	1.33E-13	1.25E-13	1.21E-13	1.12E-13	1.11E-13
La-141	2.59E-15	2.45E-15	2.34E-15	2.28E-15	2.16E-15	2.14E-15
La-142	1.49E-13	1.41E-13	1.33E-13	1.28E-13	1.20E-13	1.19E-13
La-143	1.77E-14	1.65E-14	1.56E-14	1.51E-14	1.41E-14	1.39E-14
Cerium						
Ce-130	2.90E-14	2.65E-14	2.46E-14	2.36E-14	2.14E-14	2.11E-14
Ce-131	9.85E-14	9.11E-14	8.49E-14	8.18E-14	7.50E-14	7.40E-14
Ce-132	1.53E-14	1.37E-14	1.27E-14	1.21E-14	1.09E-14	1.07E-14
Ce-133	3.12E-14	2.85E-14	2.62E-14	2.52E-14	2.28E-14	2.25E-14
Ce-133m	1.05E-13	9.70E-14	9.06E-14	8.72E-14	8.03E-14	7.93E-14
Ce-134	8.06E-16	5.87E-16	4.97E-16	4.48E-16	3.57E-16	3.46E-16
Ce-135	4.87E-14	4.46E-14	4.14E-14	3.98E-14	3.62E-14	3.58E-14
Ce-137	1.38E-15	1.12E-15	9.88E-16	9.21E-16	7.88E-16	7.71E-16
Ce-137m	2.80E-15	2.44E-15	2.23E-15	2.12E-15	1.89E-15	1.86E-15
Ce-139	8.52E-15	7.58E-15	6.96E-15	6.64E-15	5.91E-15	5.81E-15
Ce-141	4.38E-15	3.95E-15	3.63E-15	3.48E-15	3.11E-15	3.06E-15
Ce-143	1.63E-14	1.48E-14	1.37E-14	1.31E-14	1.19E-14	1.17E-14
Ce-144	1.05E-15	9.34E-16	8.54E-16	8.14E-16	7.22E-16	7.09E-16
Ce-145	4.88E-14	4.48E-14	4.17E-14	4.01E-14	3.67E-14	3.62E-14
Praseodymium						
Pr-134	1.92E-13	1.77E-13	1.65E-13	1.59E-13	1.45E-13	1.43E-13
Pr-134m	1.42E-13	1.32E-13	1.23E-13	1.19E-13	1.10E-13	1.08E-13
Pr-135	5.22E-14	4.81E-14	4.45E-14	4.29E-14	3.91E-14	3.86E-14
Pr-136	1.31E-13	1.22E-13	1.13E-13	1.09E-13	1.01E-13	9.93E-14
Pr-137	2.17E-14	2.00E-14	1.85E-14	1.78E-14	1.63E-14	1.61E-14
Pr-138	4.99E-14	4.62E-14	4.27E-14	4.12E-14	3.76E-14	3.72E-14
Pr-138m	1.50E-13	1.38E-13	1.29E-13	1.25E-13	1.14E-13	1.13E-13
Pr-139	7.03E-15	6.36E-15	5.85E-15	5.61E-15	5.08E-15	5.01E-15
Pr-140	3.28E-14	3.03E-14	2.80E-14	2.70E-14	2.46E-14	2.43E-14
Pr-142	4.33E-15	4.09E-15	3.88E-15	3.76E-15	3.54E-15	3.50E-15
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	2.04E-16	2.00E-16	1.98E-16	1.97E-16	1.94E-16	1.94E-16
Pr-144	3.01E-15	2.86E-15	2.73E-15	2.66E-15	2.52E-15	2.50E-15
Pr-144m	4.43E-16	3.42E-16	2.96E-16	2.70E-16	2.25E-16	2.19E-16
Pr-145	1.68E-15	1.58E-15	1.51E-15	1.46E-15	1.38E-15	1.36E-15
Pr-146	6.36E-14	5.94E-14	5.57E-14	5.37E-14	4.98E-14	4.92E-14
Pr-147	2.92E-14	2.68E-14	2.49E-14	2.39E-14	2.19E-14	2.16E-14
Pr-148	6.28E-14	5.83E-14	5.47E-14	5.27E-14	4.88E-14	4.82E-14
Pr-148m	5.83E-14	5.37E-14	4.99E-14	4.81E-14	4.40E-14	4.34E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Neodymium						
Nd-134	3.17E-14	2.89E-14	2.67E-14	2.57E-14	2.33E-14	2.29E-14
Nd-135	7.58E-14	6.98E-14	6.46E-14	6.22E-14	5.67E-14	5.59E-14
Nd-136	1.54E-14	1.38E-14	1.27E-14	1.22E-14	1.10E-14	1.08E-14
Nd-137	7.07E-14	6.53E-14	6.08E-14	5.86E-14	5.37E-14	5.30E-14
Nd-138	1.75E-15	1.43E-15	1.26E-15	1.18E-15	1.01E-15	9.88E-16
Nd-139	2.62E-14	2.41E-14	2.23E-14	2.15E-14	1.96E-14	1.94E-14
Nd-139m	9.55E-14	8.80E-14	8.23E-14	7.91E-14	7.26E-14	7.17E-14
Nd-140	8.69E-16	6.29E-16	5.27E-16	4.71E-16	3.71E-16	3.59E-16
Nd-141	3.77E-15	3.32E-15	3.03E-15	2.89E-15	2.59E-15	2.55E-15
Nd-141m	4.21E-14	3.88E-14	3.63E-14	3.49E-14	3.20E-14	3.16E-14
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	7.97E-15	7.19E-15	6.60E-15	6.32E-15	5.69E-15	5.61E-15
Nd-149	2.22E-14	2.02E-14	1.87E-14	1.80E-14	1.63E-14	1.61E-14
Nd-151	5.21E-14	4.80E-14	4.49E-14	4.32E-14	3.96E-14	3.91E-14
Nd-152	9.95E-15	9.02E-15	8.36E-15	8.02E-15	7.27E-15	7.17E-15
Promethium						
Pm-136	1.67E-13	1.54E-13	1.43E-13	1.38E-13	1.26E-13	1.24E-13
Pm-137m	1.08E-13	9.90E-14	9.19E-14	8.85E-14	8.07E-14	7.96E-14
Pm-139	5.72E-14	5.30E-14	4.91E-14	4.74E-14	4.33E-14	4.27E-14
Pm-140	6.57E-14	6.09E-14	5.64E-14	5.44E-14	4.98E-14	4.92E-14
Pm-140m	1.85E-13	1.71E-13	1.59E-13	1.53E-13	1.40E-13	1.39E-13
Pm-141	4.45E-14	4.12E-14	3.83E-14	3.69E-14	3.38E-14	3.34E-14
Pm-142	5.27E-14	4.88E-14	4.52E-14	4.36E-14	3.99E-14	3.94E-14
Pm-143	1.83E-14	1.67E-14	1.55E-14	1.49E-14	1.36E-14	1.34E-14
Pm-144	9.33E-14	8.61E-14	7.98E-14	7.69E-14	7.02E-14	6.93E-14
Pm-145	1.03E-15	7.65E-16	6.48E-16	5.83E-16	4.66E-16	4.52E-16
Pm-146	4.48E-14	4.12E-14	3.82E-14	3.68E-14	3.36E-14	3.31E-14
Pm-147	9.05E-18	8.87E-18	8.78E-18	8.73E-18	8.63E-18	8.61E-18
Pm-148	3.59E-14	3.34E-14	3.14E-14	3.02E-14	2.80E-14	2.76E-14
Pm-148m	1.20E-13	1.11E-13	1.03E-13	9.93E-14	9.08E-14	8.96E-14
Pm-149	9.62E-16	8.92E-16	8.43E-16	8.17E-16	7.60E-16	7.52E-16
Pm-150	9.10E-14	8.44E-14	7.92E-14	7.63E-14	7.05E-14	6.96E-14
Pm-151	1.96E-14	1.78E-14	1.65E-14	1.59E-14	1.44E-14	1.42E-14
Pm-152	1.88E-14	1.75E-14	1.64E-14	1.58E-14	1.46E-14	1.44E-14
Pm-152m	9.33E-14	8.60E-14	8.07E-14	7.76E-14	7.14E-14	7.04E-14
Pm-153	4.69E-15	4.21E-15	3.89E-15	3.72E-15	3.36E-15	3.30E-15
Pm-154	1.12E-13	1.05E-13	9.85E-14	9.49E-14	8.85E-14	8.73E-14
Pm-154m	1.11E-13	1.03E-13	9.66E-14	9.30E-14	8.60E-14	8.49E-14
Samarium						
Sm-139	8.86E-14	8.18E-14	7.60E-14	7.32E-14	6.70E-14	6.61E-14
Sm-140	3.38E-14	3.11E-14	2.89E-14	2.78E-14	2.54E-14	2.51E-14
Sm-141	8.57E-14	7.94E-14	7.38E-14	7.12E-14	6.53E-14	6.45E-14
Sm-141m	1.18E-13	1.09E-13	1.02E-13	9.81E-14	9.01E-14	8.89E-14
Sm-142	5.87E-15	5.25E-15	4.80E-15	4.59E-15	4.12E-15	4.06E-15
Sm-143	3.17E-14	2.93E-14	2.71E-14	2.61E-14	2.38E-14	2.35E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-143m	4.15E-14	3.83E-14	3.57E-14	3.44E-14	3.15E-14	3.11E-14
Sm-145	2.25E-15	1.70E-15	1.45E-15	1.31E-15	1.05E-15	1.02E-15
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	8.31E-20	5.49E-20	4.61E-20	4.29E-20	2.74E-20	2.61E-20
Sm-153	3.23E-15	2.75E-15	2.47E-15	2.32E-15	2.02E-15	1.98E-15
Sm-155	6.26E-15	5.58E-15	5.13E-15	4.89E-15	4.38E-15	4.31E-15
Sm-156	6.63E-15	5.92E-15	5.46E-15	5.21E-15	4.67E-15	4.59E-15
Sm-157	2.56E-14	2.34E-14	2.18E-14	2.10E-14	1.91E-14	1.89E-14
Europium						
Eu-142	7.63E-14	7.09E-14	6.59E-14	6.36E-14	5.84E-14	5.76E-14
Eu-142m	2.10E-13	1.94E-13	1.81E-13	1.74E-13	1.60E-13	1.58E-13
Eu-143	6.93E-14	6.44E-14	5.99E-14	5.78E-14	5.31E-14	5.24E-14
Eu-144	6.85E-14	6.36E-14	5.91E-14	5.70E-14	5.23E-14	5.17E-14
Eu-145	7.78E-14	7.22E-14	6.77E-14	6.52E-14	6.02E-14	5.94E-14
Eu-146	1.46E-13	1.35E-13	1.26E-13	1.22E-13	1.12E-13	1.10E-13
Eu-147	2.75E-14	2.51E-14	2.33E-14	2.24E-14	2.04E-14	2.01E-14
Eu-148	1.34E-13	1.24E-13	1.15E-13	1.11E-13	1.02E-13	1.00E-13
Eu-149	3.08E-15	2.62E-15	2.36E-15	2.22E-15	1.95E-15	1.91E-15
Eu-150	9.30E-14	8.55E-14	7.94E-14	7.64E-14	6.97E-14	6.88E-14
Eu-150m	3.10E-15	2.85E-15	2.65E-15	2.55E-15	2.34E-15	2.31E-15
Eu-152	7.12E-14	6.56E-14	6.15E-14	5.91E-14	5.44E-14	5.36E-14
Eu-152m	1.82E-14	1.67E-14	1.57E-14	1.51E-14	1.39E-14	1.37E-14
Eu-152n	3.90E-15	3.37E-15	3.05E-15	2.88E-15	2.52E-15	2.46E-15
Eu-154	7.64E-14	7.05E-14	6.61E-14	6.36E-14	5.85E-14	5.78E-14
Eu-154m	3.29E-15	2.77E-15	2.48E-15	2.32E-15	2.01E-15	1.95E-15
Eu-155	3.23E-15	2.79E-15	2.52E-15	2.38E-15	2.08E-15	2.03E-15
Eu-156	7.65E-14	7.14E-14	6.72E-14	6.48E-14	6.02E-14	5.94E-14
Eu-157	1.69E-14	1.54E-14	1.41E-14	1.36E-14	1.23E-14	1.21E-14
Eu-158	8.03E-14	7.43E-14	6.99E-14	6.73E-14	6.22E-14	6.14E-14
Eu-159	1.79E-14	1.62E-14	1.51E-14	1.44E-14	1.31E-14	1.29E-14
Gadolinium						
Gd-142	6.35E-14	5.87E-14	5.46E-14	5.26E-14	4.83E-14	4.76E-14
Gd-143m	1.29E-13	1.20E-13	1.11E-13	1.07E-13	9.85E-14	9.73E-14
Gd-144	5.56E-14	5.17E-14	4.82E-14	4.65E-14	4.29E-14	4.24E-14
Gd-145	1.50E-13	1.41E-13	1.33E-13	1.28E-13	1.20E-13	1.18E-13
Gd-145m	4.11E-14	3.79E-14	3.53E-14	3.40E-14	3.11E-14	3.07E-14
Gd-146	1.30E-14	1.13E-14	1.02E-14	9.70E-15	8.50E-15	8.34E-15
Gd-147	8.43E-14	7.73E-14	7.21E-14	6.93E-14	6.33E-14	6.25E-14
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	3.07E-14	2.79E-14	2.58E-14	2.47E-14	2.24E-14	2.20E-14
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	3.29E-15	2.79E-15	2.51E-15	2.35E-15	2.05E-15	2.01E-15
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	4.92E-15	4.11E-15	3.66E-15	3.42E-15	2.93E-15	2.86E-15

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-159	3.22E-15	2.91E-15	2.68E-15	2.57E-15	2.32E-15	2.29E-15
Gd-162	2.50E-14	2.31E-14	2.13E-14	2.05E-14	1.87E-14	1.84E-14
Terbium						
Tb-146	2.25E-13	2.10E-13	1.97E-13	1.90E-13	1.77E-13	1.74E-13
Tb-147	1.33E-13	1.24E-13	1.16E-13	1.12E-13	1.03E-13	1.01E-13
Tb-147m	1.18E-13	1.10E-13	1.03E-13	9.95E-14	9.23E-14	9.11E-14
Tb-148	1.45E-13	1.35E-13	1.26E-13	1.22E-13	1.12E-13	1.11E-13
Tb-148m	1.90E-13	1.75E-13	1.63E-13	1.57E-13	1.44E-13	1.42E-13
Tb-149	8.26E-14	7.64E-14	7.15E-14	6.88E-14	6.34E-14	6.26E-14
Tb-149m	8.28E-14	7.63E-14	7.11E-14	6.84E-14	6.26E-14	6.18E-14
Tb-150	1.51E-13	1.41E-13	1.32E-13	1.28E-13	1.19E-13	1.17E-13
Tb-150m	1.51E-13	1.39E-13	1.29E-13	1.24E-13	1.13E-13	1.12E-13
Tb-151	5.88E-14	5.38E-14	4.99E-14	4.79E-14	4.36E-14	4.30E-14
Tb-151m	4.42E-15	3.99E-15	3.68E-15	3.52E-15	3.18E-15	3.13E-15
Tb-152	9.11E-14	8.46E-14	7.91E-14	7.63E-14	7.04E-14	6.95E-14
Tb-152m	4.48E-14	4.08E-14	3.77E-14	3.62E-14	3.28E-14	3.24E-14
Tb-153	1.88E-14	1.69E-14	1.56E-14	1.49E-14	1.34E-14	1.32E-14
Tb-154	1.41E-13	1.32E-13	1.24E-13	1.20E-13	1.12E-13	1.10E-13
Tb-155	9.27E-15	8.06E-15	7.32E-15	6.93E-15	6.10E-15	5.98E-15
Tb-156	1.17E-13	1.08E-13	1.01E-13	9.74E-14	8.96E-14	8.84E-14
Tb-156m	1.57E-15	1.25E-15	1.08E-15	9.85E-16	8.10E-16	7.86E-16
Tb-156n	1.63E-16	1.32E-16	1.16E-16	1.07E-16	9.05E-17	8.80E-17
Tb-157	1.77E-16	1.36E-16	1.16E-16	1.05E-16	8.49E-17	8.23E-17
Tb-158	4.83E-14	4.42E-14	4.14E-14	3.97E-14	3.64E-14	3.59E-14
Tb-160	6.88E-14	6.33E-14	5.95E-14	5.72E-14	5.25E-14	5.19E-14
Tb-161	1.46E-15	1.18E-15	1.04E-15	9.68E-16	8.18E-16	7.95E-16
Tb-162	6.74E-14	6.18E-14	5.78E-14	5.55E-14	5.08E-14	5.01E-14
Tb-163	4.74E-14	4.36E-14	4.02E-14	3.88E-14	3.53E-14	3.48E-14
Tb-164	1.50E-13	1.39E-13	1.30E-13	1.25E-13	1.15E-13	1.14E-13
Tb-165	5.23E-14	4.87E-14	4.58E-14	4.41E-14	4.09E-14	4.04E-14
Dysprosium						
Dy-148	4.24E-14	3.90E-14	3.61E-14	3.48E-14	3.17E-14	3.13E-14
Dy-149	9.85E-14	9.13E-14	8.56E-14	8.24E-14	7.61E-14	7.51E-14
Dy-150	1.61E-14	1.47E-14	1.35E-14	1.30E-14	1.18E-14	1.16E-14
Dy-151	8.30E-14	7.67E-14	7.17E-14	6.90E-14	6.35E-14	6.26E-14
Dy-152	1.65E-14	1.47E-14	1.36E-14	1.29E-14	1.16E-14	1.14E-14
Dy-153	5.15E-14	4.70E-14	4.38E-14	4.20E-14	3.84E-14	3.78E-14
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	3.98E-14	3.63E-14	3.39E-14	3.25E-14	2.97E-14	2.93E-14
Dy-157	2.00E-14	1.80E-14	1.66E-14	1.59E-14	1.43E-14	1.41E-14
Dy-159	1.77E-15	1.38E-15	1.18E-15	1.07E-15	8.72E-16	8.46E-16
Dy-165	1.83E-15	1.67E-15	1.56E-15	1.50E-15	1.37E-15	1.36E-15
Dy-165m	1.00E-15	8.95E-16	8.17E-16	7.80E-16	6.97E-16	6.86E-16
Dy-166	2.02E-15	1.69E-15	1.50E-15	1.40E-15	1.20E-15	1.17E-15
Dy-167	3.23E-14	2.96E-14	2.75E-14	2.64E-14	2.41E-14	2.37E-14
Dy-168	2.35E-14	2.15E-14	1.98E-14	1.91E-14	1.73E-14	1.71E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Holmium						
Ho-150	1.16E-13	1.07E-13	9.99E-14	9.64E-14	8.82E-14	8.70E-14
Ho-153	6.19E-14	5.69E-14	5.28E-14	5.08E-14	4.63E-14	4.57E-14
Ho-153m	6.37E-14	5.85E-14	5.42E-14	5.21E-14	4.75E-14	4.68E-14
Ho-154	1.15E-13	1.06E-13	9.86E-14	9.50E-14	8.70E-14	8.59E-14
Ho-154m	1.47E-13	1.35E-13	1.25E-13	1.21E-13	1.10E-13	1.09E-13
Ho-155	3.64E-14	3.34E-14	3.10E-14	2.98E-14	2.72E-14	2.68E-14
Ho-156	1.29E-13	1.19E-13	1.11E-13	1.07E-13	9.87E-14	9.74E-14
Ho-157	3.37E-14	3.06E-14	2.83E-14	2.71E-14	2.45E-14	2.42E-14
Ho-159	2.15E-14	1.92E-14	1.76E-14	1.68E-14	1.50E-14	1.48E-14
Ho-160	1.02E-13	9.38E-14	8.77E-14	8.43E-14	7.72E-14	7.62E-14
Ho-161	2.25E-15	1.79E-15	1.56E-15	1.44E-15	1.19E-15	1.16E-15
Ho-162	9.04E-15	8.12E-15	7.49E-15	7.15E-15	6.46E-15	6.36E-15
Ho-162m	3.32E-14	3.03E-14	2.84E-14	2.72E-14	2.49E-14	2.46E-14
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	1.31E-15	1.06E-15	9.26E-16	8.55E-16	7.20E-16	7.01E-16
Ho-164m	1.81E-15	1.43E-15	1.23E-15	1.13E-15	9.24E-16	8.96E-16
Ho-166	2.23E-15	2.06E-15	1.94E-15	1.87E-15	1.74E-15	1.71E-15
Ho-166m	9.79E-14	8.99E-14	8.38E-14	8.06E-14	7.35E-14	7.26E-14
Ho-167	2.18E-14	1.99E-14	1.83E-14	1.76E-14	1.59E-14	1.57E-14
Ho-168	5.38E-14	4.96E-14	4.64E-14	4.47E-14	4.10E-14	4.05E-14
Ho-168m	2.57E-16	2.03E-16	1.75E-16	1.60E-16	1.31E-16	1.27E-16
Ho-170	1.04E-13	9.56E-14	8.97E-14	8.62E-14	7.91E-14	7.80E-14
Erbium						
Er-154	3.40E-15	2.90E-15	2.59E-15	2.44E-15	2.12E-15	2.08E-15
Er-156	2.78E-15	2.27E-15	2.00E-15	1.85E-15	1.57E-15	1.53E-15
Er-159	5.79E-14	5.34E-14	4.98E-14	4.79E-14	4.39E-14	4.34E-14
Er-161	5.95E-14	5.47E-14	5.11E-14	4.91E-14	4.50E-14	4.44E-14
Er-163	1.67E-15	1.32E-15	1.14E-15	1.05E-15	8.66E-16	8.40E-16
Er-165	1.54E-15	1.22E-15	1.05E-15	9.60E-16	7.88E-16	7.64E-16
Er-167m	5.65E-15	5.04E-15	4.66E-15	4.44E-15	3.99E-15	3.93E-15
Er-169	3.05E-17	3.01E-17	2.98E-17	2.97E-17	2.94E-17	2.94E-17
Er-171	2.22E-14	2.00E-14	1.85E-14	1.77E-14	1.60E-14	1.58E-14
Er-172	3.04E-14	2.79E-14	2.57E-14	2.47E-14	2.24E-14	2.21E-14
Er-173	5.04E-14	4.59E-14	4.29E-14	4.11E-14	3.75E-14	3.70E-14
Thulium						
Tm-161	7.76E-14	7.17E-14	6.69E-14	6.43E-14	5.93E-14	5.84E-14
Tm-162	1.18E-13	1.10E-13	1.03E-13	9.96E-14	9.24E-14	9.12E-14
Tm-163	7.95E-14	7.34E-14	6.87E-14	6.60E-14	6.08E-14	6.00E-14
Tm-164	4.71E-14	4.37E-14	4.06E-14	3.92E-14	3.60E-14	3.55E-14
Tm-165	3.28E-14	2.97E-14	2.75E-14	2.64E-14	2.39E-14	2.35E-14
Tm-166	1.21E-13	1.12E-13	1.05E-13	1.02E-13	9.41E-14	9.28E-14
Tm-167	7.96E-15	6.94E-15	6.34E-15	6.01E-15	5.32E-15	5.22E-15
Tm-168	7.43E-14	6.80E-14	6.33E-14	6.08E-14	5.55E-14	5.47E-14
Tm-170	4.01E-16	3.66E-16	3.47E-16	3.36E-16	3.14E-16	3.10E-16
Tm-171	2.73E-17	2.21E-17	1.94E-17	1.79E-17	1.50E-17	1.45E-17

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-172	2.95E-14	2.75E-14	2.59E-14	2.49E-14	2.32E-14	2.29E-14
Tm-173	2.33E-14	2.14E-14	1.98E-14	1.90E-14	1.73E-14	1.71E-14
Tm-174	1.08E-13	9.88E-14	9.23E-14	8.86E-14	8.10E-14	7.99E-14
Tm-175	6.60E-14	6.09E-14	5.68E-14	5.47E-14	5.01E-14	4.95E-14
Tm-176	1.22E-13	1.13E-13	1.06E-13	1.02E-13	9.49E-14	9.37E-14
Ytterbium						
Yb-162	1.41E-14	1.27E-14	1.16E-14	1.11E-14	9.92E-15	9.76E-15
Yb-163	4.37E-14	4.03E-14	3.75E-14	3.61E-14	3.31E-14	3.27E-14
Yb-164	2.51E-15	2.09E-15	1.86E-15	1.73E-15	1.48E-15	1.45E-15
Yb-165	1.89E-14	1.70E-14	1.57E-14	1.50E-14	1.36E-14	1.33E-14
Yb-166	3.83E-15	3.11E-15	2.73E-15	2.52E-15	2.11E-15	2.05E-15
Yb-167	1.41E-14	1.23E-14	1.11E-14	1.05E-14	9.22E-15	9.04E-15
Yb-169	1.74E-14	1.51E-14	1.37E-14	1.30E-14	1.14E-14	1.12E-14
Yb-175	2.35E-15	2.15E-15	1.98E-15	1.90E-15	1.73E-15	1.70E-15
Yb-177	1.21E-14	1.11E-14	1.04E-14	1.00E-14	9.18E-15	9.06E-15
Yb-178	2.37E-15	2.17E-15	2.01E-15	1.94E-15	1.77E-15	1.74E-15
Yb-179	5.90E-14	5.45E-14	5.05E-14	4.87E-14	4.44E-14	4.38E-14
Lutetium						
Lu-165	6.67E-14	6.15E-14	5.72E-14	5.51E-14	5.05E-14	4.98E-14
Lu-167	1.03E-13	9.59E-14	9.00E-14	8.66E-14	8.03E-14	7.92E-14
Lu-169	7.98E-14	7.37E-14	6.91E-14	6.64E-14	6.13E-14	6.05E-14
Lu-169m	1.57E-19	1.07E-19	8.87E-20	7.70E-20	2.45E-20	2.29E-20
Lu-170	1.59E-13	1.49E-13	1.40E-13	1.35E-13	1.26E-13	1.25E-13
Lu-171	3.79E-14	3.45E-14	3.21E-14	3.08E-14	2.80E-14	2.76E-14
Lu-171m	1.52E-17	1.26E-17	1.12E-17	1.04E-17	8.81E-18	8.51E-18
Lu-172	1.19E-13	1.09E-13	1.02E-13	9.84E-14	9.05E-14	8.93E-14
Lu-172m	1.10E-19	7.96E-20	6.67E-20	5.93E-20	3.45E-20	3.31E-20
Lu-173	9.51E-15	8.22E-15	7.44E-15	7.03E-15	6.18E-15	6.05E-15
Lu-174	6.24E-15	5.53E-15	5.09E-15	4.84E-15	4.35E-15	4.27E-15
Lu-174m	2.76E-15	2.29E-15	2.04E-15	1.90E-15	1.62E-15	1.58E-15
Lu-176	2.85E-14	2.57E-14	2.38E-14	2.28E-14	2.06E-14	2.02E-14
Lu-176m	1.02E-15	9.11E-16	8.47E-16	8.12E-16	7.40E-16	7.27E-16
Lu-177	2.09E-15	1.87E-15	1.73E-15	1.65E-15	1.48E-15	1.46E-15
Lu-177m	5.86E-14	5.29E-14	4.88E-14	4.67E-14	4.21E-14	4.14E-14
Lu-178	8.28E-15	7.70E-15	7.26E-15	7.00E-15	6.50E-15	6.42E-15
Lu-178m	6.21E-14	5.65E-14	5.21E-14	5.00E-14	4.52E-14	4.45E-14
Lu-179	2.15E-15	1.96E-15	1.84E-15	1.77E-15	1.63E-15	1.61E-15
Lu-180	9.31E-14	8.61E-14	8.09E-14	7.78E-14	7.18E-14	7.08E-14
Lu-181	3.47E-14	3.19E-14	2.96E-14	2.85E-14	2.60E-14	2.56E-14
Hafnium						
Hf-167	3.70E-14	3.39E-14	3.13E-14	3.01E-14	2.73E-14	2.70E-14
Hf-169	3.77E-14	3.46E-14	3.19E-14	3.07E-14	2.79E-14	2.75E-14
Hf-170	2.52E-14	2.29E-14	2.10E-14	2.02E-14	1.82E-14	1.79E-14
Hf-172	4.78E-15	3.99E-15	3.55E-15	3.32E-15	2.84E-15	2.76E-15
Hf-173	2.27E-14	2.03E-14	1.87E-14	1.78E-14	1.60E-14	1.57E-14
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-175	2.03E-14	1.83E-14	1.69E-14	1.61E-14	1.45E-14	1.43E-14
Hf-177m	1.35E-13	1.22E-13	1.13E-13	1.08E-13	9.80E-14	9.66E-14
Hf-178m	1.33E-13	1.22E-13	1.12E-13	1.08E-13	9.80E-14	9.66E-14
Hf-179m	5.39E-14	4.90E-14	4.52E-14	4.33E-14	3.91E-14	3.86E-14
Hf-180m	5.84E-14	5.32E-14	4.91E-14	4.71E-14	4.26E-14	4.20E-14
Hf-181	3.15E-14	2.89E-14	2.66E-14	2.57E-14	2.33E-14	2.29E-14
Hf-182	1.43E-14	1.29E-14	1.19E-14	1.14E-14	1.03E-14	1.02E-14
Hf-182m	5.41E-14	4.94E-14	4.58E-14	4.40E-14	3.99E-14	3.94E-14
Hf-183	4.68E-14	4.30E-14	4.01E-14	3.85E-14	3.52E-14	3.47E-14
Hf-184	1.37E-14	1.23E-14	1.14E-14	1.09E-14	9.80E-15	9.65E-15
Tantalum						
Ta-170	6.53E-14	6.02E-14	5.58E-14	5.38E-14	4.91E-14	4.85E-14
Ta-172	1.03E-13	9.54E-14	8.92E-14	8.58E-14	7.89E-14	7.79E-14
Ta-173	3.43E-14	3.14E-14	2.92E-14	2.80E-14	2.56E-14	2.53E-14
Ta-174	5.91E-14	5.44E-14	5.08E-14	4.89E-14	4.49E-14	4.42E-14
Ta-175	6.70E-14	6.18E-14	5.79E-14	5.56E-14	5.12E-14	5.05E-14
Ta-176	1.37E-13	1.28E-13	1.21E-13	1.16E-13	1.08E-13	1.07E-13
Ta-177	3.28E-15	2.77E-15	2.49E-15	2.33E-15	2.01E-15	1.96E-15
Ta-178	6.58E-15	5.85E-15	5.37E-15	5.11E-15	4.59E-15	4.50E-15
Ta-178m	6.76E-14	6.13E-14	5.65E-14	5.41E-14	4.88E-14	4.81E-14
Ta-179	1.10E-15	8.99E-16	7.92E-16	7.32E-16	6.17E-16	5.96E-16
Ta-180	2.21E-15	1.83E-15	1.62E-15	1.50E-15	1.28E-15	1.24E-15
Ta-182	7.87E-14	7.25E-14	6.82E-14	6.55E-14	6.04E-14	5.95E-14
Ta-182m	1.48E-14	1.32E-14	1.21E-14	1.15E-14	1.03E-14	1.01E-14
Ta-183	1.68E-14	1.49E-14	1.37E-14	1.31E-14	1.17E-14	1.15E-14
Ta-184	9.50E-14	8.71E-14	8.12E-14	7.80E-14	7.12E-14	7.03E-14
Ta-185	9.22E-15	8.28E-15	7.66E-15	7.33E-15	6.60E-15	6.49E-15
Ta-186	8.63E-14	7.93E-14	7.37E-14	7.10E-14	6.47E-14	6.39E-14
Tungsten						
W-177	5.40E-14	4.92E-14	4.57E-14	4.38E-14	3.99E-14	3.93E-14
W-178	6.76E-16	5.54E-16	4.89E-16	4.54E-16	3.84E-16	3.71E-16
W-179	2.29E-15	1.86E-15	1.64E-15	1.52E-15	1.28E-15	1.24E-15
W-179m	2.89E-15	2.49E-15	2.26E-15	2.13E-15	1.88E-15	1.83E-15
W-181	1.80E-15	1.47E-15	1.30E-15	1.21E-15	1.02E-15	9.87E-16
W-185	5.20E-17	5.10E-17	5.04E-17	5.01E-17	4.94E-17	4.93E-17
W-185m	1.33E-15	1.17E-15	1.07E-15	1.02E-15	9.00E-16	8.80E-16
W-187	2.68E-14	2.47E-14	2.29E-14	2.20E-14	2.01E-14	1.98E-14
W-188	1.41E-16	1.30E-16	1.22E-16	1.18E-16	1.09E-16	1.07E-16
W-190	8.18E-15	7.19E-15	6.56E-15	6.23E-15	5.51E-15	5.39E-15
Rhenium						
Re-178	1.05E-13	9.82E-14	9.21E-14	8.89E-14	8.24E-14	8.14E-14
Re-179	6.50E-14	5.99E-14	5.58E-14	5.37E-14	4.92E-14	4.85E-14
Re-180	7.25E-14	6.66E-14	6.23E-14	5.99E-14	5.49E-14	5.41E-14
Re-181	4.75E-14	4.34E-14	4.03E-14	3.87E-14	3.52E-14	3.47E-14
Re-182	1.08E-13	9.88E-14	9.25E-14	8.88E-14	8.13E-14	8.02E-14
Re-182m	7.37E-14	6.79E-14	6.37E-14	6.12E-14	5.63E-14	5.55E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-183	8.05E-15	6.98E-15	6.34E-15	5.99E-15	5.26E-15	5.14E-15
Re-184	5.35E-14	4.90E-14	4.58E-14	4.40E-14	4.02E-14	3.96E-14
Re-184m	2.23E-14	2.02E-14	1.88E-14	1.80E-14	1.63E-14	1.60E-14
Re-186	1.34E-15	1.21E-15	1.12E-15	1.07E-15	9.72E-16	9.56E-16
Re-186m	6.73E-16	5.50E-16	4.86E-16	4.51E-16	3.80E-16	3.68E-16
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	4.28E-15	3.96E-15	3.71E-15	3.58E-15	3.29E-15	3.25E-15
Re-188m	3.38E-15	2.86E-15	2.57E-15	2.41E-15	2.08E-15	2.02E-15
Re-189	3.46E-15	3.13E-15	2.91E-15	2.79E-15	2.54E-15	2.50E-15
Re-190	8.10E-14	7.46E-14	6.93E-14	6.67E-14	6.09E-14	6.01E-14
Re-190m	5.55E-14	5.10E-14	4.73E-14	4.55E-14	4.15E-14	4.09E-14
Osmium						
Os-180	6.59E-15	5.82E-15	5.32E-15	5.06E-15	4.51E-15	4.42E-15
Os-181	8.35E-14	7.69E-14	7.20E-14	6.92E-14	6.36E-14	6.27E-14
Os-182	2.49E-14	2.27E-14	2.09E-14	2.01E-14	1.81E-14	1.78E-14
Os-183	3.64E-14	3.30E-14	3.05E-14	2.92E-14	2.64E-14	2.60E-14
Os-183m	6.11E-14	5.62E-14	5.28E-14	5.08E-14	4.67E-14	4.61E-14
Os-185	4.11E-14	3.77E-14	3.50E-14	3.37E-14	3.07E-14	3.03E-14
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	6.62E-19	4.57E-19	3.79E-19	3.34E-19	1.03E-19	9.57E-20
Os-190m	9.50E-14	8.74E-14	8.08E-14	7.79E-14	7.09E-14	6.99E-14
Os-191	4.27E-15	3.72E-15	3.38E-15	3.20E-15	2.81E-15	2.73E-15
Os-191m	2.75E-16	2.29E-16	2.04E-16	1.90E-16	1.63E-16	1.57E-16
Os-193	4.09E-15	3.73E-15	3.45E-15	3.31E-15	3.01E-15	2.96E-15
Os-194	9.31E-17	7.11E-17	6.06E-17	5.48E-17	4.39E-17	4.26E-17
Os-196	4.93E-15	4.48E-15	4.15E-15	3.99E-15	3.62E-15	3.56E-15
Iridium						
Ir-180	9.70E-14	8.93E-14	8.29E-14	7.99E-14	7.29E-14	7.19E-14
Ir-182	8.58E-14	7.90E-14	7.34E-14	7.07E-14	6.46E-14	6.37E-14
Ir-183	7.18E-14	6.65E-14	6.22E-14	5.98E-14	5.52E-14	5.44E-14
Ir-184	1.19E-13	1.10E-13	1.03E-13	9.89E-14	9.09E-14	8.97E-14
Ir-185	5.15E-14	4.77E-14	4.47E-14	4.30E-14	3.97E-14	3.92E-14
Ir-186	1.01E-13	9.30E-14	8.69E-14	8.36E-14	7.68E-14	7.58E-14
Ir-186m	7.61E-14	7.06E-14	6.61E-14	6.36E-14	5.86E-14	5.79E-14
Ir-187	1.91E-14	1.73E-14	1.61E-14	1.54E-14	1.39E-14	1.37E-14
Ir-188	1.29E-13	1.21E-13	1.14E-13	1.10E-13	1.02E-13	1.01E-13
Ir-189	3.89E-15	3.33E-15	3.01E-15	2.84E-15	2.48E-15	2.41E-15
Ir-190	8.79E-14	8.07E-14	7.47E-14	7.19E-14	6.54E-14	6.45E-14
Ir-190m	7.21E-19	5.01E-19	4.17E-19	3.69E-19	1.15E-19	1.07E-19
Ir-190n	2.72E-15	2.28E-15	2.05E-15	1.92E-15	1.66E-15	1.60E-15
Ir-191m	3.84E-15	3.35E-15	3.04E-15	2.88E-15	2.53E-15	2.46E-15
Ir-192	4.90E-14	4.48E-14	4.14E-14	3.99E-14	3.62E-14	3.57E-14
Ir-192m	5.68E-18	4.56E-18	4.03E-18	3.75E-18	2.62E-18	2.55E-18
Ir-192n	8.05E-17	7.46E-17	7.15E-17	6.98E-17	6.51E-17	6.45E-17
Ir-193m	1.60E-17	1.33E-17	1.19E-17	1.11E-17	9.37E-18	9.04E-18
Ir-194	6.22E-15	5.75E-15	5.38E-15	5.19E-15	4.79E-15	4.73E-15

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-194m	1.40E-13	1.29E-13	1.19E-13	1.15E-13	1.05E-13	1.03E-13
Ir-195	3.13E-15	2.70E-15	2.46E-15	2.33E-15	2.06E-15	2.00E-15
Ir-195m	2.22E-14	2.03E-14	1.87E-14	1.80E-14	1.63E-14	1.61E-14
Ir-196	1.52E-14	1.41E-14	1.32E-14	1.27E-14	1.17E-14	1.15E-14
Ir-196m	1.48E-13	1.36E-13	1.26E-13	1.22E-13	1.11E-13	1.09E-13
Platinum						
Pt-184	4.16E-14	3.76E-14	3.46E-14	3.32E-14	2.99E-14	2.94E-14
Pt-186	4.03E-14	3.69E-14	3.42E-14	3.29E-14	2.99E-14	2.95E-14
Pt-187	3.61E-14	3.28E-14	3.04E-14	2.92E-14	2.65E-14	2.61E-14
Pt-188	1.13E-14	1.00E-14	9.20E-15	8.76E-15	7.82E-15	7.66E-15
Pt-189	2.81E-14	2.55E-14	2.36E-14	2.26E-14	2.05E-14	2.01E-14
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	1.64E-14	1.47E-14	1.35E-14	1.29E-14	1.15E-14	1.13E-14
Pt-193	1.72E-18	1.19E-18	9.95E-19	8.88E-19	2.81E-19	2.62E-19
Pt-193m	5.32E-16	4.51E-16	4.08E-16	3.84E-16	3.34E-16	3.23E-16
Pt-195m	3.60E-15	3.07E-15	2.77E-15	2.60E-15	2.26E-15	2.19E-15
Pt-197	1.38E-15	1.21E-15	1.11E-15	1.06E-15	9.44E-16	9.22E-16
Pt-197m	4.52E-15	4.01E-15	3.69E-15	3.52E-15	3.15E-15	3.08E-15
Pt-199	1.23E-14	1.14E-14	1.05E-14	1.02E-14	9.28E-15	9.16E-15
Pt-200	3.27E-15	2.88E-15	2.64E-15	2.51E-15	2.24E-15	2.19E-15
Pt-202	5.39E-16	5.25E-16	5.16E-16	5.12E-16	5.02E-16	5.00E-16
Gold						
Au-186	9.15E-14	8.44E-14	7.85E-14	7.56E-14	6.92E-14	6.83E-14
Au-187	6.46E-14	6.00E-14	5.62E-14	5.41E-14	5.00E-14	4.93E-14
Au-190	1.47E-13	1.38E-13	1.30E-13	1.25E-13	1.17E-13	1.15E-13
Au-191	3.47E-14	3.16E-14	2.92E-14	2.81E-14	2.54E-14	2.50E-14
Au-192	1.19E-13	1.12E-13	1.05E-13	1.01E-13	9.39E-14	9.26E-14
Au-193	9.05E-15	7.97E-15	7.30E-15	6.94E-15	6.17E-15	6.03E-15
Au-193m	1.16E-14	1.04E-14	9.62E-15	9.20E-15	8.29E-15	8.17E-15
Au-194	6.30E-14	5.83E-14	5.46E-14	5.25E-14	4.85E-14	4.78E-14
Au-195	3.98E-15	3.37E-15	3.03E-15	2.85E-15	2.47E-15	2.39E-15
Au-195m	1.18E-14	1.06E-14	9.78E-15	9.35E-15	8.44E-15	8.31E-15
Au-196	2.77E-14	2.51E-14	2.32E-14	2.22E-14	2.01E-14	1.98E-14
Au-196m	1.36E-14	1.21E-14	1.11E-14	1.06E-14	9.48E-15	9.29E-15
Au-198	2.43E-14	2.24E-14	2.06E-14	1.99E-14	1.81E-14	1.78E-14
Au-198m	3.09E-14	2.76E-14	2.55E-14	2.43E-14	2.18E-14	2.14E-14
Au-199	5.52E-15	4.97E-15	4.58E-15	4.38E-15	3.93E-15	3.85E-15
Au-200	1.74E-14	1.61E-14	1.51E-14	1.46E-14	1.35E-14	1.33E-14
Au-200m	1.19E-13	1.10E-13	1.02E-13	9.78E-14	8.90E-14	8.78E-14
Au-201	2.34E-15	2.17E-15	2.02E-15	1.96E-15	1.80E-15	1.78E-15
Au-202	1.15E-14	1.07E-14	1.01E-14	9.72E-15	8.99E-15	8.89E-15
Mercury						
Hg-190	1.09E-14	9.71E-15	8.88E-15	8.46E-15	7.51E-15	7.34E-15
Hg-191m	8.96E-14	8.24E-14	7.68E-14	7.39E-14	6.77E-14	6.68E-14
Hg-192	1.54E-14	1.37E-14	1.26E-14	1.20E-14	1.08E-14	1.06E-14
Hg-193	5.03E-14	4.63E-14	4.34E-14	4.17E-14	3.83E-14	3.78E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-193m	6.17E-14	5.70E-14	5.32E-14	5.12E-14	4.70E-14	4.64E-14
Hg-194	2.49E-18	1.74E-18	1.46E-18	1.33E-18	4.39E-19	4.08E-19
Hg-195	1.12E-14	1.01E-14	9.37E-15	8.96E-15	8.10E-15	7.95E-15
Hg-195m	1.15E-14	1.04E-14	9.57E-15	9.17E-15	8.27E-15	8.14E-15
Hg-197	3.50E-15	2.96E-15	2.67E-15	2.51E-15	2.18E-15	2.10E-15
Hg-197m	5.27E-15	4.69E-15	4.30E-15	4.10E-15	3.65E-15	3.57E-15
Hg-199m	1.04E-14	9.37E-15	8.62E-15	8.25E-15	7.40E-15	7.26E-15
Hg-203	1.42E-14	1.28E-14	1.19E-14	1.14E-14	1.03E-14	1.02E-14
Hg-205	7.32E-16	6.89E-16	6.63E-16	6.48E-16	6.16E-16	6.11E-16
Hg-206	7.51E-15	6.83E-15	6.34E-15	6.09E-15	5.54E-15	5.46E-15
Hg-207	1.65E-13	1.54E-13	1.45E-13	1.39E-13	1.30E-13	1.28E-13
Thallium						
Tl-190	7.94E-14	7.34E-14	6.80E-14	6.56E-14	5.99E-14	5.91E-14
Tl-190m	1.49E-13	1.37E-13	1.27E-13	1.23E-13	1.12E-13	1.11E-13
Tl-194	5.50E-14	5.07E-14	4.69E-14	4.52E-14	4.12E-14	4.06E-14
Tl-194m	1.51E-13	1.40E-13	1.30E-13	1.25E-13	1.14E-13	1.12E-13
Tl-195	7.46E-14	6.93E-14	6.50E-14	6.26E-14	5.80E-14	5.72E-14
Tl-196	1.14E-13	1.07E-13	9.97E-14	9.61E-14	8.89E-14	8.77E-14
Tl-197	2.70E-14	2.47E-14	2.30E-14	2.20E-14	2.01E-14	1.98E-14
Tl-198	1.23E-13	1.15E-13	1.08E-13	1.04E-13	9.60E-14	9.48E-14
Tl-198m	7.23E-14	6.65E-14	6.15E-14	5.92E-14	5.39E-14	5.31E-14
Tl-199	1.43E-14	1.28E-14	1.18E-14	1.13E-14	1.02E-14	9.98E-15
Tl-200	7.92E-14	7.30E-14	6.82E-14	6.56E-14	6.03E-14	5.94E-14
Tl-201	4.69E-15	4.05E-15	3.67E-15	3.47E-15	3.04E-15	2.95E-15
Tl-202	2.71E-14	2.48E-14	2.28E-14	2.20E-14	1.99E-14	1.96E-14
Tl-204	2.00E-16	1.88E-16	1.82E-16	1.79E-16	1.71E-16	1.70E-16
Tl-206	4.24E-16	4.14E-16	4.07E-16	4.04E-16	3.96E-16	3.95E-16
Tl-206m	1.46E-13	1.34E-13	1.25E-13	1.20E-13	1.10E-13	1.09E-13
Tl-207	5.18E-16	4.98E-16	4.85E-16	4.77E-16	4.62E-16	4.59E-16
Tl-208	2.11E-13	1.99E-13	1.88E-13	1.81E-13	1.70E-13	1.68E-13
Tl-209	1.32E-13	1.23E-13	1.15E-13	1.11E-13	1.03E-13	1.02E-13
Tl-210	1.71E-13	1.59E-13	1.50E-13	1.44E-13	1.34E-13	1.32E-13
Lead						
Pb-194	6.53E-14	6.02E-14	5.63E-14	5.41E-14	4.97E-14	4.90E-14
Pb-195m	9.92E-14	9.12E-14	8.48E-14	8.16E-14	7.45E-14	7.35E-14
Pb-196	2.88E-14	2.61E-14	2.41E-14	2.31E-14	2.09E-14	2.06E-14
Pb-197	9.33E-14	8.65E-14	8.11E-14	7.81E-14	7.21E-14	7.11E-14
Pb-197m	7.01E-14	6.43E-14	5.98E-14	5.75E-14	5.24E-14	5.17E-14
Pb-198	2.55E-14	2.30E-14	2.13E-14	2.04E-14	1.84E-14	1.81E-14
Pb-199	6.30E-14	5.82E-14	5.45E-14	5.24E-14	4.83E-14	4.76E-14
Pb-200	1.14E-14	1.02E-14	9.33E-15	8.89E-15	7.93E-15	7.76E-15
Pb-201	4.50E-14	4.11E-14	3.82E-14	3.67E-14	3.35E-14	3.30E-14
Pb-201m	2.19E-14	2.02E-14	1.87E-14	1.80E-14	1.64E-14	1.62E-14
Pb-202	3.02E-18	2.09E-18	1.73E-18	1.53E-18	4.80E-19	4.47E-19
Pb-202m	1.21E-13	1.11E-13	1.04E-13	1.00E-13	9.16E-14	9.04E-14
Pb-203	1.81E-14	1.62E-14	1.50E-14	1.43E-14	1.29E-14	1.26E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-204m	1.26E-13	1.16E-13	1.08E-13	1.04E-13	9.55E-14	9.43E-14
Pb-205	3.06E-18	2.11E-18	1.76E-18	1.55E-18	4.87E-19	4.53E-19
Pb-209	1.04E-16	1.02E-16	1.02E-16	1.01E-16	1.00E-16	9.99E-17
Pb-210	8.68E-17	6.72E-17	5.75E-17	5.24E-17	4.11E-17	3.98E-17
Pb-211	4.22E-15	3.90E-15	3.65E-15	3.53E-15	3.24E-15	3.20E-15
Pb-212	8.47E-15	7.57E-15	7.00E-15	6.69E-15	6.01E-15	5.91E-15
Pb-214	1.51E-14	1.37E-14	1.27E-14	1.22E-14	1.11E-14	1.09E-14
Bismuth						
Bi-197	1.03E-13	9.56E-14	8.96E-14	8.62E-14	7.93E-14	7.83E-14
Bi-200	1.47E-13	1.35E-13	1.26E-13	1.21E-13	1.11E-13	1.09E-13
Bi-201	1.06E-13	9.81E-14	9.21E-14	8.87E-14	8.20E-14	8.09E-14
Bi-202	1.67E-13	1.54E-13	1.44E-13	1.39E-13	1.27E-13	1.26E-13
Bi-203	1.46E-13	1.36E-13	1.28E-13	1.23E-13	1.14E-13	1.13E-13
Bi-204	1.78E-13	1.64E-13	1.54E-13	1.48E-13	1.36E-13	1.34E-13
Bi-205	1.04E-13	9.64E-14	9.05E-14	8.72E-14	8.08E-14	7.97E-14
Bi-206	1.99E-13	1.84E-13	1.72E-13	1.66E-13	1.53E-13	1.51E-13
Bi-207	9.31E-14	8.59E-14	8.03E-14	7.73E-14	7.10E-14	7.01E-14
Bi-208	1.67E-13	1.58E-13	1.50E-13	1.45E-13	1.37E-13	1.35E-13
Bi-210	2.72E-16	2.67E-16	2.63E-16	2.61E-16	2.58E-16	2.57E-16
Bi-210m	1.56E-14	1.41E-14	1.31E-14	1.25E-14	1.13E-14	1.12E-14
Bi-211	2.81E-15	2.57E-15	2.37E-15	2.28E-15	2.06E-15	2.04E-15
Bi-212	6.71E-15	6.24E-15	5.86E-15	5.65E-15	5.23E-15	5.17E-15
Bi-212n	4.14E-16	4.05E-16	3.99E-16	3.96E-16	3.89E-16	3.88E-16
Bi-213	7.93E-15	7.32E-15	6.78E-15	6.54E-15	5.97E-15	5.89E-15
Bi-214	9.18E-14	8.57E-14	8.06E-14	7.77E-14	7.21E-14	7.12E-14
Bi-215	1.57E-14	1.44E-14	1.35E-14	1.29E-14	1.18E-14	1.17E-14
Bi-216	4.56E-14	4.22E-14	3.90E-14	3.77E-14	3.44E-14	3.39E-14
Polonium						
Po-203	9.95E-14	9.18E-14	8.61E-14	8.28E-14	7.62E-14	7.52E-14
Po-204	6.92E-14	6.33E-14	5.90E-14	5.67E-14	5.17E-14	5.10E-14
Po-205	9.63E-14	8.89E-14	8.34E-14	8.02E-14	7.38E-14	7.28E-14
Po-206	7.14E-14	6.55E-14	6.11E-14	5.87E-14	5.37E-14	5.29E-14
Po-207	7.78E-14	7.16E-14	6.70E-14	6.44E-14	5.91E-14	5.84E-14
Po-208	1.26E-18	1.16E-18	1.07E-18	1.03E-18	9.39E-19	9.26E-19
Po-209	3.71E-16	3.39E-16	3.16E-16	3.03E-16	2.77E-16	2.73E-16
Po-210	5.92E-19	5.45E-19	5.10E-19	4.91E-19	4.50E-19	4.44E-19
Po-211	4.96E-16	4.58E-16	4.27E-16	4.11E-16	3.77E-16	3.72E-16
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	4.98E-15	4.71E-15	4.45E-15	4.30E-15	4.05E-15	4.00E-15
Po-213	2.28E-18	2.10E-18	1.96E-18	1.89E-18	1.73E-18	1.71E-18
Po-214	5.05E-18	4.65E-18	4.35E-18	4.19E-18	3.84E-18	3.79E-18
Po-215	1.05E-17	9.71E-18	8.96E-18	8.64E-18	7.85E-18	7.75E-18
Po-216	9.32E-19	8.58E-19	8.03E-19	7.73E-19	7.09E-19	7.00E-19
Po-218	2.71E-21	2.66E-21	2.64E-21	2.63E-21	2.61E-21	2.60E-21
Astatine						
At-204	1.40E-13	1.29E-13	1.19E-13	1.15E-13	1.05E-13	1.04E-13

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
At-205	6.91E-14	6.38E-14	5.95E-14	5.73E-14	5.26E-14	5.19E-14
At-206	1.50E-13	1.38E-13	1.29E-13	1.24E-13	1.13E-13	1.12E-13
At-207	1.23E-13	1.14E-13	1.06E-13	1.02E-13	9.44E-14	9.31E-14
At-208	1.85E-13	1.71E-13	1.60E-13	1.54E-13	1.41E-13	1.39E-13
At-209	1.38E-13	1.27E-13	1.18E-13	1.14E-13	1.04E-13	1.03E-13
At-210	1.82E-13	1.69E-13	1.59E-13	1.53E-13	1.41E-13	1.40E-13
At-211	1.84E-15	1.59E-15	1.45E-15	1.37E-15	1.20E-15	1.16E-15
At-215	1.02E-17	9.38E-18	8.65E-18	8.33E-18	7.56E-18	7.45E-18
At-216	1.35E-16	1.19E-16	1.09E-16	1.03E-16	9.15E-17	8.94E-17
At-217	1.45E-17	1.31E-17	1.21E-17	1.16E-17	1.05E-17	1.03E-17
At-218	1.08E-18	1.04E-18	1.02E-18	1.01E-18	9.78E-19	9.75E-19
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	2.82E-14	2.57E-14	2.39E-14	2.29E-14	2.09E-14	2.06E-14
Radon						
Rn-207	5.92E-14	5.44E-14	5.06E-14	4.87E-14	4.44E-14	4.38E-14
Rn-209	7.23E-14	6.68E-14	6.23E-14	6.00E-14	5.51E-14	5.44E-14
Rn-210	3.64E-15	3.34E-15	3.10E-15	2.98E-15	2.72E-15	2.68E-15
Rn-211	1.14E-13	1.05E-13	9.85E-14	9.48E-14	8.72E-14	8.60E-14
Rn-212	2.04E-17	1.89E-17	1.76E-17	1.69E-17	1.55E-17	1.53E-17
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	4.55E-17	4.21E-17	3.90E-17	3.76E-17	3.44E-17	3.39E-17
Rn-219	3.50E-15	3.19E-15	2.95E-15	2.83E-15	2.56E-15	2.53E-15
Rn-220	3.76E-17	3.49E-17	3.22E-17	3.11E-17	2.83E-17	2.80E-17
Rn-222	2.33E-17	2.15E-17	1.99E-17	1.92E-17	1.75E-17	1.72E-17
Rn-223	2.08E-14	1.92E-14	1.78E-14	1.72E-14	1.57E-14	1.55E-14
Francium						
Fr-212	6.94E-14	6.40E-14	6.00E-14	5.77E-14	5.31E-14	5.24E-14
Fr-219	2.13E-16	1.95E-16	1.80E-16	1.73E-16	1.57E-16	1.55E-16
Fr-220	5.06E-16	4.44E-16	4.05E-16	3.85E-16	3.39E-16	3.31E-16
Fr-221	1.74E-15	1.56E-15	1.45E-15	1.38E-15	1.24E-15	1.22E-15
Fr-222	1.11E-14	1.01E-14	9.37E-15	8.99E-15	8.17E-15	8.05E-15
Fr-223	3.06E-15	2.68E-15	2.45E-15	2.33E-15	2.07E-15	2.03E-15
Fr-224	3.44E-14	3.18E-14	2.98E-14	2.87E-14	2.65E-14	2.61E-14
Fr-227	2.70E-14	2.48E-14	2.29E-14	2.20E-14	2.00E-14	1.98E-14
Radium						
Ra-219	1.01E-14	9.15E-15	8.46E-15	8.12E-15	7.34E-15	7.24E-15
Ra-220	2.79E-16	2.58E-16	2.38E-16	2.29E-16	2.09E-16	2.06E-16
Ra-221	2.06E-15	1.85E-15	1.70E-15	1.62E-15	1.45E-15	1.42E-15
Ra-222	5.51E-16	5.01E-16	4.64E-16	4.45E-16	4.04E-16	3.98E-16
Ra-223	8.01E-15	7.18E-15	6.61E-15	6.31E-15	5.66E-15	5.56E-15
Ra-224	6.22E-16	5.59E-16	5.19E-16	4.96E-16	4.48E-16	4.42E-16
Ra-225	4.48E-16	3.39E-16	2.90E-16	2.63E-16	2.13E-16	2.07E-16
Ra-226	4.33E-16	3.89E-16	3.61E-16	3.45E-16	3.10E-16	3.05E-16
Ra-227	8.65E-15	7.88E-15	7.30E-15	7.02E-15	6.37E-15	6.28E-15

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-228	9.94E-18	6.82E-18	5.86E-18	5.58E-18	2.47E-18	2.30E-18
Ra-230	4.59E-15	4.15E-15	3.83E-15	3.67E-15	3.30E-15	3.25E-15
Actinium						
Ac-223	1.01E-15	9.12E-16	8.40E-16	8.05E-16	7.23E-16	7.11E-16
Ac-224	1.31E-14	1.17E-14	1.08E-14	1.03E-14	9.21E-15	9.05E-15
Ac-225	8.05E-16	7.17E-16	6.58E-16	6.27E-16	5.57E-16	5.46E-16
Ac-226	7.84E-15	7.06E-15	6.55E-15	6.27E-15	5.65E-15	5.56E-15
Ac-227	6.66E-18	5.33E-18	4.75E-18	4.48E-18	3.43E-18	3.33E-18
Ac-228	5.29E-14	4.89E-14	4.58E-14	4.41E-14	4.06E-14	4.01E-14
Ac-230	3.42E-14	3.20E-14	3.01E-14	2.90E-14	2.70E-14	2.66E-14
Ac-231	2.52E-14	2.28E-14	2.11E-14	2.03E-14	1.83E-14	1.81E-14
Ac-232	7.21E-14	6.76E-14	6.37E-14	6.14E-14	5.73E-14	5.65E-14
Ac-233	3.06E-14	2.83E-14	2.62E-14	2.53E-14	2.31E-14	2.28E-14
Thorium						
Th-223	3.98E-15	3.52E-15	3.22E-15	3.06E-15	2.71E-15	2.65E-15
Th-224	1.35E-15	1.22E-15	1.13E-15	1.08E-15	9.74E-16	9.58E-16
Th-226	4.56E-16	4.07E-16	3.75E-16	3.57E-16	3.18E-16	3.13E-16
Th-227	7.26E-15	6.52E-15	6.02E-15	5.76E-15	5.18E-15	5.10E-15
Th-228	1.20E-16	1.05E-16	9.62E-17	9.15E-17	8.01E-17	7.83E-17
Th-229	4.77E-15	4.21E-15	3.86E-15	3.67E-15	3.24E-15	3.18E-15
Th-230	2.44E-17	2.03E-17	1.83E-17	1.73E-17	1.41E-17	1.37E-17
Th-231	7.07E-16	5.98E-16	5.41E-16	5.12E-16	4.38E-16	4.26E-16
Th-232	1.40E-17	1.12E-17	9.96E-18	9.35E-18	7.16E-18	6.89E-18
Th-233	2.36E-15	2.17E-15	2.02E-15	1.95E-15	1.79E-15	1.77E-15
Th-234	4.77E-16	4.11E-16	3.72E-16	3.51E-16	3.05E-16	2.97E-16
Th-235	3.79E-15	3.52E-15	3.30E-15	3.19E-15	2.95E-15	2.92E-15
Th-236	2.23E-15	2.05E-15	1.91E-15	1.84E-15	1.68E-15	1.66E-15
Protactinium						
Pa-227	1.06E-15	9.19E-16	8.34E-16	7.88E-16	6.88E-16	6.71E-16
Pa-228	8.24E-14	7.60E-14	7.11E-14	6.83E-14	6.27E-14	6.19E-14
Pa-229	3.40E-15	3.00E-15	2.73E-15	2.59E-15	2.28E-15	2.23E-15
Pa-230	4.01E-14	3.68E-14	3.44E-14	3.30E-14	3.02E-14	2.98E-14
Pa-231	2.03E-15	1.82E-15	1.68E-15	1.61E-15	1.44E-15	1.42E-15
Pa-232	5.67E-14	5.22E-14	4.89E-14	4.70E-14	4.31E-14	4.26E-14
Pa-233	1.28E-14	1.16E-14	1.07E-14	1.02E-14	9.24E-15	9.11E-15
Pa-234	8.87E-14	8.17E-14	7.64E-14	7.35E-14	6.74E-14	6.65E-14
Pa-234m	1.71E-15	1.61E-15	1.55E-15	1.51E-15	1.42E-15	1.41E-15
Pa-235	3.56E-16	3.48E-16	3.43E-16	3.40E-16	3.35E-16	3.34E-16
Pa-236	5.65E-14	5.27E-14	4.94E-14	4.76E-14	4.41E-14	4.36E-14
Pa-237	3.74E-14	3.45E-14	3.23E-14	3.11E-14	2.85E-14	2.81E-14
Uranium						
U-227	6.78E-15	6.07E-15	5.61E-15	5.35E-15	4.80E-15	4.73E-15
U-228	2.29E-16	2.03E-16	1.86E-16	1.77E-16	1.57E-16	1.54E-16
U-230	6.86E-17	5.90E-17	5.39E-17	5.12E-17	4.37E-17	4.27E-17
U-231	3.92E-15	3.43E-15	3.13E-15	2.96E-15	2.60E-15	2.54E-15
U-232	1.98E-17	1.58E-17	1.41E-17	1.33E-17	1.00E-17	9.69E-18

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-233	1.72E-17	1.44E-17	1.30E-17	1.24E-17	1.02E-17	9.95E-18
U-234	1.28E-17	9.83E-18	8.64E-18	8.16E-18	5.60E-18	5.40E-18
U-235	9.58E-15	8.63E-15	7.98E-15	7.63E-15	6.85E-15	6.74E-15
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	9.02E-18	6.64E-18	5.78E-18	5.45E-18	3.37E-18	3.23E-18
U-237	7.57E-15	6.69E-15	6.13E-15	5.83E-15	5.17E-15	5.07E-15
U-238	7.42E-18	5.51E-18	4.81E-18	4.54E-18	2.87E-18	2.76E-18
U-239	2.90E-15	2.54E-15	2.33E-15	2.22E-15	1.98E-15	1.93E-15
U-240	3.00E-16	2.63E-16	2.42E-16	2.31E-16	2.03E-16	1.99E-16
U-242	2.61E-15	2.38E-15	2.21E-15	2.13E-15	1.94E-15	1.91E-15
Neptunium						
Np-232	7.18E-14	6.58E-14	6.14E-14	5.90E-14	5.39E-14	5.32E-14
Np-233	4.87E-15	4.33E-15	3.96E-15	3.77E-15	3.34E-15	3.27E-15
Np-234	6.77E-14	6.31E-14	5.93E-14	5.71E-14	5.30E-14	5.23E-14
Np-235	5.40E-17	4.28E-17	3.81E-17	3.62E-17	2.67E-17	2.59E-17
Np-236	7.96E-15	7.12E-15	6.53E-15	6.23E-15	5.53E-15	5.43E-15
Np-236m	2.71E-15	2.42E-15	2.22E-15	2.11E-15	1.88E-15	1.85E-15
Np-237	1.29E-15	1.11E-15	1.01E-15	9.51E-16	8.25E-16	8.06E-16
Np-238	3.59E-14	3.30E-14	3.11E-14	2.99E-14	2.75E-14	2.72E-14
Np-239	1.03E-14	9.27E-15	8.55E-15	8.16E-15	7.31E-15	7.19E-15
Np-240	6.32E-14	5.81E-14	5.43E-14	5.22E-14	4.78E-14	4.72E-14
Np-240m	1.97E-14	1.83E-14	1.71E-14	1.65E-14	1.51E-14	1.49E-14
Np-241	2.44E-15	2.21E-15	2.05E-15	1.97E-15	1.78E-15	1.75E-15
Np-242	1.71E-14	1.60E-14	1.51E-14	1.45E-14	1.35E-14	1.34E-14
Np-242m	5.54E-14	5.10E-14	4.77E-14	4.59E-14	4.21E-14	4.15E-14
Plutonium						
Pu-232	3.36E-15	2.98E-15	2.72E-15	2.59E-15	2.28E-15	2.24E-15
Pu-234	3.63E-15	3.22E-15	2.94E-15	2.80E-15	2.47E-15	2.42E-15
Pu-235	4.99E-15	4.44E-15	4.06E-15	3.87E-15	3.43E-15	3.36E-15
Pu-236	1.11E-17	7.85E-18	6.78E-18	6.42E-18	3.72E-18	3.55E-18
Pu-237	2.61E-15	2.31E-15	2.11E-15	2.00E-15	1.76E-15	1.73E-15
Pu-238	9.24E-18	6.41E-18	5.51E-18	5.22E-18	2.83E-18	2.68E-18
Pu-239	7.24E-18	5.69E-18	5.05E-18	4.80E-18	3.51E-18	3.41E-18
Pu-240	8.91E-18	6.21E-18	5.34E-18	5.06E-18	2.78E-18	2.64E-18
Pu-241	8.89E-20	7.89E-20	7.22E-20	6.87E-20	6.07E-20	5.96E-20
Pu-242	1.22E-17	9.63E-18	8.63E-18	8.25E-18	6.04E-18	5.88E-18
Pu-243	1.37E-15	1.20E-15	1.10E-15	1.04E-15	9.23E-16	9.01E-16
Pu-244	1.24E-15	1.16E-15	1.09E-15	1.06E-15	9.81E-16	9.69E-16
Pu-245	2.43E-14	2.23E-14	2.07E-14	1.99E-14	1.82E-14	1.80E-14
Pu-246	7.74E-15	6.88E-15	6.32E-15	6.02E-15	5.36E-15	5.28E-15
Americium						
Am-237	2.14E-14	1.94E-14	1.80E-14	1.72E-14	1.55E-14	1.53E-14
Am-238	5.43E-14	5.01E-14	4.69E-14	4.51E-14	4.14E-14	4.08E-14
Am-239	1.33E-14	1.19E-14	1.09E-14	1.04E-14	9.30E-15	9.15E-15
Am-240	6.24E-14	5.73E-14	5.38E-14	5.17E-14	4.74E-14	4.68E-14
Am-241	1.06E-15	8.64E-16	7.64E-16	7.09E-16	5.94E-16	5.73E-16

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-242	8.64E-16	7.70E-16	7.10E-16	6.78E-16	6.04E-16	5.94E-16
Am-242m	4.15E-17	3.06E-17	2.67E-17	2.53E-17	1.74E-17	1.68E-17
Am-243	2.81E-15	2.38E-15	2.15E-15	2.02E-15	1.75E-15	1.69E-15
Am-244	4.78E-14	4.40E-14	4.11E-14	3.96E-14	3.62E-14	3.58E-14
Am-244m	1.29E-15	1.20E-15	1.14E-15	1.11E-15	1.04E-15	1.03E-15
Am-245	1.98E-15	1.79E-15	1.66E-15	1.60E-15	1.44E-15	1.42E-15
Am-246	4.40E-14	4.04E-14	3.76E-14	3.62E-14	3.30E-14	3.26E-14
Am-246m	6.01E-14	5.55E-14	5.22E-14	5.02E-14	4.63E-14	4.57E-14
Am-247	8.06E-15	7.28E-15	6.75E-15	6.46E-15	5.83E-15	5.75E-15
Curium						
Cm-238	4.41E-15	3.92E-15	3.59E-15	3.42E-15	3.03E-15	2.97E-15
Cm-239	1.47E-14	1.32E-14	1.22E-14	1.17E-14	1.04E-14	1.03E-14
Cm-240	1.18E-17	8.10E-18	6.94E-18	6.59E-18	3.76E-18	3.58E-18
Cm-241	2.90E-14	2.66E-14	2.45E-14	2.36E-14	2.13E-14	2.10E-14
Cm-242	1.03E-17	7.03E-18	6.02E-18	5.71E-18	3.20E-18	3.04E-18
Cm-243	7.49E-15	6.71E-15	6.19E-15	5.91E-15	5.30E-15	5.21E-15
Cm-244	9.65E-18	6.81E-18	5.90E-18	5.62E-18	3.42E-18	3.27E-18
Cm-245	5.75E-15	5.13E-15	4.70E-15	4.48E-15	3.97E-15	3.90E-15
Cm-246	2.33E-16	2.16E-16	2.03E-16	1.96E-16	1.80E-16	1.78E-16
Cm-247	1.87E-14	1.72E-14	1.59E-14	1.53E-14	1.39E-14	1.37E-14
Cm-248	8.21E-14	7.68E-14	7.22E-14	6.97E-14	6.49E-14	6.41E-14
Cm-249	1.32E-15	1.23E-15	1.15E-15	1.11E-15	1.02E-15	1.01E-15
Cm-250	8.35E-13	7.80E-13	7.35E-13	7.09E-13	6.60E-13	6.52E-13
Cm-251	6.92E-15	6.40E-15	5.94E-15	5.73E-15	5.24E-15	5.17E-15
Berkelium						
Bk-245	1.31E-14	1.18E-14	1.08E-14	1.04E-14	9.25E-15	9.10E-15
Bk-246	5.10E-14	4.69E-14	4.39E-14	4.22E-14	3.86E-14	3.81E-14
Bk-247	8.41E-15	7.50E-15	6.91E-15	6.59E-15	5.90E-15	5.80E-15
Bk-248m	3.13E-15	2.86E-15	2.64E-15	2.53E-15	2.29E-15	2.25E-15
Bk-249	5.04E-19	4.70E-19	4.55E-19	4.48E-19	4.29E-19	4.27E-19
Bk-250	5.51E-14	5.08E-14	4.78E-14	4.59E-14	4.23E-14	4.18E-14
Bk-251	5.00E-15	4.50E-15	4.15E-15	3.97E-15	3.54E-15	3.49E-15
Californium						
Cf-244	1.15E-17	7.62E-18	6.46E-18	6.11E-18	3.40E-18	3.22E-18
Cf-246	1.05E-17	7.62E-18	6.65E-18	6.32E-18	4.27E-18	4.11E-18
Cf-247	5.14E-15	4.59E-15	4.21E-15	4.01E-15	3.56E-15	3.50E-15
Cf-248	3.08E-17	2.61E-17	2.39E-17	2.30E-17	1.94E-17	1.91E-17
Cf-249	1.94E-14	1.78E-14	1.64E-14	1.58E-14	1.43E-14	1.41E-14
Cf-250	6.22E-16	5.79E-16	5.44E-16	5.25E-16	4.87E-16	4.81E-16
Cf-251	6.83E-15	6.13E-15	5.65E-15	5.39E-15	4.82E-15	4.74E-15
Cf-252	2.85E-14	2.67E-14	2.51E-14	2.42E-14	2.25E-14	2.23E-14
Cf-253	5.46E-17	4.18E-17	3.74E-17	3.56E-17	2.80E-17	2.74E-17
Cf-254	1.06E-12	9.86E-13	9.28E-13	8.96E-13	8.34E-13	8.23E-13
Cf-255	1.21E-16	1.19E-16	1.18E-16	1.17E-16	1.16E-16	1.16E-16
Einsteinium						
Es-249	2.41E-14	2.20E-14	2.04E-14	1.96E-14	1.78E-14	1.75E-14

Table 4-6. Reference person effective dose rate coefficients for air submersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Es-250	7.10E-14	6.49E-14	6.04E-14	5.81E-14	5.29E-14	5.21E-14
Es-250m	3.32E-14	3.05E-14	2.86E-14	2.75E-14	2.52E-14	2.49E-14
Es-251	5.13E-15	4.59E-15	4.21E-15	4.02E-15	3.56E-15	3.50E-15
Es-253	2.21E-17	1.93E-17	1.77E-17	1.69E-17	1.47E-17	1.45E-17
Es-254	2.57E-16	2.03E-16	1.80E-16	1.70E-16	1.34E-16	1.30E-16
Es-254m	2.84E-14	2.63E-14	2.44E-14	2.35E-14	2.15E-14	2.12E-14
Es-255	5.94E-17	5.63E-17	5.39E-17	5.25E-17	4.98E-17	4.94E-17
Es-256	4.77E-16	4.57E-16	4.48E-16	4.43E-16	4.30E-16	4.29E-16
Fermium						
Fm-251	8.81E-15	8.00E-15	7.39E-15	7.08E-15	6.37E-15	6.27E-15
Fm-252	2.73E-17	2.25E-17	2.05E-17	1.96E-17	1.63E-17	1.60E-17
Fm-253	3.33E-15	2.97E-15	2.73E-15	2.60E-15	2.31E-15	2.27E-15
Fm-254	4.50E-16	4.17E-16	3.92E-16	3.78E-16	3.50E-16	3.45E-16
Fm-255	1.78E-16	1.35E-16	1.19E-16	1.12E-16	8.36E-17	8.07E-17
Fm-256	7.78E-13	7.26E-13	6.84E-13	6.60E-13	6.14E-13	6.06E-13
Fm-257	8.32E-15	7.52E-15	6.97E-15	6.67E-15	6.01E-15	5.92E-15

Table 4-7. Reference person effective dose rate coefficients for water immersion.

Explanation of entries

For each radionuclide, values for the reference person effective dose rate coefficients *e*, based on the weighting factors of Table 3-1, are given in SI units. The coefficients are for water at a density of 1×10^3 kg m^{-3}. Reference person organ equivalent dose coefficients h_T are provided electronically.[17]

e: The effective dose rate coefficient (Sv Bq^{-1} s^{-1} m^3), that is, the effective dose per unit time-integrated exposure to a radionuclide

w_T: The tissue weighting factor

$$e = \sum_T w_T \, h_T$$

where h_T is the equivalent dose rate coefficient (Sv Bq^{-1} s^{-1} m^3) for tissue *T*.

The dose rate coefficients provided in Table 4-7 are based on the radiations emitted by the indicated radionuclide and do not include the radiations emitted by radioactive decay products. Radioactive decay products for each radionuclide are identified in Appendix A.

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

To convert from SI units (Sv Bq^{-1} s^{-1} m^3) to conventional units (mrem μCi^{-1} y^{-1} cm^3 or mrem μCi^{-1} y^{-1} g), 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}.

[17] https://www.epa.gov/radiation/federal-guidance-report-no-15-external-exposure-radionuclides-air-water-and-soil

Table 4-7. Reference person effective dose rate coefficients for water immersion.

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hydrogen						
H-3	4.09E-26	2.91E-26	2.43E-26	2.33E-26	7.07E-27	6.53E-27
Beryllium						
Be-7	6.24E-18	5.71E-18	5.26E-18	5.07E-18	4.54E-18	4.47E-18
Be-10	1.64E-19	1.59E-19	1.57E-19	1.56E-19	1.53E-19	1.52E-19
Carbon						
C-10	2.22E-16	2.04E-16	1.88E-16	1.82E-16	1.64E-16	1.61E-16
C-11	1.28E-16	1.18E-16	1.08E-16	1.05E-16	9.38E-17	9.24E-17
C-14	3.17E-21	3.01E-21	2.94E-21	2.91E-21	2.83E-21	2.82E-21
Nitrogen						
N-13	1.28E-16	1.18E-16	1.08E-16	1.05E-16	9.39E-17	9.25E-17
N-16	6.46E-16	6.28E-16	5.89E-16	5.92E-16	5.55E-16	5.53E-16
Oxygen						
O-14	4.50E-16	4.14E-16	3.85E-16	3.77E-16	3.47E-16	3.43E-16
O-15	1.29E-16	1.18E-16	1.09E-16	1.05E-16	9.43E-17	9.29E-17
O-19	1.28E-16	1.17E-16	1.08E-16	1.05E-16	9.58E-17	9.45E-17
Fluorine						
F-17	1.29E-16	1.18E-16	1.09E-16	1.05E-16	9.43E-17	9.29E-17
F-18	1.24E-16	1.14E-16	1.05E-16	1.01E-16	9.08E-17	8.94E-17
Neon						
Ne-19	1.29E-16	1.18E-16	1.09E-16	1.05E-16	9.46E-17	9.32E-17
Ne-24	6.91E-17	6.33E-17	5.83E-17	5.63E-17	5.05E-17	4.98E-17
Sodium						
Na-22	2.86E-16	2.63E-16	2.44E-16	2.38E-16	2.15E-16	2.12E-16
Na-24	5.72E-16	5.29E-16	4.94E-16	4.87E-16	4.50E-16	4.46E-16
Magnesium						
Mg-27	1.17E-16	1.08E-16	1.00E-16	9.79E-17	8.82E-17	8.70E-17
Mg-28	1.80E-16	1.66E-16	1.54E-16	1.50E-16	1.36E-16	1.35E-16
Aluminum						
Al-26	3.59E-16	3.29E-16	3.06E-16	2.99E-16	2.73E-16	2.70E-16
Al-28	2.47E-16	2.27E-16	2.11E-16	2.07E-16	1.91E-16	1.89E-16
Al-29	1.87E-16	1.73E-16	1.61E-16	1.58E-16	1.44E-16	1.42E-16
Silicon						
Si-31	6.89E-19	6.56E-19	6.34E-19	6.24E-19	5.99E-19	5.96E-19
Si-32	1.21E-20	1.17E-20	1.15E-20	1.15E-20	1.13E-20	1.12E-20
Phosphorus						
P-30	1.30E-16	1.19E-16	1.10E-16	1.06E-16	9.55E-17	9.41E-17
P-32	7.09E-19	6.78E-19	6.58E-19	6.48E-19	6.27E-19	6.24E-19
P-33	1.66E-20	1.61E-20	1.59E-20	1.58E-20	1.55E-20	1.55E-20
Sulfur						
S-35	3.69E-21	3.52E-21	3.45E-21	3.42E-21	3.33E-21	3.32E-21
S-37	4.14E-16	3.86E-16	3.61E-16	3.57E-16	3.33E-16	3.30E-16
S-38	2.35E-16	2.16E-16	2.02E-16	1.98E-16	1.83E-16	1.81E-16
Chlorine						
Cl-34	1.32E-16	1.21E-16	1.11E-16	1.08E-16	9.66E-17	9.52E-17
Cl-34m	2.86E-16	2.63E-16	2.45E-16	2.40E-16	2.20E-16	2.18E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cl-36	2.09E-19	2.02E-19	1.97E-19	1.95E-19	1.90E-19	1.89E-19
Cl-38	2.02E-16	1.86E-16	1.74E-16	1.71E-16	1.58E-16	1.56E-16
Cl-39	1.95E-16	1.80E-16	1.67E-16	1.63E-16	1.49E-16	1.47E-16
Cl-40	5.69E-16	5.29E-16	4.94E-16	4.87E-16	4.51E-16	4.47E-16
Argon						
Ar-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ar-39	1.35E-19	1.31E-19	1.29E-19	1.28E-19	1.26E-19	1.26E-19
Ar-41	1.72E-16	1.59E-16	1.48E-16	1.45E-16	1.32E-16	1.31E-16
Ar-42	1.49E-19	1.45E-19	1.42E-19	1.41E-19	1.38E-19	1.38E-19
Ar-43	2.09E-16	1.93E-16	1.80E-16	1.76E-16	1.61E-16	1.59E-16
Ar-44	2.65E-16	2.42E-16	2.26E-16	2.21E-16	2.03E-16	2.00E-16
Potassium						
K-38	4.31E-16	3.97E-16	3.69E-16	3.61E-16	3.31E-16	3.27E-16
K-40	2.17E-17	2.00E-17	1.86E-17	1.83E-17	1.68E-17	1.65E-17
K-42	4.00E-17	3.69E-17	3.44E-17	3.37E-17	3.10E-17	3.06E-17
K-43	1.22E-16	1.11E-16	1.03E-16	9.91E-17	8.88E-17	8.75E-17
K-44	3.28E-16	3.04E-16	2.83E-16	2.78E-16	2.56E-16	2.53E-16
K-45	2.52E-16	2.31E-16	2.15E-16	2.11E-16	1.93E-16	1.91E-16
K-46	4.00E-16	3.72E-16	3.48E-16	3.43E-16	3.16E-16	3.13E-16
Calcium						
Ca-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ca-45	1.75E-20	1.70E-20	1.68E-20	1.67E-20	1.64E-20	1.64E-20
Ca-47	1.41E-16	1.30E-16	1.21E-16	1.18E-16	1.08E-16	1.06E-16
Ca-49	4.48E-16	4.18E-16	3.91E-16	3.87E-16	3.61E-16	3.58E-16
Scandium						
Sc-42m	5.55E-16	5.10E-16	4.73E-16	4.61E-16	4.19E-16	4.13E-16
Sc-43	1.24E-16	1.13E-16	1.04E-16	1.01E-16	9.03E-17	8.89E-17
Sc-44	2.77E-16	2.55E-16	2.37E-16	2.30E-16	2.08E-16	2.05E-16
Sc-44m	3.49E-17	3.11E-17	2.84E-17	2.72E-17	2.42E-17	2.38E-17
Sc-46	2.64E-16	2.44E-16	2.27E-16	2.22E-16	2.00E-16	1.98E-16
Sc-47	1.37E-17	1.20E-17	1.09E-17	1.02E-17	9.00E-18	8.83E-18
Sc-48	4.44E-16	4.10E-16	3.82E-16	3.74E-16	3.38E-16	3.34E-16
Sc-49	1.04E-18	9.86E-19	9.50E-19	9.34E-19	8.95E-19	8.90E-19
Sc-50	4.30E-16	3.96E-16	3.68E-16	3.60E-16	3.28E-16	3.24E-16
Titanium						
Ti-44	1.58E-17	1.30E-17	1.16E-17	1.06E-17	9.17E-18	8.94E-18
Ti-45	1.09E-16	1.00E-16	9.25E-17	8.93E-17	8.01E-17	7.89E-17
Ti-51	4.78E-17	4.31E-17	3.95E-17	3.80E-17	3.39E-17	3.34E-17
Ti-52	1.61E-17	1.40E-17	1.28E-17	1.20E-17	1.06E-17	1.03E-17
Vanadium						
V-47	1.26E-16	1.15E-16	1.06E-16	1.03E-16	9.21E-17	9.07E-17
V-48	3.83E-16	3.54E-16	3.29E-16	3.21E-16	2.91E-16	2.87E-16
V-49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
V-50	1.93E-16	1.77E-16	1.65E-16	1.62E-16	1.48E-16	1.46E-16
V-52	1.97E-16	1.81E-16	1.69E-16	1.65E-16	1.51E-16	1.49E-16
V-53	1.38E-16	1.27E-16	1.19E-16	1.16E-16	1.05E-16	1.03E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Chromium						
Cr-48	5.44E-17	4.82E-17	4.39E-17	4.17E-17	3.69E-17	3.63E-17
Cr-49	1.32E-16	1.20E-16	1.11E-16	1.07E-16	9.54E-17	9.40E-17
Cr-51	4.00E-18	3.58E-18	3.27E-18	3.12E-18	2.77E-18	2.73E-18
Cr-55	1.47E-18	1.39E-18	1.34E-18	1.32E-18	1.26E-18	1.25E-18
Cr-56	1.03E-17	8.59E-18	7.73E-18	7.15E-18	6.23E-18	6.09E-18
Manganese						
Mn-50m	6.10E-16	5.62E-16	5.22E-16	5.10E-16	4.61E-16	4.55E-16
Mn-51	1.26E-16	1.16E-16	1.07E-16	1.03E-16	9.25E-17	9.11E-17
Mn-52	4.56E-16	4.20E-16	3.90E-16	3.81E-16	3.45E-16	3.41E-16
Mn-52m	3.17E-16	2.92E-16	2.71E-16	2.64E-16	2.39E-16	2.36E-16
Mn-53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn-54	1.08E-16	9.98E-17	9.27E-17	9.04E-17	8.13E-17	8.02E-17
Mn-56	2.28E-16	2.10E-16	1.95E-16	1.91E-16	1.75E-16	1.73E-16
Mn-57	1.37E-17	1.25E-17	1.16E-17	1.12E-17	1.02E-17	1.00E-17
Mn-58m	3.20E-16	2.95E-16	2.74E-16	2.68E-16	2.44E-16	2.41E-16
Iron						
Fe-52	9.30E-17	8.44E-17	7.75E-17	7.44E-17	6.65E-17	6.54E-17
Fe-53	1.49E-16	1.37E-16	1.26E-16	1.22E-16	1.09E-16	1.08E-16
Fe-53m	4.05E-16	3.74E-16	3.47E-16	3.40E-16	3.09E-16	3.05E-16
Fe-55	1.98E-26	1.72E-26	1.56E-26	1.46E-26	1.28E-26	1.25E-26
Fe-59	1.58E-16	1.46E-16	1.36E-16	1.33E-16	1.21E-16	1.19E-16
Fe-60	8.10E-21	7.80E-21	7.67E-21	7.62E-21	7.47E-21	7.45E-21
Fe-61	1.87E-16	1.72E-16	1.60E-16	1.56E-16	1.42E-16	1.40E-16
Fe-62	6.44E-17	5.90E-17	5.44E-17	5.26E-17	4.71E-17	4.64E-17
Cobalt						
Co-54m	5.18E-16	4.76E-16	4.42E-16	4.31E-16	3.90E-16	3.85E-16
Co-55	2.58E-16	2.38E-16	2.20E-16	2.14E-16	1.93E-16	1.90E-16
Co-56	4.90E-16	4.53E-16	4.22E-16	4.14E-16	3.79E-16	3.74E-16
Co-57	1.48E-17	1.28E-17	1.17E-17	1.09E-17	9.53E-18	9.33E-18
Co-58	1.25E-16	1.16E-16	1.07E-16	1.04E-16	9.37E-17	9.25E-17
Co-58m	3.22E-22	2.10E-22	1.76E-22	1.66E-22	1.18E-22	1.13E-22
Co-60	3.35E-16	3.09E-16	2.88E-16	2.82E-16	2.56E-16	2.53E-16
Co-60m	5.67E-19	5.08E-19	4.67E-19	4.52E-19	4.07E-19	4.01E-19
Co-61	1.19E-17	1.03E-17	9.36E-18	8.87E-18	7.83E-18	7.69E-18
Co-62	2.19E-16	2.03E-16	1.89E-16	1.85E-16	1.69E-16	1.67E-16
Co-62m	3.63E-16	3.35E-16	3.12E-16	3.06E-16	2.79E-16	2.76E-16
Nickel						
Ni-56	2.22E-16	2.03E-16	1.88E-16	1.82E-16	1.64E-16	1.61E-16
Ni-57	2.58E-16	2.37E-16	2.20E-16	2.15E-16	1.96E-16	1.93E-16
Ni-59	1.95E-21	1.79E-21	1.65E-21	1.59E-21	1.42E-21	1.40E-21
Ni-63	2.45E-23	1.69E-23	1.42E-23	1.37E-23	8.52E-24	8.11E-24
Ni-65	7.56E-17	6.97E-17	6.49E-17	6.35E-17	5.80E-17	5.72E-17
Ni-66	1.57E-20	1.52E-20	1.50E-20	1.49E-20	1.47E-20	1.46E-20
Copper						
Cu-57	1.54E-16	1.41E-16	1.31E-16	1.26E-16	1.14E-16	1.12E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cu-59	1.86E-16	1.71E-16	1.58E-16	1.53E-16	1.38E-16	1.36E-16
Cu-60	5.23E-16	4.82E-16	4.48E-16	4.38E-16	4.00E-16	3.95E-16
Cu-61	1.04E-16	9.53E-17	8.79E-17	8.50E-17	7.62E-17	7.51E-17
Cu-62	1.28E-16	1.17E-16	1.08E-16	1.05E-16	9.39E-17	9.25E-17
Cu-64	2.32E-17	2.13E-17	1.97E-17	1.90E-17	1.70E-17	1.68E-17
Cu-66	1.42E-17	1.32E-17	1.23E-17	1.20E-17	1.09E-17	1.08E-17
Cu-67	1.44E-17	1.25E-17	1.14E-17	1.07E-17	9.39E-18	9.23E-18
Cu-69	7.02E-17	6.48E-17	6.03E-17	5.89E-17	5.32E-17	5.25E-17
Zinc						
Zn-60	1.94E-16	1.78E-16	1.64E-16	1.58E-16	1.42E-16	1.40E-16
Zn-61	2.00E-16	1.84E-16	1.70E-16	1.65E-16	1.50E-16	1.48E-16
Zn-62	5.48E-17	5.01E-17	4.62E-17	4.46E-17	4.00E-17	3.94E-17
Zn-63	1.39E-16	1.28E-16	1.18E-16	1.14E-16	1.03E-16	1.01E-16
Zn-65	7.65E-17	7.07E-17	6.58E-17	6.44E-17	5.83E-17	5.75E-17
Zn-69	2.43E-19	2.35E-19	2.30E-19	2.28E-19	2.23E-19	2.22E-19
Zn-69m	5.21E-17	4.75E-17	4.36E-17	4.20E-17	3.75E-17	3.70E-17
Zn-71	4.15E-17	3.82E-17	3.54E-17	3.43E-17	3.09E-17	3.05E-17
Zn-71m	1.98E-16	1.81E-16	1.67E-16	1.62E-16	1.45E-16	1.43E-16
Zn-72	1.82E-17	1.59E-17	1.44E-17	1.35E-17	1.19E-17	1.16E-17
Gallium						
Ga-64	4.53E-16	4.19E-16	3.89E-16	3.81E-16	3.49E-16	3.44E-16
Ga-65	1.47E-16	1.35E-16	1.24E-16	1.20E-16	1.07E-16	1.06E-16
Ga-66	3.39E-16	3.15E-16	2.93E-16	2.88E-16	2.65E-16	2.62E-16
Ga-67	1.92E-17	1.69E-17	1.53E-17	1.45E-17	1.28E-17	1.26E-17
Ga-68	1.20E-16	1.10E-16	1.02E-16	9.81E-17	8.80E-17	8.67E-17
Ga-70	1.60E-18	1.49E-18	1.41E-18	1.39E-18	1.29E-18	1.28E-18
Ga-72	3.65E-16	3.36E-16	3.13E-16	3.07E-16	2.81E-16	2.77E-16
Ga-73	4.41E-17	3.95E-17	3.62E-17	3.47E-17	3.09E-17	3.04E-17
Ga-74	4.28E-16	3.95E-16	3.68E-16	3.61E-16	3.32E-16	3.28E-16
Germanium						
Ge-66	8.44E-17	7.66E-17	7.03E-17	6.77E-17	6.05E-17	5.96E-17
Ge-67	1.83E-16	1.67E-16	1.55E-16	1.49E-16	1.34E-16	1.32E-16
Ge-68	1.95E-21	1.34E-21	1.21E-21	1.05E-21	2.92E-22	2.68E-22
Ge-69	1.23E-16	1.14E-16	1.05E-16	1.03E-16	9.27E-17	9.14E-17
Ge-71	1.97E-21	1.36E-21	1.22E-21	1.06E-21	2.96E-22	2.72E-22
Ge-75	4.81E-18	4.29E-18	3.93E-18	3.75E-18	3.35E-18	3.30E-18
Ge-77	1.40E-16	1.27E-16	1.17E-16	1.13E-16	1.02E-16	1.00E-16
Ge-78	3.53E-17	3.13E-17	2.85E-17	2.72E-17	2.41E-17	2.37E-17
Arsenic						
As-68	4.91E-16	4.53E-16	4.20E-16	4.10E-16	3.72E-16	3.67E-16
As-69	1.46E-16	1.34E-16	1.24E-16	1.20E-16	1.08E-16	1.06E-16
As-70	5.60E-16	5.16E-16	4.79E-16	4.67E-16	4.24E-16	4.18E-16
As-71	7.25E-17	6.58E-17	6.05E-17	5.82E-17	5.20E-17	5.12E-17
As-72	2.30E-16	2.11E-16	1.96E-16	1.90E-16	1.71E-16	1.69E-16
As-73	5.58E-19	4.38E-19	3.78E-19	3.48E-19	2.89E-19	2.81E-19
As-74	9.56E-17	8.79E-17	8.11E-17	7.85E-17	7.04E-17	6.94E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
As-76	5.48E-17	5.05E-17	4.68E-17	4.55E-17	4.11E-17	4.05E-17
As-77	1.19E-18	1.08E-18	9.92E-19	9.52E-19	8.58E-19	8.46E-19
As-78	1.74E-16	1.61E-16	1.49E-16	1.46E-16	1.33E-16	1.31E-16
As-79	5.30E-18	4.89E-18	4.56E-18	4.43E-18	4.03E-18	3.98E-18
Selenium						
Se-70	8.90E-17	8.10E-17	7.44E-17	7.16E-17	6.40E-17	6.30E-17
Se-71	2.07E-16	1.90E-16	1.76E-16	1.70E-16	1.53E-16	1.51E-16
Se-72	2.36E-18	1.80E-18	1.53E-18	1.41E-18	1.14E-18	1.11E-18
Se-73	1.36E-16	1.24E-16	1.14E-16	1.10E-16	9.78E-17	9.64E-17
Se-73m	3.31E-17	3.03E-17	2.79E-17	2.69E-17	2.41E-17	2.38E-17
Se-75	4.81E-17	4.25E-17	3.87E-17	3.67E-17	3.24E-17	3.19E-17
Se-77m	1.08E-17	9.47E-18	8.60E-18	8.07E-18	7.10E-18	6.97E-18
Se-79	3.70E-21	3.51E-21	3.44E-21	3.41E-21	3.31E-21	3.30E-21
Se-79m	1.11E-18	9.43E-19	8.51E-19	7.89E-19	6.80E-19	6.65E-19
Se-81	1.62E-18	1.49E-18	1.40E-18	1.37E-18	1.26E-18	1.25E-18
Se-81m	1.68E-18	1.44E-18	1.30E-18	1.21E-18	1.05E-18	1.03E-18
Se-83	3.47E-16	3.18E-16	2.95E-16	2.88E-16	2.61E-16	2.58E-16
Se-83m	1.33E-16	1.22E-16	1.14E-16	1.11E-16	1.01E-16	9.97E-17
Se-84	5.31E-17	4.83E-17	4.43E-17	4.26E-17	3.81E-17	3.75E-17
Bromine						
Br-72	3.92E-16	3.61E-16	3.35E-16	3.26E-16	2.95E-16	2.91E-16
Br-73	1.82E-16	1.67E-16	1.54E-16	1.49E-16	1.34E-16	1.32E-16
Br-74	6.27E-16	5.82E-16	5.42E-16	5.33E-16	4.91E-16	4.85E-16
Br-74m	5.53E-16	5.11E-16	4.75E-16	4.64E-16	4.24E-16	4.19E-16
Br-75	1.51E-16	1.38E-16	1.27E-16	1.22E-16	1.09E-16	1.08E-16
Br-76	3.72E-16	3.43E-16	3.19E-16	3.12E-16	2.85E-16	2.81E-16
Br-76m	3.38E-18	2.73E-18	2.38E-18	2.23E-18	1.88E-18	1.83E-18
Br-77	3.98E-17	3.61E-17	3.32E-17	3.20E-17	2.85E-17	2.81E-17
Br-77m	1.81E-18	1.55E-18	1.40E-18	1.30E-18	1.13E-18	1.11E-18
Br-78	1.31E-16	1.20E-16	1.11E-16	1.07E-16	9.60E-17	9.46E-17
Br-80	1.04E-17	9.55E-18	8.86E-18	8.59E-18	7.76E-18	7.65E-18
Br-80m	1.06E-18	7.66E-19	6.36E-19	5.84E-19	4.55E-19	4.41E-19
Br-82	3.43E-16	3.16E-16	2.93E-16	2.85E-16	2.58E-16	2.54E-16
Br-82m	4.37E-19	3.96E-19	3.66E-19	3.57E-19	3.12E-19	3.08E-19
Br-83	1.11E-18	1.03E-18	9.65E-19	9.38E-19	8.60E-19	8.50E-19
Br-84	2.43E-16	2.25E-16	2.10E-16	2.07E-16	1.90E-16	1.88E-16
Br-84m	3.67E-16	3.38E-16	3.14E-16	3.06E-16	2.78E-16	2.74E-16
Br-85	9.95E-18	9.21E-18	8.60E-18	8.41E-18	7.66E-18	7.57E-18
Krypton						
Kr-74	1.33E-16	1.21E-16	1.11E-16	1.07E-16	9.54E-17	9.39E-17
Kr-75	1.64E-16	1.49E-16	1.38E-16	1.33E-16	1.19E-16	1.17E-16
Kr-76	5.26E-17	4.71E-17	4.31E-17	4.13E-17	3.67E-17	3.61E-17
Kr-77	1.31E-16	1.19E-16	1.09E-16	1.05E-16	9.39E-17	9.24E-17
Kr-79	3.15E-17	2.86E-17	2.63E-17	2.54E-17	2.27E-17	2.24E-17
Kr-81	1.42E-19	1.20E-19	1.06E-19	1.02E-19	7.73E-20	7.57E-20
Kr-81m	1.63E-17	1.42E-17	1.29E-17	1.22E-17	1.07E-17	1.05E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Kr-83m	1.47E-20	1.07E-20	8.45E-21	8.64E-21	2.99E-21	2.78E-21
Kr-85	4.49E-19	4.21E-19	3.98E-19	3.88E-19	3.61E-19	3.58E-19
Kr-85m	1.97E-17	1.74E-17	1.58E-17	1.49E-17	1.32E-17	1.29E-17
Kr-87	1.09E-16	1.00E-16	9.30E-17	9.10E-17	8.35E-17	8.25E-17
Kr-88	2.69E-16	2.48E-16	2.31E-16	2.27E-16	2.09E-16	2.07E-16
Kr-89	2.63E-16	2.43E-16	2.26E-16	2.22E-16	2.04E-16	2.01E-16
Rubidium						
Rb-77	1.98E-16	1.81E-16	1.67E-16	1.62E-16	1.45E-16	1.43E-16
Rb-78	5.55E-16	5.15E-16	4.80E-16	4.71E-16	4.34E-16	4.29E-16
Rb-78m	4.23E-16	3.89E-16	3.61E-16	3.52E-16	3.19E-16	3.15E-16
Rb-79	1.83E-16	1.68E-16	1.55E-16	1.49E-16	1.34E-16	1.32E-16
Rb-80	1.53E-16	1.41E-16	1.30E-16	1.25E-16	1.13E-16	1.11E-16
Rb-81	6.34E-17	5.81E-17	5.36E-17	5.18E-17	4.64E-17	4.57E-17
Rb-81m	3.10E-18	2.79E-18	2.56E-18	2.47E-18	2.20E-18	2.16E-18
Rb-82	1.42E-16	1.30E-16	1.20E-16	1.16E-16	1.04E-16	1.03E-16
Rb-82m	3.78E-16	3.48E-16	3.23E-16	3.15E-16	2.84E-16	2.80E-16
Rb-83	6.08E-17	5.58E-17	5.15E-17	4.98E-17	4.46E-17	4.39E-17
Rb-84	1.16E-16	1.07E-16	9.94E-17	9.68E-17	8.70E-17	8.58E-17
Rb-84m	4.80E-17	4.29E-17	3.92E-17	3.75E-17	3.33E-17	3.28E-17
Rb-86	1.30E-17	1.20E-17	1.12E-17	1.10E-17	9.96E-18	9.84E-18
Rb-86m	6.87E-17	6.31E-17	5.83E-17	5.64E-17	5.06E-17	4.98E-17
Rb-87	4.09E-20	3.99E-20	3.94E-20	3.91E-20	3.86E-20	3.85E-20
Rb-88	9.12E-17	8.40E-17	7.84E-17	7.70E-17	7.09E-17	7.00E-17
Rb-89	3.04E-16	2.81E-16	2.61E-16	2.56E-16	2.34E-16	2.32E-16
Rb-90	2.86E-16	2.69E-16	2.51E-16	2.49E-16	2.31E-16	2.29E-16
Rb-90m	4.45E-16	4.13E-16	3.85E-16	3.79E-16	3.49E-16	3.45E-16
Strontium						
Sr-79	1.50E-16	1.37E-16	1.26E-16	1.22E-16	1.09E-16	1.07E-16
Sr-80	5.42E-17	4.96E-17	4.57E-17	4.41E-17	3.95E-17	3.89E-17
Sr-81	1.76E-16	1.61E-16	1.48E-16	1.43E-16	1.28E-16	1.26E-16
Sr-82	6.28E-20	4.59E-20	3.60E-20	3.79E-20	1.30E-20	1.21E-20
Sr-83	1.04E-16	9.57E-17	8.85E-17	8.59E-17	7.73E-17	7.62E-17
Sr-85	6.18E-17	5.67E-17	5.22E-17	5.04E-17	4.52E-17	4.45E-17
Sr-85m	2.74E-17	2.41E-17	2.18E-17	2.07E-17	1.83E-17	1.80E-17
Sr-87m	4.00E-17	3.62E-17	3.32E-17	3.19E-17	2.84E-17	2.80E-17
Sr-89	5.77E-19	5.52E-19	5.37E-19	5.29E-19	5.12E-19	5.10E-19
Sr-90	1.15E-19	1.12E-19	1.10E-19	1.09E-19	1.08E-19	1.07E-19
Sr-91	9.28E-17	8.57E-17	7.96E-17	7.77E-17	7.01E-17	6.92E-17
Sr-92	1.80E-16	1.66E-16	1.54E-16	1.51E-16	1.38E-16	1.36E-16
Sr-93	2.99E-16	2.76E-16	2.56E-16	2.50E-16	2.27E-16	2.24E-16
Sr-94	1.93E-16	1.78E-16	1.66E-16	1.63E-16	1.49E-16	1.47E-16
Yttrium						
Y-81	1.49E-16	1.36E-16	1.25E-16	1.21E-16	1.08E-16	1.06E-16
Y-83	1.72E-16	1.58E-16	1.46E-16	1.41E-16	1.27E-16	1.25E-16
Y-83m	1.06E-16	9.64E-17	8.86E-17	8.54E-17	7.64E-17	7.52E-17
Y-84m	5.17E-16	4.77E-16	4.42E-16	4.31E-16	3.89E-16	3.84E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Y-85	1.36E-16	1.25E-16	1.15E-16	1.11E-16	9.97E-17	9.83E-17
Y-85m	1.73E-16	1.59E-16	1.47E-16	1.43E-16	1.30E-16	1.28E-16
Y-86	4.72E-16	4.35E-16	4.04E-16	3.95E-16	3.58E-16	3.54E-16
Y-86m	2.79E-17	2.46E-17	2.23E-17	2.12E-17	1.88E-17	1.85E-17
Y-87	5.49E-17	5.02E-17	4.62E-17	4.46E-17	3.99E-17	3.93E-17
Y-87m	3.83E-17	3.47E-17	3.18E-17	3.05E-17	2.72E-17	2.68E-17
Y-88	3.64E-16	3.35E-16	3.12E-16	3.06E-16	2.80E-16	2.77E-16
Y-89m	1.17E-16	1.09E-16	1.01E-16	9.86E-17	8.87E-17	8.76E-17
Y-90	1.10E-18	1.05E-18	1.01E-18	9.95E-19	9.55E-19	9.49E-19
Y-90m	7.98E-17	7.20E-17	6.59E-17	6.32E-17	5.63E-17	5.55E-17
Y-91	1.01E-18	9.51E-19	9.09E-19	8.94E-19	8.44E-19	8.38E-19
Y-91m	6.64E-17	6.10E-17	5.63E-17	5.45E-17	4.89E-17	4.82E-17
Y-92	3.53E-17	3.26E-17	3.03E-17	2.97E-17	2.69E-17	2.66E-17
Y-93	1.44E-17	1.32E-17	1.23E-17	1.20E-17	1.10E-17	1.08E-17
Y-94	1.05E-16	9.70E-17	9.02E-17	8.82E-17	8.00E-17	7.90E-17
Y-95	1.55E-16	1.44E-16	1.34E-16	1.32E-16	1.22E-16	1.21E-16
Zirconium						
Zr-85	1.88E-16	1.73E-16	1.59E-16	1.54E-16	1.39E-16	1.37E-16
Zr-86	3.49E-17	3.08E-17	2.80E-17	2.67E-17	2.36E-17	2.32E-17
Zr-87	1.18E-16	1.08E-16	9.98E-17	9.65E-17	8.67E-17	8.54E-17
Zr-88	4.80E-17	4.34E-17	3.98E-17	3.83E-17	3.41E-17	3.36E-17
Zr-89	1.49E-16	1.38E-16	1.28E-16	1.24E-16	1.12E-16	1.10E-16
Zr-89m	8.08E-17	7.44E-17	6.88E-17	6.67E-17	6.01E-17	5.92E-17
Zr-93	2.93E-23	2.04E-23	1.72E-23	1.67E-23	1.05E-23	1.01E-23
Zr-95	9.40E-17	8.67E-17	8.04E-17	7.82E-17	7.03E-17	6.93E-17
Zr-97	1.14E-16	1.05E-16	9.75E-17	9.50E-17	8.55E-17	8.44E-17
Niobium						
Nb-87	1.55E-16	1.41E-16	1.30E-16	1.25E-16	1.11E-16	1.10E-16
Nb-88	5.46E-16	5.03E-16	4.66E-16	4.53E-16	4.08E-16	4.03E-16
Nb-88m	5.36E-16	4.93E-16	4.57E-16	4.46E-16	4.02E-16	3.97E-16
Nb-89	1.80E-16	1.66E-16	1.54E-16	1.50E-16	1.36E-16	1.34E-16
Nb-89m	1.65E-16	1.51E-16	1.39E-16	1.35E-16	1.21E-16	1.19E-16
Nb-90	5.70E-16	5.25E-16	4.88E-16	4.78E-16	4.39E-16	4.33E-16
Nb-91	3.17E-19	2.67E-19	2.38E-19	2.37E-19	1.78E-19	1.74E-19
Nb-91m	3.43E-18	3.14E-18	2.92E-18	2.86E-18	2.56E-18	2.53E-18
Nb-92	1.93E-16	1.78E-16	1.65E-16	1.61E-16	1.44E-16	1.42E-16
Nb-92m	1.25E-16	1.16E-16	1.08E-16	1.05E-16	9.48E-17	9.36E-17
Nb-93m	2.42E-20	1.68E-20	1.43E-20	1.51E-20	7.02E-21	6.52E-21
Nb-94	2.01E-16	1.86E-16	1.72E-16	1.68E-16	1.51E-16	1.49E-16
Nb-94m	6.65E-19	5.93E-19	5.46E-19	5.37E-19	4.58E-19	4.51E-19
Nb-95	9.83E-17	9.08E-17	8.42E-17	8.20E-17	7.37E-17	7.27E-17
Nb-95m	8.11E-18	7.12E-18	6.47E-18	6.16E-18	5.42E-18	5.34E-18
Nb-96	3.19E-16	2.94E-16	2.73E-16	2.66E-16	2.39E-16	2.36E-16
Nb-97	8.50E-17	7.84E-17	7.26E-17	7.05E-17	6.33E-17	6.24E-17
Nb-98m	3.71E-16	3.42E-16	3.17E-16	3.10E-16	2.81E-16	2.77E-16
Nb-99	2.27E-17	1.98E-17	1.81E-17	1.70E-17	1.50E-17	1.47E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Nb-99m	1.05E-16	9.70E-17	9.04E-17	8.87E-17	8.17E-17	8.07E-17
Molybdenum						
Mo-89	1.58E-16	1.45E-16	1.34E-16	1.30E-16	1.17E-16	1.15E-16
Mo-90	1.04E-16	9.43E-17	8.67E-17	8.34E-17	7.45E-17	7.34E-17
Mo-91	1.25E-16	1.15E-16	1.06E-16	1.02E-16	9.17E-17	9.03E-17
Mo-91m	1.81E-16	1.66E-16	1.54E-16	1.50E-16	1.36E-16	1.34E-16
Mo-93	1.35E-19	9.40E-20	7.99E-20	8.44E-20	3.93E-20	3.65E-20
Mo-93m	3.07E-16	2.82E-16	2.62E-16	2.56E-16	2.32E-16	2.29E-16
Mo-99	1.92E-17	1.76E-17	1.63E-17	1.58E-17	1.42E-17	1.40E-17
Mo-101	1.95E-16	1.80E-16	1.67E-16	1.63E-16	1.48E-16	1.46E-16
Mo-102	2.60E-18	2.30E-18	2.11E-18	2.00E-18	1.79E-18	1.76E-18
Technetium						
Tc-91	3.33E-16	3.07E-16	2.85E-16	2.78E-16	2.54E-16	2.51E-16
Tc-91m	1.83E-16	1.68E-16	1.55E-16	1.50E-16	1.35E-16	1.33E-16
Tc-92	5.03E-16	4.61E-16	4.27E-16	4.16E-16	3.77E-16	3.72E-16
Tc-93	2.10E-16	1.93E-16	1.80E-16	1.76E-16	1.61E-16	1.59E-16
Tc-93m	1.29E-16	1.19E-16	1.10E-16	1.08E-16	9.93E-17	9.82E-17
Tc-94	3.42E-16	3.16E-16	2.93E-16	2.86E-16	2.57E-16	2.54E-16
Tc-94m	2.55E-16	2.35E-16	2.18E-16	2.12E-16	1.92E-16	1.89E-16
Tc-95	1.01E-16	9.34E-17	8.66E-17	8.44E-17	7.58E-17	7.48E-17
Tc-95m	8.68E-17	7.93E-17	7.32E-17	7.08E-17	6.34E-17	6.25E-17
Tc-96	3.23E-16	2.98E-16	2.76E-16	2.70E-16	2.42E-16	2.39E-16
Tc-96m	5.53E-18	5.07E-18	4.71E-18	4.60E-18	4.13E-18	4.08E-18
Tc-97	1.60E-19	1.09E-19	9.50E-20	9.90E-20	4.95E-20	4.61E-20
Tc-97m	1.85E-19	1.31E-19	1.17E-19	1.17E-19	7.29E-20	6.92E-20
Tc-98	1.81E-16	1.67E-16	1.54E-16	1.50E-16	1.35E-16	1.33E-16
Tc-99	3.30E-20	3.21E-20	3.17E-20	3.15E-20	3.10E-20	3.10E-20
Tc-99m	1.55E-17	1.36E-17	1.23E-17	1.15E-17	1.01E-17	9.90E-18
Tc-101	4.29E-17	3.84E-17	3.51E-17	3.36E-17	2.99E-17	2.95E-17
Tc-102	1.39E-17	1.28E-17	1.19E-17	1.16E-17	1.06E-17	1.05E-17
Tc-102m	3.30E-16	3.04E-16	2.82E-16	2.76E-16	2.52E-16	2.48E-16
Tc-104	3.04E-16	2.79E-16	2.60E-16	2.54E-16	2.32E-16	2.29E-16
Tc-105	1.05E-16	9.59E-17	8.87E-17	8.60E-17	7.77E-17	7.66E-17
Ruthenium						
Ru-92	2.67E-16	2.42E-16	2.24E-16	2.16E-16	1.95E-16	1.92E-16
Ru-94	6.48E-17	5.91E-17	5.45E-17	5.27E-17	4.71E-17	4.64E-17
Ru-95	1.60E-16	1.47E-16	1.36E-16	1.32E-16	1.19E-16	1.18E-16
Ru-97	2.90E-17	2.55E-17	2.32E-17	2.20E-17	1.94E-17	1.91E-17
Ru-103	6.22E-17	5.70E-17	5.25E-17	5.07E-17	4.54E-17	4.47E-17
Ru-105	9.54E-17	8.76E-17	8.09E-17	7.85E-17	7.04E-17	6.94E-17
Ru-106	2.39E-24	1.65E-24	1.38E-24	1.39E-24	6.43E-25	6.02E-25
Ru-107	4.63E-17	4.25E-17	3.94E-17	3.83E-17	3.46E-17	3.41E-17
Ru-108	8.05E-18	7.06E-18	6.43E-18	6.06E-18	5.36E-18	5.26E-18
Rhodium						
Rh-94	5.02E-16	4.63E-16	4.30E-16	4.19E-16	3.81E-16	3.76E-16
Rh-95	3.38E-16	3.11E-16	2.89E-16	2.82E-16	2.56E-16	2.53E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Rh-95m	1.18E-16	1.09E-16	1.01E-16	9.90E-17	9.03E-17	8.92E-17
Rh-96	5.09E-16	4.69E-16	4.35E-16	4.23E-16	3.82E-16	3.77E-16
Rh-96m	1.68E-16	1.55E-16	1.44E-16	1.40E-16	1.27E-16	1.26E-16
Rh-97	1.85E-16	1.70E-16	1.57E-16	1.52E-16	1.37E-16	1.35E-16
Rh-97m	2.96E-16	2.72E-16	2.53E-16	2.48E-16	2.27E-16	2.24E-16
Rh-98	2.33E-16	2.14E-16	1.98E-16	1.92E-16	1.73E-16	1.71E-16
Rh-99	6.90E-17	6.26E-17	5.76E-17	5.56E-17	4.97E-17	4.89E-17
Rh-99m	8.19E-17	7.47E-17	6.89E-17	6.66E-17	5.98E-17	5.89E-17
Rh-100	3.67E-16	3.38E-16	3.14E-16	3.08E-16	2.81E-16	2.78E-16
Rh-100m	6.03E-18	5.35E-18	4.92E-18	4.76E-18	4.22E-18	4.15E-18
Rh-101	3.44E-17	3.01E-17	2.73E-17	2.58E-17	2.26E-17	2.22E-17
Rh-101m	3.48E-17	3.10E-17	2.83E-17	2.71E-17	2.40E-17	2.37E-17
Rh-102	6.31E-17	5.78E-17	5.34E-17	5.16E-17	4.63E-17	4.56E-17
Rh-102m	2.75E-16	2.53E-16	2.34E-16	2.28E-16	2.05E-16	2.02E-16
Rh-103m	3.26E-20	2.15E-20	1.89E-20	1.87E-20	1.14E-20	1.08E-20
Rh-104	2.74E-18	2.56E-18	2.41E-18	2.35E-18	2.17E-18	2.15E-18
Rh-104m	3.31E-18	2.60E-18	2.26E-18	2.10E-18	1.73E-18	1.68E-18
Rh-105	9.80E-18	8.77E-18	8.01E-18	7.66E-18	6.81E-18	6.71E-18
Rh-106	2.82E-17	2.60E-17	2.41E-17	2.34E-17	2.11E-17	2.08E-17
Rh-106m	3.71E-16	3.42E-16	3.17E-16	3.08E-16	2.78E-16	2.75E-16
Rh-107	3.98E-17	3.57E-17	3.27E-17	3.13E-17	2.78E-17	2.74E-17
Rh-108	4.29E-17	3.94E-17	3.64E-17	3.51E-17	3.16E-17	3.11E-17
Rh-109	3.85E-17	3.45E-17	3.15E-17	3.02E-17	2.69E-17	2.65E-17
Palladium						
Pd-96	1.84E-16	1.69E-16	1.56E-16	1.51E-16	1.36E-16	1.34E-16
Pd-97	3.14E-16	2.88E-16	2.67E-16	2.60E-16	2.37E-16	2.33E-16
Pd-98	5.06E-17	4.59E-17	4.23E-17	4.07E-17	3.63E-17	3.58E-17
Pd-99	1.65E-16	1.51E-16	1.40E-16	1.36E-16	1.22E-16	1.21E-16
Pd-100	1.17E-17	9.71E-18	8.69E-18	8.02E-18	6.87E-18	6.71E-18
Pd-101	4.21E-17	3.83E-17	3.53E-17	3.42E-17	3.06E-17	3.02E-17
Pd-103	3.01E-19	2.01E-19	1.77E-19	1.76E-19	1.08E-19	1.02E-19
Pd-107	1.61E-24	1.12E-24	9.38E-25	9.48E-25	4.04E-25	3.77E-25
Pd-109	9.44E-19	7.99E-19	7.37E-19	7.06E-19	6.22E-19	6.11E-19
Pd-109m	1.35E-17	1.18E-17	1.07E-17	1.01E-17	8.84E-18	8.69E-18
Pd-111	7.15E-18	6.60E-18	6.15E-18	5.99E-18	5.47E-18	5.40E-18
Pd-112	9.41E-20	6.86E-20	6.25E-20	6.37E-20	4.13E-20	3.96E-20
Pd-114	3.72E-18	3.31E-18	3.04E-18	2.90E-18	2.60E-18	2.56E-18
Silver						
Ag-99	3.02E-16	2.77E-16	2.57E-16	2.49E-16	2.26E-16	2.23E-16
Ag-100m	3.71E-16	3.41E-16	3.16E-16	3.08E-16	2.79E-16	2.75E-16
Ag-101	2.02E-16	1.85E-16	1.71E-16	1.65E-16	1.49E-16	1.47E-16
Ag-102	4.47E-16	4.12E-16	3.82E-16	3.73E-16	3.38E-16	3.34E-16
Ag-102m	2.69E-16	2.48E-16	2.31E-16	2.26E-16	2.07E-16	2.05E-16
Ag-103	1.07E-16	9.78E-17	9.03E-17	8.74E-17	7.86E-17	7.75E-17
Ag-104	3.51E-16	3.23E-16	2.99E-16	2.92E-16	2.64E-16	2.60E-16
Ag-104m	2.35E-16	2.17E-16	2.01E-16	1.95E-16	1.77E-16	1.75E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ag-105	6.31E-17	5.70E-17	5.23E-17	5.03E-17	4.49E-17	4.42E-17
Ag-105m	1.26E-19	1.14E-19	1.04E-19	1.00E-19	8.94E-20	8.81E-20
Ag-106	8.77E-17	8.04E-17	7.41E-17	7.16E-17	6.41E-17	6.32E-17
Ag-106m	3.63E-16	3.34E-16	3.09E-16	3.01E-16	2.72E-16	2.68E-16
Ag-108	2.90E-18	2.69E-18	2.51E-18	2.44E-18	2.23E-18	2.20E-18
Ag-108m	2.04E-16	1.87E-16	1.73E-16	1.68E-16	1.50E-16	1.48E-16
Ag-109m	5.73E-19	4.45E-19	3.96E-19	3.70E-19	3.00E-19	2.91E-19
Ag-110	5.46E-18	5.07E-18	4.74E-18	4.62E-18	4.23E-18	4.18E-18
Ag-110m	3.60E-16	3.32E-16	3.08E-16	3.00E-16	2.71E-16	2.68E-16
Ag-111	3.61E-18	3.25E-18	2.99E-18	2.87E-18	2.57E-18	2.53E-18
Ag-111m	5.38E-19	4.54E-19	4.11E-19	3.94E-19	3.36E-19	3.29E-19
Ag-112	9.32E-17	8.59E-17	7.99E-17	7.80E-17	7.10E-17	7.01E-17
Ag-113	9.99E-18	9.07E-18	8.36E-18	8.07E-18	7.26E-18	7.16E-18
Ag-113m	2.70E-17	2.44E-17	2.24E-17	2.15E-17	1.92E-17	1.89E-17
Ag-114	3.79E-17	3.50E-17	3.26E-17	3.18E-17	2.90E-17	2.86E-17
Ag-115	6.60E-17	6.04E-17	5.61E-17	5.47E-17	5.00E-17	4.94E-17
Ag-116	2.93E-16	2.71E-16	2.52E-16	2.47E-16	2.27E-16	2.24E-16
Ag-117	1.79E-16	1.65E-16	1.53E-16	1.50E-16	1.38E-16	1.36E-16
Cadmium						
Cd-101	3.28E-16	3.01E-16	2.79E-16	2.72E-16	2.48E-16	2.44E-16
Cd-102	1.05E-16	9.64E-17	8.91E-17	8.62E-17	7.75E-17	7.64E-17
Cd-103	2.79E-16	2.57E-16	2.39E-16	2.34E-16	2.14E-16	2.11E-16
Cd-104	2.93E-17	2.64E-17	2.43E-17	2.34E-17	2.09E-17	2.05E-17
Cd-105	1.72E-16	1.58E-16	1.47E-16	1.43E-16	1.31E-16	1.29E-16
Cd-107	1.73E-18	1.38E-18	1.24E-18	1.19E-18	9.75E-19	9.50E-19
Cd-109	9.61E-19	6.98E-19	6.13E-19	5.81E-19	4.38E-19	4.21E-19
Cd-111m	3.50E-17	3.07E-17	2.79E-17	2.65E-17	2.33E-17	2.30E-17
Cd-113	2.86E-20	2.78E-20	2.74E-20	2.72E-20	2.68E-20	2.68E-20
Cd-113m	1.14E-19	1.10E-19	1.07E-19	1.06E-19	1.04E-19	1.04E-19
Cd-115	2.43E-17	2.23E-17	2.05E-17	1.98E-17	1.78E-17	1.75E-17
Cd-115m	4.93E-18	4.57E-18	4.27E-18	4.18E-18	3.81E-18	3.77E-18
Cd-117	1.43E-16	1.32E-16	1.22E-16	1.19E-16	1.08E-16	1.07E-16
Cd-117m	2.76E-16	2.54E-16	2.37E-16	2.32E-16	2.12E-16	2.10E-16
Cd-118	8.45E-20	8.21E-20	8.09E-20	8.03E-20	7.90E-20	7.88E-20
Cd-119	2.22E-16	2.04E-16	1.89E-16	1.85E-16	1.70E-16	1.68E-16
Cd-119m	3.11E-16	2.86E-16	2.67E-16	2.61E-16	2.39E-16	2.36E-16
Indium						
In-103	3.63E-16	3.34E-16	3.10E-16	3.02E-16	2.74E-16	2.70E-16
In-105	2.51E-16	2.30E-16	2.13E-16	2.07E-16	1.87E-16	1.85E-16
In-106	4.58E-16	4.22E-16	3.91E-16	3.80E-16	3.42E-16	3.37E-16
In-106m	3.74E-16	3.45E-16	3.20E-16	3.12E-16	2.85E-16	2.81E-16
In-107	2.01E-16	1.84E-16	1.71E-16	1.66E-16	1.51E-16	1.49E-16
In-108	5.11E-16	4.70E-16	4.36E-16	4.25E-16	3.84E-16	3.79E-16
In-108m	3.71E-16	3.44E-16	3.19E-16	3.13E-16	2.87E-16	2.84E-16
In-109	8.16E-17	7.41E-17	6.83E-17	6.61E-17	5.94E-17	5.85E-17
In-109m	7.72E-17	7.11E-17	6.58E-17	6.39E-17	5.74E-17	5.65E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
In-110	3.99E-16	3.68E-16	3.41E-16	3.33E-16	2.99E-16	2.95E-16
In-110m	2.03E-16	1.87E-16	1.73E-16	1.68E-16	1.52E-16	1.50E-16
In-111	4.93E-17	4.32E-17	3.92E-17	3.71E-17	3.27E-17	3.21E-17
In-111m	5.89E-17	5.41E-17	4.99E-17	4.82E-17	4.32E-17	4.26E-17
In-112	3.33E-17	3.05E-17	2.81E-17	2.72E-17	2.44E-17	2.40E-17
In-112m	3.03E-18	2.56E-18	2.31E-18	2.17E-18	1.87E-18	1.83E-18
In-113m	3.21E-17	2.91E-17	2.67E-17	2.56E-17	2.28E-17	2.25E-17
In-114	1.14E-18	1.07E-18	1.03E-18	1.01E-18	9.61E-19	9.55E-19
In-114m	9.38E-18	8.39E-18	7.68E-18	7.38E-18	6.55E-18	6.45E-18
In-115	7.67E-20	7.46E-20	7.36E-20	7.30E-20	7.18E-20	7.17E-20
In-115m	1.98E-17	1.77E-17	1.61E-17	1.55E-17	1.37E-17	1.35E-17
In-116m	3.30E-16	3.05E-16	2.83E-16	2.77E-16	2.53E-16	2.49E-16
In-117	8.71E-17	7.92E-17	7.29E-17	7.01E-17	6.27E-17	6.17E-17
In-117m	1.13E-17	1.01E-17	9.19E-18	8.75E-18	7.77E-18	7.65E-18
In-118	1.36E-17	1.26E-17	1.18E-17	1.16E-17	1.06E-17	1.05E-17
In-118m	3.67E-16	3.39E-16	3.15E-16	3.08E-16	2.79E-16	2.76E-16
In-119	9.92E-17	9.16E-17	8.49E-17	8.27E-17	7.43E-17	7.33E-17
In-119m	9.76E-18	9.01E-18	8.40E-18	8.22E-18	7.48E-18	7.39E-18
In-121	1.22E-16	1.13E-16	1.05E-16	1.02E-16	9.19E-17	9.08E-17
In-121m	9.44E-18	8.52E-18	7.91E-18	7.69E-18	7.00E-18	6.91E-18
Tin						
Sn-106	1.53E-16	1.40E-16	1.29E-16	1.25E-16	1.12E-16	1.11E-16
Sn-108	8.45E-17	7.63E-17	7.00E-17	6.73E-17	6.00E-17	5.91E-17
Sn-109	2.95E-16	2.71E-16	2.52E-16	2.47E-16	2.26E-16	2.23E-16
Sn-110	3.51E-17	3.10E-17	2.82E-17	2.69E-17	2.38E-17	2.34E-17
Sn-111	6.21E-17	5.70E-17	5.27E-17	5.12E-17	4.62E-17	4.56E-17
Sn-113	1.26E-18	9.79E-19	8.64E-19	8.20E-19	6.72E-19	6.55E-19
Sn-113m	5.00E-19	3.36E-19	2.82E-19	2.64E-19	1.96E-19	1.88E-19
Sn-117m	1.82E-17	1.58E-17	1.43E-17	1.34E-17	1.18E-17	1.15E-17
Sn-119m	4.84E-19	3.17E-19	2.65E-19	2.50E-19	1.79E-19	1.71E-19
Sn-121	4.58E-20	4.46E-20	4.40E-20	4.37E-20	4.31E-20	4.30E-20
Sn-121m	2.22E-19	1.54E-19	1.29E-19	1.20E-19	9.35E-20	9.04E-20
Sn-123	1.40E-18	1.31E-18	1.24E-18	1.21E-18	1.13E-18	1.12E-18
Sn-123m	1.77E-17	1.55E-17	1.41E-17	1.33E-17	1.17E-17	1.15E-17
Sn-125	4.52E-17	4.17E-17	3.88E-17	3.80E-17	3.44E-17	3.40E-17
Sn-125m	4.46E-17	4.01E-17	3.67E-17	3.52E-17	3.14E-17	3.10E-17
Sn-126	5.81E-18	4.82E-18	4.31E-18	3.97E-18	3.42E-18	3.34E-18
Sn-127	2.53E-16	2.33E-16	2.17E-16	2.12E-16	1.92E-16	1.90E-16
Sn-127m	7.39E-17	6.78E-17	6.27E-17	6.07E-17	5.47E-17	5.39E-17
Sn-128	7.21E-17	6.54E-17	6.01E-17	5.79E-17	5.17E-17	5.09E-17
Sn-129	1.32E-16	1.22E-16	1.13E-16	1.10E-16	9.97E-17	9.83E-17
Sn-130	1.19E-16	1.08E-16	9.93E-17	9.60E-17	8.58E-17	8.46E-17
Sn-130m	1.17E-16	1.07E-16	9.96E-17	9.71E-17	8.78E-17	8.66E-17
Antimony						
Sb-111	1.89E-16	1.73E-16	1.60E-16	1.54E-16	1.38E-16	1.36E-16
Sb-113	1.60E-16	1.47E-16	1.35E-16	1.31E-16	1.17E-16	1.16E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sb-114	3.55E-16	3.27E-16	3.03E-16	2.96E-16	2.68E-16	2.65E-16
Sb-115	1.11E-16	1.02E-16	9.36E-17	9.04E-17	8.10E-17	7.98E-17
Sb-116	3.02E-16	2.78E-16	2.58E-16	2.52E-16	2.29E-16	2.27E-16
Sb-116m	4.04E-16	3.72E-16	3.45E-16	3.37E-16	3.04E-16	3.00E-16
Sb-117	2.14E-17	1.87E-17	1.70E-17	1.61E-17	1.41E-17	1.39E-17
Sb-118	1.02E-16	9.34E-17	8.61E-17	8.33E-17	7.47E-17	7.36E-17
Sb-118m	3.41E-16	3.13E-16	2.91E-16	2.84E-16	2.57E-16	2.53E-16
Sb-119	7.85E-19	5.15E-19	4.29E-19	4.04E-19	2.91E-19	2.78E-19
Sb-120	5.61E-17	5.14E-17	4.74E-17	4.58E-17	4.10E-17	4.04E-17
Sb-120m	3.22E-16	2.95E-16	2.74E-16	2.67E-16	2.41E-16	2.38E-16
Sb-122	5.68E-17	5.22E-17	4.83E-17	4.67E-17	4.20E-17	4.14E-17
Sb-122m	6.19E-18	4.91E-18	4.29E-18	3.94E-18	3.32E-18	3.23E-18
Sb-124	2.46E-16	2.27E-16	2.10E-16	2.06E-16	1.87E-16	1.85E-16
Sb-124m	5.57E-17	5.12E-17	4.73E-17	4.58E-17	4.11E-17	4.05E-17
Sb-124n	2.91E-23	1.91E-23	1.59E-23	1.49E-23	1.08E-23	1.04E-23
Sb-125	5.38E-17	4.91E-17	4.52E-17	4.36E-17	3.90E-17	3.84E-17
Sb-126	3.52E-16	3.24E-16	2.99E-16	2.91E-16	2.61E-16	2.57E-16
Sb-126m	1.97E-16	1.81E-16	1.68E-16	1.63E-16	1.46E-16	1.44E-16
Sb-127	8.83E-17	8.11E-17	7.49E-17	7.26E-17	6.52E-17	6.42E-17
Sb-128	3.97E-16	3.65E-16	3.38E-16	3.28E-16	2.95E-16	2.91E-16
Sb-128m	2.46E-16	2.26E-16	2.09E-16	2.03E-16	1.82E-16	1.80E-16
Sb-129	1.92E-16	1.77E-16	1.64E-16	1.60E-16	1.45E-16	1.43E-16
Sb-130	4.25E-16	3.90E-16	3.61E-16	3.52E-16	3.17E-16	3.12E-16
Sb-130m	3.53E-16	3.26E-16	3.02E-16	2.95E-16	2.66E-16	2.62E-16
Sb-131	2.76E-16	2.54E-16	2.36E-16	2.31E-16	2.10E-16	2.07E-16
Sb-133	3.70E-16	3.42E-16	3.18E-16	3.12E-16	2.85E-16	2.82E-16
Tellurium						
Te-113	2.93E-16	2.69E-16	2.50E-16	2.43E-16	2.21E-16	2.18E-16
Te-114	1.67E-16	1.53E-16	1.42E-16	1.38E-16	1.26E-16	1.24E-16
Te-115	2.93E-16	2.70E-16	2.50E-16	2.44E-16	2.21E-16	2.18E-16
Te-115m	3.43E-16	3.16E-16	2.93E-16	2.86E-16	2.60E-16	2.56E-16
Te-116	1.12E-17	9.69E-18	8.81E-18	8.38E-18	7.35E-18	7.22E-18
Te-117	2.03E-16	1.87E-16	1.74E-16	1.69E-16	1.54E-16	1.52E-16
Te-118	7.67E-19	5.09E-19	4.20E-19	3.91E-19	2.91E-19	2.79E-19
Te-119	9.67E-17	8.89E-17	8.23E-17	8.00E-17	7.20E-17	7.10E-17
Te-119m	1.97E-16	1.81E-16	1.68E-16	1.64E-16	1.48E-16	1.46E-16
Te-121	7.09E-17	6.49E-17	5.99E-17	5.79E-17	5.19E-17	5.11E-17
Te-121m	2.65E-17	2.32E-17	2.11E-17	2.01E-17	1.77E-17	1.75E-17
Te-123	1.33E-21	8.84E-22	7.30E-22	6.79E-22	5.06E-22	4.85E-22
Te-123m	1.73E-17	1.50E-17	1.36E-17	1.27E-17	1.12E-17	1.10E-17
Te-125m	1.59E-18	1.08E-18	8.95E-19	8.27E-19	6.37E-19	6.14E-19
Te-127	7.52E-19	6.91E-19	6.43E-19	6.21E-19	5.66E-19	5.60E-19
Te-127m	5.08E-19	3.50E-19	2.92E-19	2.70E-19	2.11E-19	2.03E-19
Te-129	7.95E-18	7.24E-18	6.68E-18	6.46E-18	5.81E-18	5.72E-18
Te-129m	4.32E-18	3.91E-18	3.61E-18	3.50E-18	3.13E-18	3.09E-18
Te-131	5.40E-17	4.91E-17	4.52E-17	4.36E-17	3.91E-17	3.85E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Te-131m	1.89E-16	1.74E-16	1.61E-16	1.57E-16	1.41E-16	1.40E-16
Te-132	2.77E-17	2.40E-17	2.17E-17	2.06E-17	1.81E-17	1.78E-17
Te-133	1.59E-16	1.46E-16	1.35E-16	1.31E-16	1.19E-16	1.18E-16
Te-133m	2.43E-16	2.24E-16	2.08E-16	2.03E-16	1.83E-16	1.81E-16
Te-134	1.10E-16	1.00E-16	9.22E-17	8.91E-17	7.96E-17	7.85E-17
Iodine						
I-118	2.61E-16	2.40E-16	2.22E-16	2.15E-16	1.94E-16	1.91E-16
I-118m	4.82E-16	4.43E-16	4.10E-16	3.99E-16	3.59E-16	3.54E-16
I-119	1.15E-16	1.04E-16	9.56E-17	9.21E-17	8.24E-17	8.12E-17
I-120	3.54E-16	3.26E-16	3.03E-16	2.96E-16	2.70E-16	2.67E-16
I-120m	4.57E-16	4.21E-16	3.90E-16	3.79E-16	3.43E-16	3.38E-16
I-121	4.89E-17	4.37E-17	3.99E-17	3.82E-17	3.40E-17	3.35E-17
I-122	1.22E-16	1.12E-16	1.04E-16	1.00E-16	8.99E-17	8.85E-17
I-123	1.96E-17	1.70E-17	1.54E-17	1.45E-17	1.27E-17	1.25E-17
I-124	1.44E-16	1.32E-16	1.22E-16	1.19E-16	1.08E-16	1.06E-16
I-125	1.86E-18	1.25E-18	1.03E-18	9.49E-19	7.25E-19	6.98E-19
I-126	5.43E-17	4.97E-17	4.58E-17	4.43E-17	3.97E-17	3.91E-17
I-128	9.18E-18	8.40E-18	7.76E-18	7.49E-18	6.75E-18	6.66E-18
I-129	1.32E-18	9.13E-19	7.53E-19	6.91E-19	5.44E-19	5.26E-19
I-130	2.72E-16	2.51E-16	2.32E-16	2.25E-16	2.02E-16	1.99E-16
I-130m	1.37E-17	1.25E-17	1.15E-17	1.12E-17	1.00E-17	9.90E-18
I-131	4.81E-17	4.35E-17	3.99E-17	3.83E-17	3.41E-17	3.36E-17
I-132	2.93E-16	2.70E-16	2.50E-16	2.44E-16	2.20E-16	2.17E-16
I-132m	4.25E-17	3.90E-17	3.60E-17	3.49E-17	3.13E-17	3.08E-17
I-133	7.79E-17	7.16E-17	6.62E-17	6.41E-17	5.76E-17	5.68E-17
I-134	3.39E-16	3.13E-16	2.91E-16	2.84E-16	2.56E-16	2.53E-16
I-134m	3.46E-17	3.06E-17	2.78E-17	2.66E-17	2.35E-17	2.32E-17
I-135	2.12E-16	1.96E-16	1.82E-16	1.78E-16	1.62E-16	1.60E-16
Xenon						
Xe-120	4.77E-17	4.31E-17	3.96E-17	3.83E-17	3.41E-17	3.36E-17
Xe-121	1.94E-16	1.78E-16	1.65E-16	1.61E-16	1.46E-16	1.44E-16
Xe-122	6.70E-18	5.77E-18	5.21E-18	4.95E-18	4.33E-18	4.26E-18
Xe-123	8.11E-17	7.37E-17	6.79E-17	6.57E-17	5.91E-17	5.83E-17
Xe-125	3.20E-17	2.80E-17	2.54E-17	2.42E-17	2.14E-17	2.10E-17
Xe-127	3.33E-17	2.91E-17	2.63E-17	2.50E-17	2.20E-17	2.16E-17
Xe-127m	1.97E-17	1.70E-17	1.54E-17	1.44E-17	1.26E-17	1.23E-17
Xe-129m	3.39E-18	2.56E-18	2.20E-18	2.05E-18	1.71E-18	1.66E-18
Xe-131m	1.29E-18	9.75E-19	8.38E-19	7.80E-19	6.48E-19	6.32E-19
Xe-133	4.53E-18	3.66E-18	3.24E-18	2.98E-18	2.55E-18	2.49E-18
Xe-133m	3.91E-18	3.28E-18	2.93E-18	2.77E-18	2.41E-18	2.37E-18
Xe-135	3.16E-17	2.79E-17	2.54E-17	2.42E-17	2.14E-17	2.11E-17
Xe-135m	5.31E-17	4.87E-17	4.49E-17	4.33E-17	3.88E-17	3.83E-17
Xe-137	2.71E-17	2.49E-17	2.31E-17	2.23E-17	2.02E-17	2.00E-17
Xe-138	1.52E-16	1.39E-16	1.30E-16	1.27E-16	1.16E-16	1.15E-16
Cesium						
Cs-121	1.50E-16	1.38E-16	1.27E-16	1.23E-16	1.10E-16	1.08E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Cs-121m	1.51E-16	1.37E-16	1.27E-16	1.22E-16	1.09E-16	1.08E-16
Cs-123	1.37E-16	1.26E-16	1.16E-16	1.12E-16	1.00E-16	9.89E-17
Cs-124	1.50E-16	1.38E-16	1.27E-16	1.23E-16	1.11E-16	1.09E-16
Cs-125	9.49E-17	8.69E-17	8.02E-17	7.75E-17	6.97E-17	6.87E-17
Cs-126	1.47E-16	1.35E-16	1.25E-16	1.20E-16	1.08E-16	1.07E-16
Cs-127	5.27E-17	4.76E-17	4.37E-17	4.20E-17	3.75E-17	3.69E-17
Cs-128	1.13E-16	1.03E-16	9.53E-17	9.21E-17	8.26E-17	8.14E-17
Cs-129	3.26E-17	2.92E-17	2.66E-17	2.55E-17	2.27E-17	2.23E-17
Cs-130	6.27E-17	5.74E-17	5.29E-17	5.11E-17	4.58E-17	4.51E-17
Cs-130m	6.73E-18	5.46E-18	4.83E-18	4.47E-18	3.82E-18	3.73E-18
Cs-131	1.14E-18	7.79E-19	6.40E-19	5.87E-19	4.59E-19	4.43E-19
Cs-132	8.93E-17	8.20E-17	7.58E-17	7.36E-17	6.60E-17	6.51E-17
Cs-134	1.99E-16	1.84E-16	1.70E-16	1.65E-16	1.49E-16	1.46E-16
Cs-134m	2.53E-18	2.11E-18	1.88E-18	1.75E-18	1.51E-18	1.48E-18
Cs-135	2.49E-20	2.42E-20	2.39E-20	2.38E-20	2.34E-20	2.34E-20
Cs-135m	2.06E-16	1.91E-16	1.77E-16	1.72E-16	1.55E-16	1.53E-16
Cs-136	2.77E-16	2.55E-16	2.37E-16	2.31E-16	2.08E-16	2.05E-16
Cs-137	1.11E-19	1.08E-19	1.06E-19	1.05E-19	1.03E-19	1.03E-19
Cs-138	3.20E-16	2.95E-16	2.74E-16	2.69E-16	2.46E-16	2.43E-16
Cs-138m	5.41E-17	4.93E-17	4.57E-17	4.45E-17	4.03E-17	3.98E-17
Cs-139	4.39E-17	4.06E-17	3.79E-17	3.72E-17	3.43E-17	3.39E-17
Cs-140	2.44E-16	2.25E-16	2.10E-16	2.06E-16	1.89E-16	1.87E-16
Barium						
Ba-124	7.15E-17	6.51E-17	6.00E-17	5.80E-17	5.20E-17	5.13E-17
Ba-126	7.31E-17	6.65E-17	6.13E-17	5.94E-17	5.33E-17	5.26E-17
Ba-127	9.20E-17	8.40E-17	7.75E-17	7.49E-17	6.74E-17	6.64E-17
Ba-128	6.59E-18	5.59E-18	5.01E-18	4.75E-18	4.14E-18	4.06E-18
Ba-129	4.11E-17	3.72E-17	3.43E-17	3.31E-17	2.97E-17	2.93E-17
Ba-129m	2.04E-16	1.87E-16	1.73E-16	1.68E-16	1.51E-16	1.49E-16
Ba-131	5.75E-17	5.17E-17	4.74E-17	4.55E-17	4.05E-17	3.99E-17
Ba-131m	8.28E-18	6.97E-18	6.27E-18	5.81E-18	5.05E-18	4.94E-18
Ba-133	4.75E-17	4.20E-17	3.82E-17	3.64E-17	3.22E-17	3.17E-17
Ba-133m	7.37E-18	6.35E-18	5.72E-18	5.44E-18	4.78E-18	4.70E-18
Ba-135m	6.43E-18	5.51E-18	4.96E-18	4.70E-18	4.13E-18	4.06E-18
Ba-137m	7.57E-17	6.98E-17	6.45E-17	6.27E-17	5.63E-17	5.55E-17
Ba-139	6.69E-18	5.95E-18	5.46E-18	5.19E-18	4.66E-18	4.59E-18
Ba-140	2.26E-17	2.06E-17	1.90E-17	1.83E-17	1.63E-17	1.61E-17
Ba-141	1.21E-16	1.11E-16	1.02E-16	9.89E-17	8.91E-17	8.79E-17
Ba-142	1.37E-16	1.25E-16	1.16E-16	1.13E-16	1.02E-16	1.01E-16
Lanthanum						
La-128	3.66E-16	3.35E-16	3.10E-16	3.01E-16	2.71E-16	2.67E-16
La-129	1.16E-16	1.05E-16	9.71E-17	9.36E-17	8.38E-17	8.26E-17
La-130	2.89E-16	2.65E-16	2.45E-16	2.38E-16	2.15E-16	2.12E-16
La-131	8.20E-17	7.42E-17	6.82E-17	6.56E-17	5.87E-17	5.78E-17
La-132	2.61E-16	2.40E-16	2.22E-16	2.16E-16	1.96E-16	1.94E-16
La-132m	8.40E-17	7.64E-17	7.04E-17	6.80E-17	6.09E-17	6.00E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
La-133	1.85E-17	1.67E-17	1.53E-17	1.47E-17	1.31E-17	1.29E-17
La-134	9.10E-17	8.33E-17	7.69E-17	7.43E-17	6.67E-17	6.57E-17
La-135	2.73E-18	2.19E-18	1.92E-18	1.81E-18	1.54E-18	1.51E-18
La-136	5.03E-17	4.60E-17	4.24E-17	4.09E-17	3.67E-17	3.61E-17
La-137	1.40E-18	9.78E-19	8.06E-19	7.37E-19	5.86E-19	5.67E-19
La-138	1.64E-16	1.51E-16	1.40E-16	1.37E-16	1.25E-16	1.23E-16
La-140	3.10E-16	2.85E-16	2.65E-16	2.59E-16	2.37E-16	2.34E-16
La-141	4.81E-18	4.47E-18	4.20E-18	4.12E-18	3.81E-18	3.77E-18
La-142	3.26E-16	3.01E-16	2.81E-16	2.76E-16	2.55E-16	2.52E-16
La-143	3.72E-17	3.43E-17	3.20E-17	3.14E-17	2.87E-17	2.84E-17
Cerium						
Ce-130	6.16E-17	5.55E-17	5.10E-17	4.91E-17	4.39E-17	4.32E-17
Ce-131	2.09E-16	1.92E-16	1.77E-16	1.72E-16	1.55E-16	1.53E-16
Ce-132	3.24E-17	2.83E-17	2.56E-17	2.42E-17	2.13E-17	2.10E-17
Ce-133	6.53E-17	5.89E-17	5.41E-17	5.19E-17	4.63E-17	4.56E-17
Ce-133m	2.25E-16	2.06E-16	1.91E-16	1.85E-16	1.68E-16	1.66E-16
Ce-134	1.77E-18	1.28E-18	1.07E-18	9.86E-19	8.01E-19	7.77E-19
Ce-135	1.03E-16	9.34E-17	8.59E-17	8.30E-17	7.42E-17	7.31E-17
Ce-137	2.99E-18	2.39E-18	2.09E-18	1.97E-18	1.68E-18	1.65E-18
Ce-137m	5.86E-18	5.00E-18	4.49E-18	4.27E-18	3.74E-18	3.67E-18
Ce-139	1.81E-17	1.56E-17	1.40E-17	1.32E-17	1.15E-17	1.13E-17
Ce-141	9.23E-18	8.01E-18	7.25E-18	6.79E-18	5.95E-18	5.83E-18
Ce-143	3.42E-17	3.06E-17	2.80E-17	2.68E-17	2.39E-17	2.35E-17
Ce-144	2.21E-18	1.89E-18	1.70E-18	1.59E-18	1.39E-18	1.36E-18
Ce-145	1.03E-16	9.42E-17	8.71E-17	8.46E-17	7.59E-17	7.48E-17
Praseodymium						
Pr-134	4.05E-16	3.71E-16	3.43E-16	3.33E-16	2.99E-16	2.95E-16
Pr-134m	3.03E-16	2.78E-16	2.57E-16	2.50E-16	2.26E-16	2.23E-16
Pr-135	1.10E-16	9.99E-17	9.20E-17	8.88E-17	7.97E-17	7.85E-17
Pr-136	2.78E-16	2.56E-16	2.37E-16	2.30E-16	2.09E-16	2.06E-16
Pr-137	4.58E-17	4.17E-17	3.84E-17	3.72E-17	3.34E-17	3.29E-17
Pr-138	1.04E-16	9.51E-17	8.78E-17	8.48E-17	7.61E-17	7.50E-17
Pr-138m	3.19E-16	2.94E-16	2.72E-16	2.65E-16	2.38E-16	2.35E-16
Pr-139	1.49E-17	1.33E-17	1.22E-17	1.18E-17	1.05E-17	1.03E-17
Pr-140	6.84E-17	6.26E-17	5.77E-17	5.57E-17	4.99E-17	4.92E-17
Pr-142	8.84E-18	8.16E-18	7.63E-18	7.48E-18	6.90E-18	6.82E-18
Pr-142m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-143	2.37E-19	2.29E-19	2.25E-19	2.22E-19	2.17E-19	2.17E-19
Pr-144	5.51E-18	5.12E-18	4.81E-18	4.71E-18	4.38E-18	4.33E-18
Pr-144m	9.67E-19	7.40E-19	6.34E-19	5.92E-19	4.96E-19	4.84E-19
Pr-145	3.09E-18	2.86E-18	2.68E-18	2.62E-18	2.40E-18	2.38E-18
Pr-146	1.36E-16	1.25E-16	1.16E-16	1.14E-16	1.04E-16	1.02E-16
Pr-147	6.17E-17	5.59E-17	5.15E-17	4.98E-17	4.48E-17	4.42E-17
Pr-148	1.34E-16	1.23E-16	1.14E-16	1.11E-16	1.01E-16	9.94E-17
Pr-148m	1.22E-16	1.11E-16	1.02E-16	9.87E-17	8.86E-17	8.73E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Neodymium						
Nd-134	6.68E-17	6.00E-17	5.49E-17	5.26E-17	4.68E-17	4.61E-17
Nd-135	1.59E-16	1.44E-16	1.33E-16	1.28E-16	1.15E-16	1.13E-16
Nd-136	3.24E-17	2.88E-17	2.64E-17	2.53E-17	2.24E-17	2.21E-17
Nd-137	1.51E-16	1.38E-16	1.27E-16	1.24E-16	1.12E-16	1.10E-16
Nd-138	3.76E-18	3.02E-18	2.64E-18	2.47E-18	2.11E-18	2.06E-18
Nd-139	5.52E-17	5.04E-17	4.64E-17	4.49E-17	4.03E-17	3.97E-17
Nd-139m	2.04E-16	1.87E-16	1.73E-16	1.69E-16	1.52E-16	1.50E-16
Nd-140	1.90E-18	1.37E-18	1.14E-18	1.04E-18	8.40E-19	8.15E-19
Nd-141	8.06E-18	7.04E-18	6.39E-18	6.14E-18	5.44E-18	5.35E-18
Nd-141m	8.91E-17	8.23E-17	7.63E-17	7.42E-17	6.67E-17	6.58E-17
Nd-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.67E-17	1.48E-17	1.35E-17	1.29E-17	1.15E-17	1.13E-17
Nd-149	4.65E-17	4.15E-17	3.80E-17	3.63E-17	3.23E-17	3.18E-17
Nd-151	1.11E-16	1.01E-16	9.37E-17	9.10E-17	8.20E-17	8.09E-17
Nd-152	2.07E-17	1.84E-17	1.68E-17	1.60E-17	1.42E-17	1.40E-17
Promethium						
Pm-136	3.49E-16	3.21E-16	2.96E-16	2.87E-16	2.58E-16	2.54E-16
Pm-137m	2.26E-16	2.06E-16	1.90E-16	1.83E-16	1.64E-16	1.62E-16
Pm-139	1.20E-16	1.10E-16	1.01E-16	9.79E-17	8.80E-17	8.67E-17
Pm-140	1.36E-16	1.25E-16	1.15E-16	1.12E-16	1.00E-16	9.89E-17
Pm-140m	3.91E-16	3.60E-16	3.33E-16	3.24E-16	2.91E-16	2.87E-16
Pm-141	9.39E-17	8.61E-17	7.95E-17	7.71E-17	6.94E-17	6.84E-17
Pm-142	1.10E-16	1.01E-16	9.28E-17	8.97E-17	8.07E-17	7.95E-17
Pm-143	3.87E-17	3.53E-17	3.26E-17	3.17E-17	2.84E-17	2.79E-17
Pm-144	1.97E-16	1.81E-16	1.67E-16	1.62E-16	1.45E-16	1.43E-16
Pm-145	2.25E-18	1.66E-18	1.39E-18	1.27E-18	1.04E-18	1.01E-18
Pm-146	9.43E-17	8.64E-17	7.97E-17	7.72E-17	6.92E-17	6.82E-17
Pm-147	1.03E-20	9.96E-21	9.77E-21	9.68E-21	9.47E-21	9.45E-21
Pm-148	7.68E-17	7.07E-17	6.57E-17	6.42E-17	5.84E-17	5.76E-17
Pm-148m	2.53E-16	2.33E-16	2.15E-16	2.09E-16	1.88E-16	1.85E-16
Pm-149	1.79E-18	1.63E-18	1.50E-18	1.45E-18	1.31E-18	1.30E-18
Pm-150	1.95E-16	1.79E-16	1.66E-16	1.62E-16	1.47E-16	1.45E-16
Pm-151	4.11E-17	3.69E-17	3.38E-17	3.24E-17	2.88E-17	2.84E-17
Pm-152	3.93E-17	3.61E-17	3.35E-17	3.27E-17	2.96E-17	2.92E-17
Pm-152m	1.99E-16	1.82E-16	1.69E-16	1.64E-16	1.48E-16	1.46E-16
Pm-153	9.42E-18	8.17E-18	7.43E-18	7.00E-18	6.18E-18	6.07E-18
Pm-154	2.43E-16	2.24E-16	2.08E-16	2.04E-16	1.87E-16	1.85E-16
Pm-154m	2.39E-16	2.19E-16	2.03E-16	1.98E-16	1.80E-16	1.78E-16
Samarium						
Sm-139	1.86E-16	1.70E-16	1.57E-16	1.52E-16	1.37E-16	1.35E-16
Sm-140	7.19E-17	6.54E-17	6.04E-17	5.85E-17	5.26E-17	5.19E-17
Sm-141	1.82E-16	1.66E-16	1.54E-16	1.49E-16	1.35E-16	1.33E-16
Sm-141m	2.52E-16	2.31E-16	2.13E-16	2.07E-16	1.87E-16	1.84E-16
Sm-142	1.24E-17	1.10E-17	9.98E-18	9.58E-18	8.50E-18	8.36E-18
Sm-143	6.64E-17	6.07E-17	5.60E-17	5.41E-17	4.85E-17	4.78E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Sm-143m	8.78E-17	8.10E-17	7.51E-17	7.31E-17	6.57E-17	6.48E-17
Sm-145	4.91E-18	3.66E-18	3.09E-18	2.83E-18	2.32E-18	2.25E-18
Sm-146	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.92E-22	1.27E-22	1.10E-22	1.07E-22	6.78E-23	6.40E-23
Sm-153	6.72E-18	5.54E-18	4.92E-18	4.56E-18	3.93E-18	3.84E-18
Sm-155	1.27E-17	1.10E-17	9.94E-18	9.30E-18	8.17E-18	8.01E-18
Sm-156	1.40E-17	1.21E-17	1.09E-17	1.03E-17	9.04E-18	8.88E-18
Sm-157	5.38E-17	4.84E-17	4.44E-17	4.28E-17	3.83E-17	3.77E-17
Europium						
Eu-142	1.59E-16	1.46E-16	1.35E-16	1.31E-16	1.18E-16	1.16E-16
Eu-142m	4.43E-16	4.09E-16	3.79E-16	3.68E-16	3.31E-16	3.27E-16
Eu-143	1.46E-16	1.34E-16	1.24E-16	1.20E-16	1.09E-16	1.07E-16
Eu-144	1.43E-16	1.31E-16	1.21E-16	1.18E-16	1.06E-16	1.04E-16
Eu-145	1.68E-16	1.54E-16	1.43E-16	1.40E-16	1.27E-16	1.25E-16
Eu-146	3.11E-16	2.87E-16	2.66E-16	2.59E-16	2.34E-16	2.31E-16
Eu-147	5.86E-17	5.30E-17	4.88E-17	4.72E-17	4.22E-17	4.16E-17
Eu-148	2.84E-16	2.61E-16	2.42E-16	2.35E-16	2.11E-16	2.08E-16
Eu-149	6.55E-18	5.48E-18	4.87E-18	4.60E-18	3.98E-18	3.91E-18
Eu-150	1.96E-16	1.79E-16	1.65E-16	1.60E-16	1.43E-16	1.41E-16
Eu-150m	6.37E-18	5.77E-18	5.31E-18	5.13E-18	4.61E-18	4.54E-18
Eu-152	1.53E-16	1.40E-16	1.30E-16	1.26E-16	1.14E-16	1.12E-16
Eu-152m	3.85E-17	3.53E-17	3.28E-17	3.19E-17	2.87E-17	2.84E-17
Eu-152n	8.31E-18	6.94E-18	6.22E-18	5.74E-18	4.97E-18	4.86E-18
Eu-154	1.63E-16	1.50E-16	1.39E-16	1.36E-16	1.23E-16	1.21E-16
Eu-154m	7.10E-18	5.81E-18	5.14E-18	4.74E-18	4.06E-18	3.96E-18
Eu-155	6.84E-18	5.72E-18	5.12E-18	4.74E-18	4.10E-18	4.00E-18
Eu-156	1.66E-16	1.53E-16	1.42E-16	1.39E-16	1.27E-16	1.26E-16
Eu-157	3.55E-17	3.18E-17	2.90E-17	2.79E-17	2.48E-17	2.44E-17
Eu-158	1.72E-16	1.59E-16	1.47E-16	1.44E-16	1.31E-16	1.29E-16
Eu-159	3.77E-17	3.38E-17	3.10E-17	2.99E-17	2.68E-17	2.64E-17
Gadolinium						
Gd-142	1.34E-16	1.23E-16	1.13E-16	1.10E-16	9.91E-17	9.77E-17
Gd-143m	2.75E-16	2.51E-16	2.32E-16	2.25E-16	2.03E-16	2.00E-16
Gd-144	1.19E-16	1.09E-16	1.01E-16	9.79E-17	8.89E-17	8.77E-17
Gd-145	3.28E-16	3.02E-16	2.81E-16	2.76E-16	2.53E-16	2.50E-16
Gd-145m	8.68E-17	7.99E-17	7.39E-17	7.18E-17	6.45E-17	6.36E-17
Gd-146	2.75E-17	2.31E-17	2.07E-17	1.93E-17	1.67E-17	1.63E-17
Gd-147	1.79E-16	1.63E-16	1.51E-16	1.46E-16	1.31E-16	1.29E-16
Gd-148	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-149	6.49E-17	5.81E-17	5.32E-17	5.10E-17	4.53E-17	4.46E-17
Gd-150	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-151	7.02E-18	5.80E-18	5.13E-18	4.80E-18	4.13E-18	4.04E-18
Gd-152	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gd-153	1.05E-17	8.47E-18	7.47E-18	6.90E-18	5.88E-18	5.74E-18

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Gd-159	6.59E-18	5.84E-18	5.32E-18	5.08E-18	4.51E-18	4.44E-18
Gd-162	5.23E-17	4.75E-17	4.36E-17	4.20E-17	3.75E-17	3.69E-17
Terbium						
Tb-146	4.86E-16	4.48E-16	4.16E-16	4.07E-16	3.72E-16	3.67E-16
Tb-147	2.86E-16	2.63E-16	2.44E-16	2.38E-16	2.16E-16	2.13E-16
Tb-147m	2.55E-16	2.35E-16	2.18E-16	2.14E-16	1.95E-16	1.93E-16
Tb-148	3.10E-16	2.86E-16	2.65E-16	2.58E-16	2.35E-16	2.32E-16
Tb-148m	4.02E-16	3.69E-16	3.42E-16	3.32E-16	2.98E-16	2.94E-16
Tb-149	1.77E-16	1.62E-16	1.50E-16	1.46E-16	1.32E-16	1.31E-16
Tb-149m	1.75E-16	1.61E-16	1.49E-16	1.45E-16	1.30E-16	1.28E-16
Tb-150	3.26E-16	3.00E-16	2.79E-16	2.73E-16	2.50E-16	2.47E-16
Tb-150m	3.18E-16	2.92E-16	2.69E-16	2.61E-16	2.34E-16	2.30E-16
Tb-151	1.24E-16	1.13E-16	1.03E-16	9.97E-17	8.92E-17	8.79E-17
Tb-151m	9.35E-18	8.37E-18	7.66E-18	7.37E-18	6.55E-18	6.45E-18
Tb-152	1.96E-16	1.79E-16	1.66E-16	1.62E-16	1.47E-16	1.45E-16
Tb-152m	9.45E-17	8.49E-17	7.77E-17	7.47E-17	6.65E-17	6.55E-17
Tb-153	3.99E-17	3.53E-17	3.22E-17	3.08E-17	2.73E-17	2.69E-17
Tb-154	3.08E-16	2.84E-16	2.64E-16	2.59E-16	2.38E-16	2.35E-16
Tb-155	1.97E-17	1.66E-17	1.49E-17	1.39E-17	1.21E-17	1.19E-17
Tb-156	2.51E-16	2.30E-16	2.13E-16	2.07E-16	1.87E-16	1.85E-16
Tb-156m	3.41E-18	2.65E-18	2.27E-18	2.09E-18	1.73E-18	1.68E-18
Tb-156n	3.48E-19	2.76E-19	2.40E-19	2.21E-19	1.86E-19	1.81E-19
Tb-157	3.84E-19	2.90E-19	2.45E-19	2.25E-19	1.84E-19	1.79E-19
Tb-158	1.03E-16	9.44E-17	8.74E-17	8.52E-17	7.65E-17	7.55E-17
Tb-160	1.47E-16	1.35E-16	1.25E-16	1.22E-16	1.10E-16	1.09E-16
Tb-161	3.12E-18	2.46E-18	2.14E-18	1.98E-18	1.66E-18	1.62E-18
Tb-162	1.43E-16	1.30E-16	1.20E-16	1.17E-16	1.05E-16	1.03E-16
Tb-163	9.91E-17	9.01E-17	8.28E-17	7.96E-17	7.11E-17	7.01E-17
Tb-164	3.20E-16	2.94E-16	2.72E-16	2.65E-16	2.40E-16	2.37E-16
Tb-165	1.13E-16	1.04E-16	9.63E-17	9.43E-17	8.58E-17	8.47E-17
Dysprosium						
Dy-148	8.94E-17	8.19E-17	7.55E-17	7.32E-17	6.56E-17	6.46E-17
Dy-149	2.13E-16	1.95E-16	1.81E-16	1.76E-16	1.60E-16	1.58E-16
Dy-150	3.39E-17	3.04E-17	2.78E-17	2.67E-17	2.37E-17	2.33E-17
Dy-151	1.78E-16	1.63E-16	1.51E-16	1.47E-16	1.33E-16	1.31E-16
Dy-152	3.48E-17	3.03E-17	2.74E-17	2.60E-17	2.29E-17	2.25E-17
Dy-153	1.10E-16	9.95E-17	9.16E-17	8.87E-17	7.97E-17	7.85E-17
Dy-154	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dy-155	8.50E-17	7.68E-17	7.07E-17	6.85E-17	6.14E-17	6.05E-17
Dy-157	4.20E-17	3.72E-17	3.38E-17	3.22E-17	2.85E-17	2.81E-17
Dy-159	3.84E-18	2.93E-18	2.49E-18	2.29E-18	1.88E-18	1.83E-18
Dy-165	3.57E-18	3.20E-18	2.94E-18	2.83E-18	2.54E-18	2.50E-18
Dy-165m	2.10E-18	1.84E-18	1.67E-18	1.58E-18	1.40E-18	1.37E-18
Dy-166	4.32E-18	3.51E-18	3.09E-18	2.87E-18	2.44E-18	2.39E-18
Dy-167	6.75E-17	6.12E-17	5.62E-17	5.42E-17	4.84E-17	4.77E-17
Dy-168	4.91E-17	4.43E-17	4.07E-17	3.90E-17	3.48E-17	3.43E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Holmium						
Ho-150	2.43E-16	2.24E-16	2.07E-16	2.01E-16	1.81E-16	1.78E-16
Ho-153	1.30E-16	1.19E-16	1.09E-16	1.06E-16	9.46E-17	9.32E-17
Ho-153m	1.34E-16	1.21E-16	1.12E-16	1.08E-16	9.64E-17	9.49E-17
Ho-154	2.42E-16	2.22E-16	2.05E-16	1.98E-16	1.79E-16	1.76E-16
Ho-154m	3.09E-16	2.82E-16	2.60E-16	2.51E-16	2.25E-16	2.22E-16
Ho-155	7.73E-17	6.99E-17	6.43E-17	6.21E-17	5.57E-17	5.49E-17
Ho-156	2.75E-16	2.52E-16	2.33E-16	2.26E-16	2.05E-16	2.02E-16
Ho-157	7.15E-17	6.40E-17	5.85E-17	5.63E-17	5.01E-17	4.93E-17
Ho-159	4.56E-17	3.99E-17	3.62E-17	3.43E-17	3.02E-17	2.97E-17
Ho-160	2.17E-16	1.99E-16	1.85E-16	1.80E-16	1.61E-16	1.59E-16
Ho-161	4.86E-18	3.79E-18	3.27E-18	3.02E-18	2.51E-18	2.44E-18
Ho-162	1.94E-17	1.72E-17	1.57E-17	1.52E-17	1.36E-17	1.33E-17
Ho-162m	7.13E-17	6.47E-17	5.97E-17	5.79E-17	5.20E-17	5.13E-17
Ho-163	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ho-164	2.75E-18	2.16E-18	1.87E-18	1.73E-18	1.45E-18	1.41E-18
Ho-164m	3.94E-18	3.04E-18	2.60E-18	2.39E-18	1.98E-18	1.92E-18
Ho-166	4.35E-18	3.90E-18	3.61E-18	3.50E-18	3.18E-18	3.14E-18
Ho-166m	2.07E-16	1.89E-16	1.75E-16	1.69E-16	1.52E-16	1.50E-16
Ho-167	4.57E-17	4.09E-17	3.73E-17	3.57E-17	3.17E-17	3.12E-17
Ho-168	1.14E-16	1.05E-16	9.71E-17	9.46E-17	8.51E-17	8.40E-17
Ho-168m	5.59E-19	4.32E-19	3.69E-19	3.40E-19	2.81E-19	2.73E-19
Ho-170	2.21E-16	2.03E-16	1.88E-16	1.83E-16	1.65E-16	1.63E-16
Erbium						
Er-154	7.27E-18	6.09E-18	5.42E-18	5.13E-18	4.42E-18	4.33E-18
Er-156	5.99E-18	4.79E-18	4.17E-18	3.88E-18	3.27E-18	3.20E-18
Er-159	1.24E-16	1.13E-16	1.04E-16	1.01E-16	9.15E-17	9.02E-17
Er-161	1.27E-16	1.16E-16	1.08E-16	1.05E-16	9.43E-17	9.31E-17
Er-163	3.61E-18	2.81E-18	2.41E-18	2.23E-18	1.85E-18	1.80E-18
Er-165	3.35E-18	2.59E-18	2.22E-18	2.04E-18	1.69E-18	1.64E-18
Er-167m	1.19E-17	1.03E-17	9.33E-18	8.81E-18	7.74E-18	7.61E-18
Er-169	3.41E-20	3.32E-20	3.27E-20	3.25E-20	3.20E-20	3.19E-20
Er-171	4.64E-17	4.11E-17	3.74E-17	3.57E-17	3.16E-17	3.11E-17
Er-172	6.39E-17	5.80E-17	5.33E-17	5.13E-17	4.58E-17	4.51E-17
Er-173	1.06E-16	9.64E-17	8.88E-17	8.57E-17	7.66E-17	7.55E-17
Thulium						
Tm-161	1.68E-16	1.52E-16	1.41E-16	1.37E-16	1.24E-16	1.22E-16
Tm-162	2.55E-16	2.35E-16	2.18E-16	2.13E-16	1.94E-16	1.92E-16
Tm-163	1.72E-16	1.57E-16	1.45E-16	1.41E-16	1.28E-16	1.26E-16
Tm-164	1.00E-16	9.16E-17	8.46E-17	8.22E-17	7.42E-17	7.32E-17
Tm-165	6.95E-17	6.22E-17	5.70E-17	5.48E-17	4.88E-17	4.81E-17
Tm-166	2.62E-16	2.40E-16	2.23E-16	2.18E-16	1.99E-16	1.96E-16
Tm-167	1.69E-17	1.44E-17	1.29E-17	1.21E-17	1.05E-17	1.03E-17
Tm-168	1.57E-16	1.43E-16	1.32E-16	1.28E-16	1.15E-16	1.13E-16
Tm-170	6.62E-19	5.77E-19	5.32E-19	5.06E-19	4.60E-19	4.53E-19
Tm-171	5.98E-20	4.74E-20	4.11E-20	3.78E-20	3.17E-20	3.09E-20

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Tm-172	6.39E-17	5.88E-17	5.47E-17	5.35E-17	4.88E-17	4.82E-17
Tm-173	4.87E-17	4.41E-17	4.05E-17	3.89E-17	3.47E-17	3.42E-17
Tm-174	2.29E-16	2.08E-16	1.92E-16	1.86E-16	1.66E-16	1.64E-16
Tm-175	1.40E-16	1.28E-16	1.19E-16	1.15E-16	1.04E-16	1.02E-16
Tm-176	2.62E-16	2.41E-16	2.23E-16	2.18E-16	1.99E-16	1.96E-16
Ytterbium						
Yb-162	2.99E-17	2.62E-17	2.38E-17	2.25E-17	1.99E-17	1.95E-17
Yb-163	9.32E-17	8.51E-17	7.86E-17	7.63E-17	6.88E-17	6.79E-17
Yb-164	5.42E-18	4.44E-18	3.90E-18	3.65E-18	3.11E-18	3.04E-18
Yb-165	4.06E-17	3.61E-17	3.30E-17	3.17E-17	2.82E-17	2.78E-17
Yb-166	8.35E-18	6.62E-18	5.74E-18	5.28E-18	4.43E-18	4.32E-18
Yb-167	3.00E-17	2.53E-17	2.27E-17	2.12E-17	1.84E-17	1.80E-17
Yb-169	3.72E-17	3.13E-17	2.80E-17	2.62E-17	2.27E-17	2.22E-17
Yb-175	4.89E-18	4.38E-18	4.00E-18	3.83E-18	3.40E-18	3.35E-18
Yb-177	2.56E-17	2.33E-17	2.16E-17	2.09E-17	1.88E-17	1.86E-17
Yb-178	4.87E-18	4.40E-18	4.03E-18	3.87E-18	3.46E-18	3.41E-18
Yb-179	1.24E-16	1.13E-16	1.05E-16	1.01E-16	9.08E-17	8.94E-17
Lutetium						
Lu-165	1.43E-16	1.30E-16	1.20E-16	1.16E-16	1.04E-16	1.03E-16
Lu-167	2.24E-16	2.05E-16	1.90E-16	1.86E-16	1.69E-16	1.67E-16
Lu-169	1.72E-16	1.58E-16	1.46E-16	1.43E-16	1.29E-16	1.27E-16
Lu-169m	5.06E-22	3.47E-22	3.14E-22	2.71E-22	7.90E-23	7.28E-23
Lu-170	3.48E-16	3.21E-16	2.98E-16	2.93E-16	2.69E-16	2.66E-16
Lu-171	8.03E-17	7.31E-17	6.74E-17	6.53E-17	5.84E-17	5.76E-17
Lu-171m	3.39E-20	2.73E-20	2.39E-20	2.19E-20	1.85E-20	1.80E-20
Lu-172	2.54E-16	2.33E-16	2.16E-16	2.11E-16	1.90E-16	1.88E-16
Lu-172m	2.95E-22	2.10E-22	1.83E-22	1.64E-22	8.43E-23	8.05E-23
Lu-173	2.03E-17	1.72E-17	1.53E-17	1.44E-17	1.25E-17	1.23E-17
Lu-174	1.35E-17	1.19E-17	1.08E-17	1.04E-17	9.21E-18	9.06E-18
Lu-174m	6.03E-18	4.90E-18	4.31E-18	4.00E-18	3.41E-18	3.33E-18
Lu-176	5.99E-17	5.28E-17	4.80E-17	4.57E-17	4.03E-17	3.97E-17
Lu-176m	1.90E-18	1.62E-18	1.47E-18	1.38E-18	1.23E-18	1.20E-18
Lu-177	4.36E-18	3.78E-18	3.43E-18	3.23E-18	2.84E-18	2.79E-18
Lu-177m	1.23E-16	1.09E-16	9.91E-17	9.41E-17	8.32E-17	8.18E-17
Lu-178	1.74E-17	1.59E-17	1.48E-17	1.45E-17	1.32E-17	1.30E-17
Lu-178m	1.30E-16	1.16E-16	1.06E-16	1.01E-16	8.99E-17	8.85E-17
Lu-179	4.20E-18	3.72E-18	3.41E-18	3.25E-18	2.91E-18	2.87E-18
Lu-180	2.00E-16	1.83E-16	1.70E-16	1.66E-16	1.50E-16	1.48E-16
Lu-181	7.28E-17	6.62E-17	6.10E-17	5.90E-17	5.28E-17	5.20E-17
Hafnium						
Hf-167	7.73E-17	6.99E-17	6.41E-17	6.16E-17	5.50E-17	5.41E-17
Hf-169	7.92E-17	7.19E-17	6.60E-17	6.35E-17	5.67E-17	5.58E-17
Hf-170	5.33E-17	4.76E-17	4.35E-17	4.17E-17	3.70E-17	3.64E-17
Hf-172	1.04E-17	8.43E-18	7.41E-18	6.84E-18	5.82E-18	5.67E-18
Hf-173	4.80E-17	4.19E-17	3.80E-17	3.60E-17	3.17E-17	3.11E-17
Hf-174	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hf-175	4.29E-17	3.80E-17	3.45E-17	3.29E-17	2.91E-17	2.86E-17
Hf-177m	2.85E-16	2.53E-16	2.30E-16	2.20E-16	1.94E-16	1.91E-16
Hf-178m	2.79E-16	2.52E-16	2.31E-16	2.21E-16	1.97E-16	1.94E-16
Hf-179m	1.13E-16	1.01E-16	9.23E-17	8.81E-17	7.82E-17	7.69E-17
Hf-180m	1.23E-16	1.10E-16	1.00E-16	9.60E-17	8.53E-17	8.39E-17
Hf-181	6.61E-17	5.98E-17	5.48E-17	5.26E-17	4.69E-17	4.61E-17
Hf-182	3.01E-17	2.65E-17	2.41E-17	2.29E-17	2.02E-17	1.99E-17
Hf-182m	1.14E-16	1.03E-16	9.48E-17	9.12E-17	8.13E-17	8.01E-17
Hf-183	9.90E-17	9.07E-17	8.38E-17	8.13E-17	7.30E-17	7.19E-17
Hf-184	2.86E-17	2.52E-17	2.29E-17	2.17E-17	1.92E-17	1.88E-17
Tantalum						
Ta-170	1.36E-16	1.25E-16	1.15E-16	1.11E-16	9.96E-17	9.82E-17
Ta-172	2.21E-16	2.02E-16	1.87E-16	1.82E-16	1.64E-16	1.62E-16
Ta-173	7.36E-17	6.66E-17	6.13E-17	5.94E-17	5.34E-17	5.26E-17
Ta-174	1.26E-16	1.15E-16	1.06E-16	1.03E-16	9.27E-17	9.14E-17
Ta-175	1.45E-16	1.32E-16	1.22E-16	1.19E-16	1.07E-16	1.06E-16
Ta-176	3.00E-16	2.75E-16	2.56E-16	2.51E-16	2.29E-16	2.27E-16
Ta-177	7.12E-18	5.88E-18	5.21E-18	4.85E-18	4.16E-18	4.07E-18
Ta-178	1.43E-17	1.25E-17	1.14E-17	1.09E-17	9.64E-18	9.48E-18
Ta-178m	1.42E-16	1.27E-16	1.15E-16	1.10E-16	9.74E-17	9.59E-17
Ta-179	2.43E-18	1.94E-18	1.68E-18	1.55E-18	1.30E-18	1.27E-18
Ta-180	4.83E-18	3.88E-18	3.40E-18	3.12E-18	2.65E-18	2.58E-18
Ta-182	1.69E-16	1.55E-16	1.44E-16	1.41E-16	1.27E-16	1.26E-16
Ta-182m	3.15E-17	2.71E-17	2.45E-17	2.30E-17	2.01E-17	1.97E-17
Ta-183	3.54E-17	3.08E-17	2.78E-17	2.63E-17	2.31E-17	2.27E-17
Ta-184	2.01E-16	1.83E-16	1.69E-16	1.63E-16	1.46E-16	1.44E-16
Ta-185	1.92E-17	1.67E-17	1.52E-17	1.43E-17	1.26E-17	1.24E-17
Ta-186	1.82E-16	1.65E-16	1.52E-16	1.47E-16	1.32E-16	1.30E-16
Tungsten						
W-177	1.15E-16	1.04E-16	9.54E-17	9.20E-17	8.22E-17	8.10E-17
W-178	1.49E-18	1.20E-18	1.04E-18	9.57E-19	8.09E-19	7.88E-19
W-179	5.08E-18	4.03E-18	3.51E-18	3.22E-18	2.71E-18	2.64E-18
W-179m	6.21E-18	5.20E-18	4.63E-18	4.32E-18	3.74E-18	3.66E-18
W-181	3.97E-18	3.18E-18	2.78E-18	2.55E-18	2.16E-18	2.10E-18
W-185	6.10E-20	5.86E-20	5.73E-20	5.66E-20	5.53E-20	5.51E-20
W-185m	2.83E-18	2.41E-18	2.17E-18	2.02E-18	1.76E-18	1.72E-18
W-187	5.65E-17	5.16E-17	4.76E-17	4.60E-17	4.12E-17	4.06E-17
W-188	2.68E-19	2.39E-19	2.19E-19	2.10E-19	1.88E-19	1.86E-19
W-190	1.75E-17	1.48E-17	1.33E-17	1.24E-17	1.08E-17	1.05E-17
Rhenium						
Re-178	2.27E-16	2.09E-16	1.94E-16	1.89E-16	1.73E-16	1.70E-16
Re-179	1.39E-16	1.26E-16	1.17E-16	1.13E-16	1.02E-16	1.00E-16
Re-180	1.55E-16	1.42E-16	1.31E-16	1.28E-16	1.15E-16	1.13E-16
Re-181	1.01E-16	9.12E-17	8.38E-17	8.08E-17	7.22E-17	7.12E-17
Re-182	2.32E-16	2.10E-16	1.94E-16	1.88E-16	1.69E-16	1.67E-16
Re-182m	1.59E-16	1.46E-16	1.35E-16	1.32E-16	1.19E-16	1.17E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Re-183	1.74E-17	1.46E-17	1.31E-17	1.22E-17	1.05E-17	1.03E-17
Re-184	1.14E-16	1.04E-16	9.65E-17	9.38E-17	8.42E-17	8.30E-17
Re-184m	4.75E-17	4.26E-17	3.91E-17	3.76E-17	3.35E-17	3.29E-17
Re-186	2.66E-18	2.30E-18	2.09E-18	1.96E-18	1.74E-18	1.70E-18
Re-186m	1.48E-18	1.18E-18	1.03E-18	9.48E-19	7.98E-19	7.77E-19
Re-187	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Re-188	8.53E-18	7.71E-18	7.11E-18	6.83E-18	6.15E-18	6.06E-18
Re-188m	7.40E-18	6.08E-18	5.39E-18	4.96E-18	4.25E-18	4.15E-18
Re-189	7.12E-18	6.29E-18	5.73E-18	5.45E-18	4.83E-18	4.76E-18
Re-190	1.71E-16	1.56E-16	1.43E-16	1.39E-16	1.24E-16	1.22E-16
Re-190m	1.17E-16	1.06E-16	9.79E-17	9.44E-17	8.45E-17	8.32E-17
Osmium						
Os-180	1.42E-17	1.23E-17	1.12E-17	1.06E-17	9.31E-18	9.14E-18
Os-181	1.79E-16	1.64E-16	1.51E-16	1.47E-16	1.33E-16	1.31E-16
Os-182	5.27E-17	4.72E-17	4.31E-17	4.12E-17	3.66E-17	3.60E-17
Os-183	7.72E-17	6.90E-17	6.31E-17	6.04E-17	5.37E-17	5.28E-17
Os-183m	1.31E-16	1.21E-16	1.12E-16	1.09E-16	9.88E-17	9.75E-17
Os-185	8.69E-17	7.96E-17	7.35E-17	7.12E-17	6.38E-17	6.28E-17
Os-186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Os-189m	2.11E-21	1.48E-21	1.28E-21	1.16E-21	3.31E-22	3.04E-22
Os-190m	2.00E-16	1.82E-16	1.67E-16	1.61E-16	1.44E-16	1.42E-16
Os-191	9.24E-18	7.78E-18	6.97E-18	6.45E-18	5.59E-18	5.46E-18
Os-191m	6.13E-19	4.98E-19	4.38E-19	4.01E-19	3.42E-19	3.33E-19
Os-193	8.44E-18	7.54E-18	6.90E-18	6.58E-18	5.86E-18	5.76E-18
Os-194	2.03E-19	1.53E-19	1.29E-19	1.19E-19	9.59E-20	9.31E-20
Os-196	1.02E-17	9.08E-18	8.31E-18	7.93E-18	7.06E-18	6.95E-18
Iridium						
Ir-180	2.04E-16	1.86E-16	1.72E-16	1.66E-16	1.49E-16	1.47E-16
Ir-182	1.81E-16	1.65E-16	1.52E-16	1.47E-16	1.32E-16	1.30E-16
Ir-183	1.55E-16	1.41E-16	1.31E-16	1.27E-16	1.15E-16	1.14E-16
Ir-184	2.55E-16	2.33E-16	2.15E-16	2.09E-16	1.89E-16	1.86E-16
Ir-185	1.12E-16	1.02E-16	9.44E-17	9.18E-17	8.35E-17	8.24E-17
Ir-186	2.16E-16	1.97E-16	1.82E-16	1.77E-16	1.60E-16	1.57E-16
Ir-186m	1.64E-16	1.50E-16	1.39E-16	1.36E-16	1.23E-16	1.21E-16
Ir-187	4.08E-17	3.67E-17	3.37E-17	3.25E-17	2.89E-17	2.85E-17
Ir-188	2.83E-16	2.60E-16	2.41E-16	2.36E-16	2.17E-16	2.14E-16
Ir-189	8.52E-18	7.10E-18	6.31E-18	5.85E-18	5.06E-18	4.95E-18
Ir-190	1.85E-16	1.68E-16	1.55E-16	1.49E-16	1.33E-16	1.31E-16
Ir-190m	2.28E-21	1.61E-21	1.37E-21	1.27E-21	3.65E-22	3.36E-22
Ir-190n	6.00E-18	4.92E-18	4.34E-18	3.99E-18	3.42E-18	3.34E-18
Ir-191m	8.32E-18	7.00E-18	6.27E-18	5.80E-18	5.03E-18	4.92E-18
Ir-192	1.03E-16	9.26E-17	8.49E-17	8.14E-17	7.26E-17	7.15E-17
Ir-192m	1.45E-20	1.14E-20	9.95E-21	9.37E-21	5.68E-21	5.50E-21
Ir-192n	1.30E-19	1.14E-19	1.06E-19	1.02E-19	8.92E-20	8.81E-20
Ir-193m	3.60E-20	2.91E-20	2.57E-20	2.36E-20	1.94E-20	1.89E-20
Ir-194	1.26E-17	1.14E-17	1.06E-17	1.02E-17	9.20E-18	9.08E-18

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ir-194m	2.94E-16	2.68E-16	2.47E-16	2.39E-16	2.14E-16	2.10E-16
Ir-195	6.61E-18	5.53E-18	4.95E-18	4.58E-18	3.98E-18	3.89E-18
Ir-195m	4.68E-17	4.20E-17	3.85E-17	3.69E-17	3.28E-17	3.23E-17
Ir-196	3.13E-17	2.87E-17	2.65E-17	2.57E-17	2.32E-17	2.29E-17
Ir-196m	3.11E-16	2.84E-16	2.61E-16	2.52E-16	2.26E-16	2.22E-16
Platinum						
Pt-184	8.83E-17	7.85E-17	7.17E-17	6.84E-17	6.06E-17	5.96E-17
Pt-186	8.54E-17	7.77E-17	7.16E-17	6.91E-17	6.18E-17	6.09E-17
Pt-187	7.68E-17	6.91E-17	6.35E-17	6.10E-17	5.45E-17	5.36E-17
Pt-188	2.42E-17	2.09E-17	1.89E-17	1.78E-17	1.56E-17	1.53E-17
Pt-189	5.99E-17	5.37E-17	4.93E-17	4.73E-17	4.22E-17	4.15E-17
Pt-190	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-191	3.50E-17	3.08E-17	2.80E-17	2.66E-17	2.35E-17	2.31E-17
Pt-193	5.39E-21	3.82E-21	3.22E-21	3.03E-21	8.86E-22	8.17E-22
Pt-193m	1.16E-18	9.52E-19	8.46E-19	7.77E-19	6.69E-19	6.53E-19
Pt-195m	7.88E-18	6.52E-18	5.80E-18	5.33E-18	4.60E-18	4.48E-18
Pt-197	2.89E-18	2.45E-18	2.21E-18	2.06E-18	1.80E-18	1.76E-18
Pt-197m	9.55E-18	8.29E-18	7.50E-18	7.07E-18	6.22E-18	6.11E-18
Pt-199	2.56E-17	2.33E-17	2.15E-17	2.07E-17	1.86E-17	1.83E-17
Pt-200	6.97E-18	5.97E-18	5.38E-18	5.03E-18	4.40E-18	4.31E-18
Pt-202	6.65E-19	6.35E-19	6.17E-19	6.08E-19	5.87E-19	5.85E-19
Gold						
Au-186	1.94E-16	1.76E-16	1.63E-16	1.58E-16	1.42E-16	1.40E-16
Au-187	1.40E-16	1.28E-16	1.19E-16	1.16E-16	1.05E-16	1.04E-16
Au-190	3.21E-16	2.95E-16	2.74E-16	2.68E-16	2.46E-16	2.43E-16
Au-191	7.35E-17	6.61E-17	6.06E-17	5.81E-17	5.18E-17	5.10E-17
Au-192	2.60E-16	2.38E-16	2.21E-16	2.16E-16	1.98E-16	1.95E-16
Au-193	1.95E-17	1.67E-17	1.51E-17	1.42E-17	1.24E-17	1.22E-17
Au-193m	2.44E-17	2.14E-17	1.94E-17	1.84E-17	1.63E-17	1.60E-17
Au-194	1.36E-16	1.24E-16	1.15E-16	1.12E-16	1.01E-16	9.98E-17
Au-195	8.77E-18	7.23E-18	6.42E-18	5.89E-18	5.07E-18	4.94E-18
Au-195m	2.48E-17	2.18E-17	1.98E-17	1.88E-17	1.66E-17	1.63E-17
Au-196	5.84E-17	5.21E-17	4.75E-17	4.54E-17	4.03E-17	3.96E-17
Au-196m	2.90E-17	2.50E-17	2.26E-17	2.12E-17	1.85E-17	1.82E-17
Au-198	5.07E-17	4.60E-17	4.23E-17	4.06E-17	3.63E-17	3.58E-17
Au-198m	6.53E-17	5.68E-17	5.14E-17	4.84E-17	4.25E-17	4.18E-17
Au-199	1.17E-17	1.02E-17	9.22E-18	8.65E-18	7.59E-18	7.45E-18
Au-200	3.68E-17	3.38E-17	3.13E-17	3.06E-17	2.77E-17	2.73E-17
Au-200m	2.51E-16	2.28E-16	2.10E-16	2.03E-16	1.81E-16	1.79E-16
Au-201	4.64E-18	4.25E-18	3.93E-18	3.80E-18	3.43E-18	3.38E-18
Au-202	2.38E-17	2.19E-17	2.03E-17	1.98E-17	1.80E-17	1.77E-17
Mercury						
Hg-190	2.35E-17	2.02E-17	1.82E-17	1.69E-17	1.48E-17	1.45E-17
Hg-191m	1.91E-16	1.74E-16	1.61E-16	1.55E-16	1.40E-16	1.38E-16
Hg-192	3.29E-17	2.85E-17	2.58E-17	2.43E-17	2.14E-17	2.10E-17
Hg-193	1.08E-16	9.88E-17	9.14E-17	8.87E-17	8.02E-17	7.91E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Hg-193m	1.32E-16	1.21E-16	1.12E-16	1.09E-16	9.81E-17	9.67E-17
Hg-194	7.64E-21	5.49E-21	4.47E-21	4.41E-21	1.35E-21	1.25E-21
Hg-195	2.42E-17	2.16E-17	1.97E-17	1.89E-17	1.68E-17	1.66E-17
Hg-195m	2.44E-17	2.16E-17	1.97E-17	1.88E-17	1.67E-17	1.64E-17
Hg-197	7.76E-18	6.40E-18	5.68E-18	5.21E-18	4.49E-18	4.38E-18
Hg-197m	1.12E-17	9.67E-18	8.73E-18	8.15E-18	7.13E-18	6.99E-18
Hg-199m	2.21E-17	1.93E-17	1.75E-17	1.64E-17	1.45E-17	1.42E-17
Hg-203	2.99E-17	2.65E-17	2.41E-17	2.29E-17	2.03E-17	2.00E-17
Hg-205	1.17E-18	1.07E-18	1.00E-18	9.65E-19	8.91E-19	8.82E-19
Hg-206	1.55E-17	1.39E-17	1.27E-17	1.21E-17	1.08E-17	1.07E-17
Hg-207	3.58E-16	3.29E-16	3.06E-16	2.99E-16	2.73E-16	2.70E-16
Thallium						
Tl-190	1.66E-16	1.52E-16	1.40E-16	1.35E-16	1.21E-16	1.20E-16
Tl-190m	3.13E-16	2.87E-16	2.65E-16	2.57E-16	2.30E-16	2.27E-16
Tl-194	1.15E-16	1.05E-16	9.70E-17	9.36E-17	8.38E-17	8.26E-17
Tl-194m	3.20E-16	2.93E-16	2.70E-16	2.61E-16	2.35E-16	2.31E-16
Tl-195	1.62E-16	1.48E-16	1.38E-16	1.34E-16	1.22E-16	1.21E-16
Tl-196	2.47E-16	2.27E-16	2.10E-16	2.05E-16	1.86E-16	1.84E-16
Tl-197	5.79E-17	5.23E-17	4.82E-17	4.65E-17	4.18E-17	4.11E-17
Tl-198	2.67E-16	2.45E-16	2.27E-16	2.22E-16	2.02E-16	1.99E-16
Tl-198m	1.52E-16	1.39E-16	1.28E-16	1.23E-16	1.10E-16	1.08E-16
Tl-199	3.05E-17	2.69E-17	2.45E-17	2.32E-17	2.06E-17	2.02E-17
Tl-200	1.70E-16	1.55E-16	1.43E-16	1.39E-16	1.26E-16	1.24E-16
Tl-201	1.03E-17	8.62E-18	7.70E-18	7.10E-18	6.15E-18	6.01E-18
Tl-202	5.72E-17	5.16E-17	4.72E-17	4.53E-17	4.03E-17	3.97E-17
Tl-204	2.95E-19	2.66E-19	2.51E-19	2.41E-19	2.26E-19	2.23E-19
Tl-206	5.20E-19	4.97E-19	4.84E-19	4.76E-19	4.61E-19	4.59E-19
Tl-206m	3.09E-16	2.82E-16	2.61E-16	2.52E-16	2.26E-16	2.23E-16
Tl-207	7.57E-19	7.15E-19	6.84E-19	6.72E-19	6.35E-19	6.30E-19
Tl-208	4.61E-16	4.26E-16	3.97E-16	3.90E-16	3.61E-16	3.57E-16
Tl-209	2.86E-16	2.62E-16	2.43E-16	2.37E-16	2.16E-16	2.13E-16
Tl-210	3.69E-16	3.39E-16	3.15E-16	3.08E-16	2.80E-16	2.76E-16
Lead						
Pb-194	1.40E-16	1.28E-16	1.18E-16	1.15E-16	1.04E-16	1.02E-16
Pb-195m	2.10E-16	1.92E-16	1.77E-16	1.71E-16	1.53E-16	1.51E-16
Pb-196	6.09E-17	5.44E-17	4.98E-17	4.76E-17	4.23E-17	4.16E-17
Pb-197	2.01E-16	1.84E-16	1.71E-16	1.67E-16	1.51E-16	1.49E-16
Pb-197m	1.49E-16	1.35E-16	1.24E-16	1.20E-16	1.08E-16	1.06E-16
Pb-198	5.40E-17	4.80E-17	4.38E-17	4.18E-17	3.71E-17	3.65E-17
Pb-199	1.36E-16	1.24E-16	1.15E-16	1.11E-16	1.01E-16	9.96E-17
Pb-200	2.45E-17	2.12E-17	1.91E-17	1.79E-17	1.57E-17	1.54E-17
Pb-201	9.56E-17	8.65E-17	7.96E-17	7.68E-17	6.86E-17	6.77E-17
Pb-201m	4.60E-17	4.22E-17	3.90E-17	3.77E-17	3.38E-17	3.33E-17
Pb-202	9.58E-21	6.71E-21	5.80E-21	5.31E-21	1.54E-21	1.41E-21
Pb-202m	2.56E-16	2.36E-16	2.18E-16	2.12E-16	1.91E-16	1.88E-16
Pb-203	3.84E-17	3.37E-17	3.06E-17	2.90E-17	2.55E-17	2.51E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Pb-204m	2.67E-16	2.46E-16	2.28E-16	2.22E-16	2.00E-16	1.97E-16
Pb-205	9.71E-21	6.80E-21	5.88E-21	5.37E-21	1.56E-21	1.43E-21
Pb-209	1.18E-19	1.15E-19	1.13E-19	1.12E-19	1.10E-19	1.10E-19
Pb-210	1.93E-19	1.47E-19	1.24E-19	1.15E-19	8.94E-20	8.67E-20
Pb-211	8.61E-18	7.92E-18	7.33E-18	7.12E-18	6.41E-18	6.32E-18
Pb-212	1.79E-17	1.56E-17	1.41E-17	1.34E-17	1.18E-17	1.16E-17
Pb-214	3.17E-17	2.83E-17	2.59E-17	2.47E-17	2.20E-17	2.16E-17
Bismuth						
Bi-197	2.22E-16	2.04E-16	1.89E-16	1.84E-16	1.66E-16	1.64E-16
Bi-200	3.11E-16	2.85E-16	2.63E-16	2.55E-16	2.29E-16	2.25E-16
Bi-201	2.29E-16	2.10E-16	1.95E-16	1.91E-16	1.73E-16	1.71E-16
Bi-202	3.56E-16	3.27E-16	3.03E-16	2.95E-16	2.66E-16	2.62E-16
Bi-203	3.17E-16	2.92E-16	2.71E-16	2.65E-16	2.41E-16	2.38E-16
Bi-204	3.80E-16	3.49E-16	3.24E-16	3.16E-16	2.85E-16	2.81E-16
Bi-205	2.25E-16	2.06E-16	1.92E-16	1.87E-16	1.71E-16	1.68E-16
Bi-206	4.26E-16	3.92E-16	3.63E-16	3.53E-16	3.19E-16	3.15E-16
Bi-207	1.99E-16	1.83E-16	1.69E-16	1.65E-16	1.49E-16	1.47E-16
Bi-208	3.70E-16	3.42E-16	3.19E-16	3.15E-16	2.93E-16	2.90E-16
Bi-210	3.21E-19	3.09E-19	3.03E-19	2.99E-19	2.91E-19	2.90E-19
Bi-210m	3.28E-17	2.91E-17	2.66E-17	2.53E-17	2.25E-17	2.21E-17
Bi-211	5.90E-18	5.30E-18	4.84E-18	4.63E-18	4.12E-18	4.06E-18
Bi-212	1.40E-17	1.29E-17	1.20E-17	1.17E-17	1.06E-17	1.05E-17
Bi-212n	5.02E-19	4.81E-19	4.69E-19	4.62E-19	4.48E-19	4.47E-19
Bi-213	1.64E-17	1.49E-17	1.37E-17	1.32E-17	1.18E-17	1.17E-17
Bi-214	1.99E-16	1.83E-16	1.70E-16	1.66E-16	1.52E-16	1.50E-16
Bi-215	3.29E-17	2.98E-17	2.74E-17	2.65E-17	2.37E-17	2.34E-17
Bi-216	9.45E-17	8.66E-17	7.99E-17	7.72E-17	6.92E-17	6.82E-17
Polonium						
Po-203	2.13E-16	1.96E-16	1.82E-16	1.77E-16	1.60E-16	1.58E-16
Po-204	1.47E-16	1.34E-16	1.24E-16	1.20E-16	1.07E-16	1.06E-16
Po-205	2.07E-16	1.90E-16	1.76E-16	1.72E-16	1.55E-16	1.53E-16
Po-206	1.52E-16	1.39E-16	1.28E-16	1.24E-16	1.11E-16	1.10E-16
Po-207	1.66E-16	1.53E-16	1.41E-16	1.38E-16	1.24E-16	1.22E-16
Po-208	2.67E-21	2.43E-21	2.23E-21	2.15E-21	1.93E-21	1.90E-21
Po-209	7.89E-19	7.17E-19	6.61E-19	6.39E-19	5.72E-19	5.64E-19
Po-210	1.26E-21	1.16E-21	1.08E-21	1.05E-21	9.42E-22	9.30E-22
Po-211	1.05E-18	9.69E-19	8.98E-19	8.74E-19	7.86E-19	7.75E-19
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-212m	1.09E-17	1.01E-17	9.44E-18	9.29E-18	8.61E-18	8.51E-18
Po-213	4.83E-21	4.46E-21	4.13E-21	4.03E-21	3.62E-21	3.57E-21
Po-214	1.07E-20	9.89E-21	9.17E-21	8.94E-21	8.04E-21	7.93E-21
Po-215	2.21E-20	2.01E-20	1.85E-20	1.78E-20	1.59E-20	1.56E-20
Po-216	1.98E-21	1.82E-21	1.69E-21	1.65E-21	1.48E-21	1.46E-21
Po-218	3.01E-24	2.92E-24	2.88E-24	2.86E-24	2.82E-24	2.81E-24
Astatine						
At-204	2.94E-16	2.69E-16	2.49E-16	2.41E-16	2.16E-16	2.13E-16

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
At-205	1.47E-16	1.35E-16	1.25E-16	1.21E-16	1.09E-16	1.08E-16
At-206	3.17E-16	2.91E-16	2.69E-16	2.61E-16	2.34E-16	2.31E-16
At-207	2.63E-16	2.42E-16	2.24E-16	2.18E-16	1.98E-16	1.95E-16
At-208	3.94E-16	3.62E-16	3.35E-16	3.26E-16	2.95E-16	2.91E-16
At-209	2.92E-16	2.68E-16	2.48E-16	2.40E-16	2.16E-16	2.13E-16
At-210	3.94E-16	3.62E-16	3.36E-16	3.28E-16	2.98E-16	2.95E-16
At-211	4.00E-18	3.36E-18	3.02E-18	2.79E-18	2.42E-18	2.36E-18
At-215	2.14E-20	1.94E-20	1.78E-20	1.70E-20	1.52E-20	1.50E-20
At-216	2.90E-19	2.48E-19	2.23E-19	2.08E-19	1.82E-19	1.78E-19
At-217	3.05E-20	2.71E-20	2.47E-20	2.36E-20	2.09E-20	2.06E-20
At-218	1.41E-21	1.33E-21	1.28E-21	1.26E-21	1.21E-21	1.20E-21
At-219	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
At-220	5.83E-17	5.23E-17	4.78E-17	4.58E-17	4.08E-17	4.02E-17
Radon						
Rn-207	1.25E-16	1.14E-16	1.05E-16	1.02E-16	9.11E-17	8.98E-17
Rn-209	1.54E-16	1.41E-16	1.31E-16	1.27E-16	1.14E-16	1.13E-16
Rn-210	7.70E-18	7.02E-18	6.48E-18	6.27E-18	5.62E-18	5.54E-18
Rn-211	2.44E-16	2.24E-16	2.08E-16	2.02E-16	1.83E-16	1.80E-16
Rn-212	4.31E-20	3.98E-20	3.68E-20	3.58E-20	3.21E-20	3.17E-20
Rn-215	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-217	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-218	9.57E-20	8.81E-20	8.14E-20	7.89E-20	7.08E-20	6.98E-20
Rn-219	7.35E-18	6.57E-18	6.00E-18	5.74E-18	5.09E-18	5.02E-18
Rn-220	7.90E-20	7.26E-20	6.70E-20	6.47E-20	5.81E-20	5.72E-20
Rn-222	4.88E-20	4.47E-20	4.12E-20	3.98E-20	3.56E-20	3.51E-20
Rn-223	4.37E-17	3.99E-17	3.69E-17	3.57E-17	3.20E-17	3.16E-17
Francium						
Fr-212	1.49E-16	1.36E-16	1.26E-16	1.23E-16	1.11E-16	1.10E-16
Fr-219	4.46E-19	4.03E-19	3.69E-19	3.53E-19	3.15E-19	3.10E-19
Fr-220	1.08E-18	9.22E-19	8.30E-19	7.71E-19	6.69E-19	6.55E-19
Fr-221	3.67E-18	3.21E-18	2.91E-18	2.75E-18	2.42E-18	2.38E-18
Fr-222	2.30E-17	2.04E-17	1.86E-17	1.78E-17	1.58E-17	1.56E-17
Fr-223	6.33E-18	5.40E-18	4.86E-18	4.58E-18	4.00E-18	3.92E-18
Fr-224	7.33E-17	6.69E-17	6.20E-17	6.02E-17	5.45E-17	5.38E-17
Fr-227	5.66E-17	5.11E-17	4.70E-17	4.51E-17	4.03E-17	3.97E-17
Radium						
Ra-219	2.12E-17	1.89E-17	1.72E-17	1.64E-17	1.46E-17	1.44E-17
Ra-220	5.85E-19	5.34E-19	4.92E-19	4.73E-19	4.24E-19	4.17E-19
Ra-221	4.37E-18	3.79E-18	3.43E-18	3.21E-18	2.80E-18	2.75E-18
Ra-222	1.15E-18	1.03E-18	9.43E-19	9.02E-19	8.01E-19	7.89E-19
Ra-223	1.69E-17	1.48E-17	1.34E-17	1.27E-17	1.12E-17	1.10E-17
Ra-224	1.31E-18	1.15E-18	1.04E-18	9.91E-19	8.75E-19	8.61E-19
Ra-225	9.53E-19	7.07E-19	5.96E-19	5.50E-19	4.46E-19	4.34E-19
Ra-226	9.16E-19	7.98E-19	7.22E-19	6.81E-19	5.98E-19	5.88E-19
Ra-227	1.79E-17	1.61E-17	1.47E-17	1.41E-17	1.25E-17	1.23E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Ra-228	2.70E-20	1.92E-20	1.57E-20	1.68E-20	7.04E-21	6.54E-21
Ra-230	9.61E-18	8.50E-18	7.75E-18	7.35E-18	6.51E-18	6.40E-18
Actinium						
Ac-223	2.13E-18	1.88E-18	1.71E-18	1.62E-18	1.43E-18	1.41E-18
Ac-224	2.78E-17	2.40E-17	2.18E-17	2.04E-17	1.79E-17	1.76E-17
Ac-225	1.71E-18	1.48E-18	1.34E-18	1.25E-18	1.09E-18	1.07E-18
Ac-226	1.64E-17	1.44E-17	1.30E-17	1.23E-17	1.08E-17	1.07E-17
Ac-227	1.55E-20	1.21E-20	1.05E-20	1.02E-20	7.28E-21	7.05E-21
Ac-228	1.13E-16	1.04E-16	9.63E-17	9.39E-17	8.47E-17	8.36E-17
Ac-230	7.36E-17	6.77E-17	6.30E-17	6.16E-17	5.63E-17	5.56E-17
Ac-231	5.25E-17	4.65E-17	4.24E-17	4.03E-17	3.57E-17	3.52E-17
Ac-232	1.57E-16	1.44E-16	1.34E-16	1.32E-16	1.21E-16	1.19E-16
Ac-233	6.35E-17	5.83E-17	5.38E-17	5.20E-17	4.67E-17	4.60E-17
Thorium						
Th-223	8.44E-18	7.22E-18	6.52E-18	6.06E-18	5.28E-18	5.17E-18
Th-224	2.85E-18	2.50E-18	2.27E-18	2.15E-18	1.89E-18	1.86E-18
Th-226	9.57E-19	8.27E-19	7.49E-19	7.03E-19	6.14E-19	6.02E-19
Th-227	1.53E-17	1.34E-17	1.22E-17	1.16E-17	1.02E-17	1.00E-17
Th-228	2.59E-19	2.20E-19	1.97E-19	1.85E-19	1.58E-19	1.55E-19
Th-229	1.01E-17	8.66E-18	7.81E-18	7.28E-18	6.33E-18	6.20E-18
Th-230	5.59E-20	4.54E-20	3.99E-20	3.77E-20	2.94E-20	2.86E-20
Th-231	1.53E-18	1.25E-18	1.12E-18	1.04E-18	8.69E-19	8.47E-19
Th-232	3.30E-20	2.59E-20	2.24E-20	2.14E-20	1.55E-20	1.50E-20
Th-233	4.71E-18	4.27E-18	3.94E-18	3.80E-18	3.41E-18	3.36E-18
Th-234	1.02E-18	8.53E-19	7.63E-19	7.05E-19	6.06E-19	5.92E-19
Th-235	7.50E-18	6.91E-18	6.41E-18	6.22E-18	5.62E-18	5.55E-18
Th-236	4.47E-18	4.02E-18	3.71E-18	3.55E-18	3.18E-18	3.13E-18
Protactinium						
Pa-227	2.27E-18	1.90E-18	1.71E-18	1.58E-18	1.36E-18	1.33E-18
Pa-228	1.76E-16	1.61E-16	1.49E-16	1.45E-16	1.31E-16	1.29E-16
Pa-229	7.17E-18	6.09E-18	5.50E-18	5.09E-18	4.42E-18	4.33E-18
Pa-230	8.51E-17	7.79E-17	7.21E-17	7.00E-17	6.28E-17	6.20E-17
Pa-231	4.29E-18	3.77E-18	3.42E-18	3.26E-18	2.86E-18	2.82E-18
Pa-232	1.20E-16	1.11E-16	1.03E-16	1.00E-16	9.00E-17	8.88E-17
Pa-233	2.68E-17	2.37E-17	2.16E-17	2.06E-17	1.82E-17	1.79E-17
Pa-234	1.89E-16	1.73E-16	1.60E-16	1.56E-16	1.40E-16	1.38E-16
Pa-234m	3.03E-18	2.82E-18	2.65E-18	2.59E-18	2.39E-18	2.36E-18
Pa-235	4.27E-19	4.10E-19	4.00E-19	3.95E-19	3.83E-19	3.82E-19
Pa-236	1.21E-16	1.12E-16	1.04E-16	1.01E-16	9.23E-17	9.11E-17
Pa-237	7.89E-17	7.27E-17	6.74E-17	6.57E-17	5.90E-17	5.82E-17
Uranium						
U-227	1.43E-17	1.24E-17	1.13E-17	1.06E-17	9.35E-18	9.19E-18
U-228	4.86E-19	4.17E-19	3.76E-19	3.53E-19	3.05E-19	2.99E-19
U-230	1.52E-19	1.27E-19	1.13E-19	1.07E-19	8.82E-20	8.61E-20
U-231	8.29E-18	7.00E-18	6.31E-18	5.86E-18	5.05E-18	4.94E-18
U-232	4.63E-20	3.62E-20	3.15E-20	3.07E-20	2.14E-20	2.07E-20

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
U-233	3.83E-20	3.14E-20	2.78E-20	2.67E-20	2.08E-20	2.03E-20
U-234	3.10E-20	2.35E-20	2.01E-20	1.99E-20	1.25E-20	1.20E-20
U-235	2.03E-17	1.77E-17	1.60E-17	1.51E-17	1.32E-17	1.30E-17
U-235m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-236	2.25E-20	1.66E-20	1.41E-20	1.42E-20	8.00E-21	7.61E-21
U-237	1.60E-17	1.37E-17	1.24E-17	1.16E-17	1.01E-17	9.88E-18
U-238	1.85E-20	1.37E-20	1.17E-20	1.18E-20	6.83E-21	6.51E-21
U-239	6.08E-18	5.19E-18	4.69E-18	4.38E-18	3.85E-18	3.77E-18
U-240	6.13E-19	5.17E-19	4.67E-19	4.40E-19	3.73E-19	3.65E-19
U-242	5.30E-18	4.75E-18	4.35E-18	4.17E-18	3.72E-18	3.66E-18
Neptunium						
Np-232	1.52E-16	1.39E-16	1.28E-16	1.24E-16	1.11E-16	1.10E-16
Np-233	1.02E-17	8.76E-18	7.94E-18	7.40E-18	6.45E-18	6.32E-18
Np-234	1.47E-16	1.35E-16	1.26E-16	1.23E-16	1.12E-16	1.10E-16
Np-235	1.26E-19	9.77E-20	8.55E-20	8.35E-20	5.70E-20	5.50E-20
Np-236	1.68E-17	1.44E-17	1.31E-17	1.22E-17	1.06E-17	1.04E-17
Np-236m	5.65E-18	4.89E-18	4.45E-18	4.16E-18	3.65E-18	3.57E-18
Np-237	2.77E-18	2.31E-18	2.06E-18	1.92E-18	1.64E-18	1.60E-18
Np-238	7.65E-17	7.07E-17	6.58E-17	6.43E-17	5.80E-17	5.73E-17
Np-239	2.16E-17	1.88E-17	1.71E-17	1.61E-17	1.41E-17	1.39E-17
Np-240	1.34E-16	1.23E-16	1.14E-16	1.10E-16	9.91E-17	9.77E-17
Np-240m	4.14E-17	3.81E-17	3.53E-17	3.42E-17	3.09E-17	3.04E-17
Np-241	4.85E-18	4.24E-18	3.88E-18	3.66E-18	3.24E-18	3.18E-18
Np-242	3.64E-17	3.35E-17	3.12E-17	3.06E-17	2.79E-17	2.75E-17
Np-242m	1.17E-16	1.08E-16	9.99E-17	9.72E-17	8.73E-17	8.61E-17
Plutonium						
Pu-232	7.02E-18	6.00E-18	5.43E-18	5.04E-18	4.39E-18	4.30E-18
Pu-234	7.60E-18	6.49E-18	5.87E-18	5.46E-18	4.75E-18	4.65E-18
Pu-235	1.05E-17	9.01E-18	8.17E-18	7.64E-18	6.66E-18	6.53E-18
Pu-236	2.80E-20	2.00E-20	1.71E-20	1.74E-20	9.37E-21	8.85E-21
Pu-237	5.49E-18	4.67E-18	4.22E-18	3.92E-18	3.40E-18	3.33E-18
Pu-238	2.38E-20	1.67E-20	1.42E-20	1.46E-20	7.41E-21	6.96E-21
Pu-239	1.71E-20	1.32E-20	1.15E-20	1.14E-20	7.72E-21	7.45E-21
Pu-240	2.28E-20	1.61E-20	1.37E-20	1.40E-20	7.23E-21	6.80E-21
Pu-241	1.87E-22	1.60E-22	1.45E-22	1.35E-22	1.17E-22	1.14E-22
Pu-242	2.95E-20	2.30E-20	2.03E-20	2.04E-20	1.39E-20	1.35E-20
Pu-243	2.86E-18	2.43E-18	2.19E-18	2.04E-18	1.78E-18	1.74E-18
Pu-244	2.69E-18	2.48E-18	2.30E-18	2.26E-18	2.06E-18	2.03E-18
Pu-245	5.11E-17	4.65E-17	4.29E-17	4.14E-17	3.71E-17	3.65E-17
Pu-246	1.63E-17	1.40E-17	1.27E-17	1.19E-17	1.04E-17	1.02E-17
Americium						
Am-237	4.50E-17	4.00E-17	3.66E-17	3.48E-17	3.09E-17	3.04E-17
Am-238	1.16E-16	1.06E-16	9.86E-17	9.59E-17	8.64E-17	8.52E-17
Am-239	2.79E-17	2.41E-17	2.19E-17	2.05E-17	1.80E-17	1.76E-17
Am-240	1.33E-16	1.22E-16	1.14E-16	1.11E-16	9.96E-17	9.83E-17
Am-241	2.36E-18	1.88E-18	1.64E-18	1.51E-18	1.26E-18	1.23E-18

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Am-242	1.74E-18	1.49E-18	1.35E-18	1.27E-18	1.10E-18	1.08E-18
Am-242m	9.92E-20	7.23E-20	6.31E-20	6.24E-20	4.02E-20	3.84E-20
Am-243	6.23E-18	5.14E-18	4.57E-18	4.19E-18	3.61E-18	3.52E-18
Am-244	1.01E-16	9.33E-17	8.64E-17	8.41E-17	7.55E-17	7.44E-17
Am-244m	2.39E-18	2.21E-18	2.07E-18	2.03E-18	1.85E-18	1.83E-18
Am-245	4.01E-18	3.51E-18	3.20E-18	3.02E-18	2.67E-18	2.63E-18
Am-246	9.26E-17	8.45E-17	7.80E-17	7.54E-17	6.75E-17	6.65E-17
Am-246m	1.28E-16	1.18E-16	1.10E-16	1.08E-16	9.72E-17	9.60E-17
Am-247	1.66E-17	1.46E-17	1.33E-17	1.25E-17	1.11E-17	1.09E-17
Curium						
Cm-238	9.22E-18	7.90E-18	7.16E-18	6.66E-18	5.80E-18	5.68E-18
Cm-239	3.11E-17	2.70E-17	2.44E-17	2.29E-17	2.01E-17	1.97E-17
Cm-240	2.96E-20	2.06E-20	1.77E-20	1.80E-20	9.77E-21	9.19E-21
Cm-241	6.07E-17	5.48E-17	5.03E-17	4.81E-17	4.29E-17	4.22E-17
Cm-242	2.60E-20	1.80E-20	1.55E-20	1.58E-20	8.44E-21	7.93E-21
Cm-243	1.57E-17	1.37E-17	1.24E-17	1.17E-17	1.03E-17	1.01E-17
Cm-244	2.41E-20	1.71E-20	1.49E-20	1.51E-20	8.67E-21	8.22E-21
Cm-245	1.21E-17	1.04E-17	9.39E-18	8.75E-18	7.63E-18	7.47E-18
Cm-246	5.05E-19	4.62E-19	4.29E-19	4.20E-19	3.80E-19	3.75E-19
Cm-247	3.93E-17	3.55E-17	3.26E-17	3.13E-17	2.79E-17	2.75E-17
Cm-248	1.77E-16	1.63E-16	1.52E-16	1.49E-16	1.36E-16	1.35E-16
Cm-249	2.61E-18	2.40E-18	2.23E-18	2.16E-18	1.95E-18	1.92E-18
Cm-250	1.80E-15	1.66E-15	1.55E-15	1.51E-15	1.39E-15	1.37E-15
Cm-251	1.42E-17	1.30E-17	1.20E-17	1.16E-17	1.04E-17	1.03E-17
Berkelium						
Bk-245	2.75E-17	2.39E-17	2.17E-17	2.04E-17	1.79E-17	1.76E-17
Bk-246	1.08E-16	9.96E-17	9.23E-17	8.98E-17	8.06E-17	7.95E-17
Bk-247	1.77E-17	1.54E-17	1.40E-17	1.31E-17	1.15E-17	1.13E-17
Bk-248m	6.48E-18	5.77E-18	5.29E-18	5.04E-18	4.47E-18	4.39E-18
Bk-249	6.68E-22	5.99E-22	5.69E-22	5.57E-22	5.18E-22	5.14E-22
Bk-250	1.18E-16	1.09E-16	1.01E-16	9.89E-17	8.92E-17	8.81E-17
Bk-251	1.03E-17	8.94E-18	8.13E-18	7.60E-18	6.66E-18	6.52E-18
Californium						
Cf-244	2.89E-20	1.95E-20	1.68E-20	1.70E-20	9.23E-21	8.64E-21
Cf-246	2.55E-20	1.83E-20	1.61E-20	1.61E-20	1.03E-20	9.81E-21
Cf-247	1.08E-17	9.29E-18	8.43E-18	7.88E-18	6.86E-18	6.72E-18
Cf-248	6.97E-20	5.81E-20	5.29E-20	5.22E-20	4.24E-20	4.15E-20
Cf-249	4.06E-17	3.66E-17	3.35E-17	3.22E-17	2.86E-17	2.82E-17
Cf-250	1.34E-18	1.24E-18	1.15E-18	1.13E-18	1.03E-18	1.01E-18
Cf-251	1.43E-17	1.24E-17	1.13E-17	1.06E-17	9.26E-18	9.08E-18
Cf-252	6.16E-17	5.68E-17	5.28E-17	5.17E-17	4.73E-17	4.68E-17
Cf-253	1.12E-19	8.16E-20	7.17E-20	7.04E-20	5.03E-20	4.85E-20
Cf-254	2.28E-15	2.10E-15	1.95E-15	1.91E-15	1.75E-15	1.73E-15
Cf-255	1.38E-19	1.34E-19	1.32E-19	1.31E-19	1.28E-19	1.28E-19
Einsteinium						
Es-249	5.07E-17	4.57E-17	4.19E-17	4.02E-17	3.58E-17	3.53E-17

Table 4-7. Reference person effective dose rate coefficients for water immersion. (continued)

	Reference Person Coefficients (Sv Bq^{-1} s^{-1} m^3)					
Nuclide	Newborn	1-yr-old	5-yr-old	10-yr-old	15-yr-old	Adult
Es-250	1.50E-16	1.36E-16	1.26E-16	1.21E-16	1.08E-16	1.07E-16
Es-250m	7.09E-17	6.48E-17	6.00E-17	5.84E-17	5.25E-17	5.18E-17
Es-251	1.08E-17	9.28E-18	8.41E-18	7.85E-18	6.84E-18	6.69E-18
Es-253	4.75E-20	4.07E-20	3.69E-20	3.55E-20	3.01E-20	2.95E-20
Es-254	5.86E-19	4.55E-19	4.00E-19	3.85E-19	2.91E-19	2.82E-19
Es-254m	5.99E-17	5.52E-17	5.10E-17	4.96E-17	4.45E-17	4.39E-17
Es-255	1.11E-19	1.03E-19	9.68E-20	9.51E-20	8.82E-20	8.73E-20
Es-256	6.13E-19	5.68E-19	5.48E-19	5.40E-19	5.11E-19	5.08E-19
Fermium						
Fm-251	1.86E-17	1.65E-17	1.51E-17	1.43E-17	1.26E-17	1.24E-17
Fm-252	6.19E-20	5.03E-20	4.54E-20	4.46E-20	3.58E-20	3.49E-20
Fm-253	7.01E-18	6.03E-18	5.47E-18	5.12E-18	4.45E-18	4.36E-18
Fm-254	9.73E-19	8.91E-19	8.27E-19	8.11E-19	7.36E-19	7.27E-19
Fm-255	4.14E-19	3.10E-19	2.71E-19	2.61E-19	1.86E-19	1.79E-19
Fm-256	1.68E-15	1.55E-15	1.44E-15	1.41E-15	1.29E-15	1.27E-15
Fm-257	1.76E-17	1.55E-17	1.41E-17	1.34E-17	1.18E-17	1.16E-17

CHAPTER 5. APPLICATION CONSIDERATIONS

This chapter discusses some potentially important considerations in applying the dose rate coefficients to obtain realistic estimates of doses to members of the public. Applicability of the coefficients to a specific exposure is influenced by those exposure conditions that differ from the assumptions in the derivation of the coefficients and other factors that may 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. Also, radionuclides may be distributed heterogeneously in the environment. Modifying factors have historically been used with dose rate coefficients to estimate the dose for radiation fields that depart substantially from idealized fields. Environmental factors can influence the time-integrated activity that characterizes exposure, and an individual's lifestyle 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. In prospective assessments, the combined influence of such factors is frequently expressed as a single modifying factor that can be multiplied by a tabulated dose rate coefficient.

5.1 Radionuclide decay chains

The tabulations contain separate entries for radionuclide decay chain members addressed in ICRP Publication 107 (2008). The dose rate coefficients tabulated in this report for a given radionuclide do not include contributions to dose from radioactive decay products formed in the spontaneous nuclear transformation of the radionuclide.

Dose rate coefficients for a radionuclide and its progeny should be combined only after consideration of (1) the equations describing production and decay of daughter radionuclides over time and (2) the 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 often have been made when considering radioactive progeny following an "instantaneous" deposition of the parent nuclide, that is, a deposition that occurs in a time period that is short compared to the half-life of the radionuclide and to the integration time of interest (DOE, 1988; Jacob et al., 1988a). Such assumptions should no longer be necessary, because access to personal computers makes solution of the appropriate equations an easy 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 be applied readily to the dose rate coefficients tabulated in this report to estimate equivalent doses.

5.2 Spontaneous fission

Spontaneous fission (SF) is a decay mode resulting in splitting of the nucleus into lighter nuclei referred to as "fission fragments." The radiations concomitant with SF include fission fragments, neutron, delayed beta, and prompt and delayed gamma emissions. SF occurs to some extent for 28 of the 1,252 radionuclides addressed in this report: ^{238}U, ^{236}Pu, ^{238}Pu, ^{240}Pu, ^{242}Pu, ^{244}Pu, ^{240}Cm, ^{242}Cm, ^{244}Cm, ^{245}Cm, ^{246}Cm, ^{248}Cm, ^{250}Cm, ^{246}Cf, ^{248}Cf, ^{249}Cf, ^{250}Cf, ^{252}Cf, ^{254}Cf, ^{253}Es, ^{254}Es, ^{254m}Es, ^{255}Es, ^{252}Fm, ^{254}Fm, ^{255}Fm,

^{256}Fm and ^{257}Fm. The SF yield for each of these radionuclides is listed in Table A-1 in Appendix A. The SF yield is extremely low in most cases, but it represents a substantial portion of the emitted energy for four radionuclides: ^{248}Cm (SF yield, 8.39%), ^{250}Cm (SF yield, 74.0%), ^{252}Cf (SF yield, 3.092%) and ^{254}Cf (SF yield, 99.69%). Empirical relationships describing the continuous energy spectra of photons, electrons and neutrons from spontaneous fission, as needed in dosimetric evaluations, have been developed (Dillman and Jones, 1975; Endo et al., 2005). However, detailed information has not been assembled on the radiation field resulting from distributed sources of neutrons in the environment.

Prompt and delayed emissions (photons and beta particles) following spontaneous fission are included in the decay data tabulations of ICRP Publication 107 (2008) and thus are included in the calculations of dose rate coefficients tabulated in this report. The contribution to dose from neutrons accompanying spontaneous fission is not included. This may result in a substantial underestimate of external dose for ^{248}Cm, ^{250}Cm, ^{252}Cf and ^{254}Cf.

5.3 Computational models of the human body

In Federal Guidance Report No. 12 (EPA, 1993), dose estimates from monoenergetic photon sources were made for 25 tissues. Dose rate coefficients were tabulated in Federal Guidance Report No. 12 for effective dose, the gonad, breast, lung, red marrow, bone surface, thyroid, remainder and skin. The effective dose rate coefficients were based on an adult hermaphrodite phantom (inclusive of both male and female organs and tissues). This report is based on a modification of the ORNL series of stylized age-dependent hermaphrodite phantoms used in the preparation of Federal Guidance Report No. 12. The following modifications were made: (1) previously published stylized models of the head and brain, the extrathoracic-thoracic airways, the kidneys and the rectosigmoid colon were incorporated within the mathematical structure of the ORNL model series; (2) new models of the salivary glands and the mucosa layer of the alimentary tract organs, the respiratory tract airways, and the urinary bladder were designed for each phantom age; and (3) tissue compositions and mass densities published in ICRP Publication 89 (2002) and ICRU Report 46 (1992) were adopted. When mathematical adjustments to organ volumes were feasible as constrained by the boundaries of adjacent organs, these changes were made in order to bring revised organ masses to within ≈10 percent of their age-dependent values given in ICRP Publication 89. The revised ORNL series then was incorporated within the input structure of the MCNP6 Monte Carlo radiation transport code for simulation of external dose from photon and electron sources. More details about the phantoms as they apply to external dose coefficients in this report are found in Appendix B.

5.4 Pathway-specific modifying factors and exposures

This section discusses modifying factors that can be used with the dose rate 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 rate coefficients for particular exposure modes to obtain more realistic estimates of equivalent doses to members of the public. Much of the discussion below is taken from a paper by 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; for example, 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

$$H_T = h_T \sum_{i=1}^{n} S_i \int_{t_1}^{t_2} R_i(t)\, C(t)\, dt \tag{14}$$

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 rate coefficient h_T; the function $R_i(t)$ defines whether exposure condition i is in effect at time t (it is a Heaviside function, having a value of 1 at times when condition i is applicable, and 0 when it is not); 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 usually is not available to characterize $R_i(t)$. Then, exposure condition i is assumed, on average, to represent a fraction, $\overline{R}_i$, of the exposure period, and Eq. (14) reduces to:

$$H_T = h_T \left[\int_{t_1}^{t_2} C(t)\, dt\right] \sum_{i=1}^{n} S_i\, \bar{R}_i \tag{15}$$

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; for example, 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, often is 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 used with extreme caution when the strength of the radiation field is highly time-dependent; for example, following an acute release of short-lived radionuclides to the environment.

5.4.1 Contaminated shorelines

The dose rate coefficients for exposure to contaminated soil in Tables 4-1 through 4-5 assume that the photons and electrons originate uniformly within the contaminated volume. It is further assumed that the source region is infinite in extent and, thus, is appropriate for large areas that are contaminated by deposition of radionuclides from the atmosphere or by irrigation with contaminated water. Exposure to contaminated soil also may occur during fishing or hiking along shorelines of finite width that are contaminated by deposition of radionuclides from water.

For photon exposure, the U.S. Nuclear Regulatory Commission (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 shoreline dose-reduction factors do not include consideration of exposure times. As discussed earlier, the dose rate coefficients for exposure to contaminated ground surface include consideration of ground roughness; thus, no additional factors are required.

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 rate coefficient from exposure to shorelines of finite width should be about the same as the dose rate coefficient for exposure to an infinite ground surface; that is, the dose-reduction factor should be nearly unity. However, the high moisture content of the shoreline also would 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 rate coefficients for exposure to contaminated shorelines.

Although site-specific data for exposure times to contaminated shorelines can be used when available, 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.

5.4.2 Exposure during boating activities

The dose rate coefficients for immersion in contaminated water in Table 4-7 assume immersion in an infinite pool and, thus, are appropriate for exposure while swimming. External exposure to contaminated water also can 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 equivalent doses. 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 equivalent dose 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; that is, that the electron equivalent dose 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 percent or more would be reasonable. For individuals who engage only in recreational boating activities, an exposure time as high as 5 percent (44 hours per year) would be reasonable.

5.4.3 Effects of indoor residence

The dose rate coefficients for air submersion and exposure to contaminated soil tabulated in Chapter 3 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 doses 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 houses. In some cases, it may be more appropriate to assume that individuals are exposed in house basements, schools, apartment houses or office buildings. These structures generally provide significantly greater shielding than living areas in single-family houses. 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 house 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. For 0.68 MeV photons, 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-story structures. Neighboring structures also can 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, NRC (1977) has recommended 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 greater than a few hundred keV. For photons of lower energy, use of these factors may considerably overestimate the equivalent dose (Kocher, 1980). Note that the difference in the two modifying factors implies a different fraction of time spent indoors; that is, about 60 percent for maximally exposed individuals and effectively 100 percent for average individuals in population groups. In both cases, the individuals are presumed to spend 100 percent 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 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 also will depend on the timing and extent of building ventilation. For such releases, it may be prudent to assume no reduction in external dose 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 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–NRC, 1964), which is a representative radius of rooms in single-family houses. 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 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 during indoor residence, but by unknown amounts.

Indoor residence times recommended by NRC (1977) for maximally exposed and average individuals are 60 percent and nearly 100 percent, 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 activity factors relevant to dose assessment, see Chapter 16 of the EPA Exposure Factors Handbook (EPA, 2011). That handbook suggests that, as median values, children under 12 years of age may spend about 20 percent of their time at school and approximately 20 percent of their time outdoors. Similarly, adults ages 18 to 64 years typically spend about 20 percent of their time outdoors.

Shielding factors for U.S. residential structures applicable to airborne sources and deposited activity recently have been developed by Dickson and colleagues (Dickson and Hamby, 2014; Dickson et al., 2015; Dickson and Hamby, 2016). These investigations address a wide range of housing construction within the United States and provide both floor-specific and average shielding factors. The shielding factors are based on kerma coefficients and, as such, can be applied to both open-field projections and field measurements.

5.4.4 Conclusions

Application of the dose rate 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 preceding 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. It is 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. (14) and (15). When these two aspects are combined, it is difficult to judge the reasonableness of the resulting single factor.

The modifying factors developed for prospective assessments of chronic low-level exposures generally will 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 rate coefficients tabulated in this report must be determined by the user at the time of the dose assessment.

5.5 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 (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.

External exposure to electrons from radionuclides distributed in subsurface 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–NRC, 1964). Therefore, calculations of electron dose 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 rate coefficients for volume sources in this report are based on the conservative assumption of an infinitely thick source. However, bremsstrahlung generated as the emitted electrons stop within the soil does contribute to the dose to skin and other tissues.

APPENDIX A. NUCLEAR DECAY DATA

The previous versions of this report included nuclear decay characteristics of each radionuclide in Table A-1. Data were presented for 1,252 nuclides of 97 elements as obtained from ICRP Publication 107 (2008). In the 2025 revision, this table was deemed unnecessarily duplicative and was removed. Readers are referred to Annex A of ICRP Publication 107 for nuclear decay data, available on the ICRP website: https://www.icrp.org/publication.asp?id=ICRP%20Publication%20107.

APPENDIX B. MODIFICATIONS TO THE HUMAN PHANTOM

This appendix focuses on the differences in the mathematical phantoms used in this report and the phantom used in Federal Guidance Report No. 12 (EPA, 1993). In Federal Guidance Report No. 12, dose rate coefficients were computed for 25 tissues of an adult; the printed tables provided values for the gonad, breast, lung, red marrow, bone surface, thyroid, remainder, skin and for effective dose. The effective dose coefficients were based on an adult hermaphrodite phantom and the tissue weighting factors of ICRP Publication 26 (1977); thus the skin dose coefficient was not part of the effective dose coefficient. In this report, tissue dose rate coefficients were computed for 28 tissues in each of the phantoms as described below. Effective dose rate coefficients in this report are based on an average of the male and female tissue coefficients, as recommended in ICRP Publication 103 (2007).

The series of stylized (or mathematical) computational phantoms used in this report are modifications (Han et al., 2006) of the computational phantoms developed at ORNL in the 1980s (Cristy and Eckerman, 1987). The original ORNL age-specific phantoms have been used extensively (e.g., EPA, 1993; Eckerman et al., 1999; ICRP, 1990, 1992, 1994, 1995a, 1995b, 2001). The ORNL series of phantoms utilize three-dimensional surface equations to represent both internal organ structure and external body shape. The ORNL series are hermaphrodites (inclusive of both male and female reproductive organs) and include mathematical representations of a newborn, children at ages 1, 5, 10 and 15 years, and an adult. In their original design, adult organ volumes (defined by mathematical equations) were set so that their product with reference tissue densities provided reasonable agreement with reference organ masses given in ICRP Publication 23 (1975). Because reference organ masses for pre-adult ages were not given in ICRP Publication 23, other literature sources were consulted during model construction (Cristy, 1980). For all phantoms except the newborn, three tissue compositions were assumed: soft tissue (1.04 g cm^{-3}), homogeneous skeleton (bone and marrow at 1.4 g cm^{-3}) and homogeneous lung (soft tissue and air at 0.296 g cm^{-3}). The elemental compositions adopted for the newborn soft tissues and the newborn skeleton were 1.04 g cm^{-3} and 1.22 g cm^{-3}, respectively.

The changes to the original ORNL phantoms are summarized below. The reader is referred to Han et al. (2006) for a detailed description of these changes.

The age-dependent model of the head and brain described in Pamphlet No. 15 of the Committee on Medical Internal Radiation Dose (MIRD) and its subsequent monograph (Bouchet et al., 1999a, 1999b) was adopted. In the original ORNL series, the brain is represented by an ellipsoid. In the modified ORNL phantoms, the brain is an ellipsoid sliced by a plane, as shown Figure B-1. Revisions were made to the shape of the spine (cervical, thoracic, lumbar/sacrum sections); the ORNL spine was more elliptical in cross section.

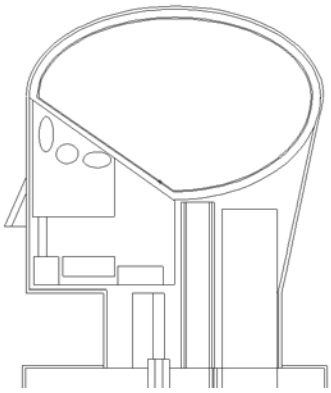


Figure B-1. Shape of the brain in the dosimetric phantoms applied in this report.

The age-dependent multi-region kidney models of MIRD Pamphlet No. 19 were adopted (Bouchet et al., 2003). These models include separate sub-organ models for the renal cortex, medulla and pelvis within the original boundaries of the ORNL kidney series.

Revisions suggested by Mardirossian et al. (1999) for the rectosigmoid colon and associated repositioning of the prostate gland and urinary bladder were adopted. The stylized representations of the extrathoracic airways, trachea and extrapulmonary bronchi given by Farfán et al. (2004) for the adult model were adopted and rescaled for inclusion in the revised ORNL pediatric phantoms.

Mathematical models of the salivary glands were created for insertion within the oral cavity of the revised phantoms. The three pairs of ellipsoidal salivary glands were designed with volumes selected to match their age-dependent tissue masses given in ICRP Publication 89 (2002) and with shapes guided by histological photographs and anatomic drawings (Marieb, 2001; Netter and Hansen, 2003).

The parotid glands are modeled as two elliptical cylinders parallel to the *z*-axis and located in the soft-tissue region medial to the lateral sides of the mandible. The defining equations for the parotid glands are

$$\left(\frac{x \pm x_{PG}}{a_{PG}}\right)^2 + \left(\frac{y - y_{PG}}{b_{PG}}\right)^2 \leq 1 \qquad \text{(B-1)}$$

and

$$z_{PG1} \leq z \leq z_{PG2} \qquad \text{(B-2)}$$

The sublingual glands are modeled as two right circular cylinders parallel to the *y*-axis and located in the soft-tissue region medial to the anterior portion of the mandible. The defining equations for the sublingual glands are given as

$$\left(\frac{x \pm x_{LG}}{r_{LG}}\right)^2 + \left(\frac{z - z_{LG}}{r_{LG}}\right)^2 \leq 1 \quad \text{(B-3)}$$

and

$$y_{LG1} \leq y \leq y_{LG2} \quad \text{(B-4)}$$

The submandibular glands are modeled as two right circular cylinders parallel to the *z*-axis and located in the soft-tissue region medial to the posterior portion of the mandible. The defining equations for the submandibular glands are

$$\left(\frac{x \pm x_{MG}}{r_{MG}}\right)^2 + \left(\frac{y - y_{MG}}{r_{MG}}\right)^2 \leq 1 \quad \text{(B-5)}$$

and

$$z_{MG1} \leq z \leq z_{MG2} \quad \text{(B-6)}$$

Ellipsoidal parameters used to define the age-dependent salivary gland volumes were given by Han et al. (2006).

Update of Organ Volume

During the quality assurance review of the modified ORNL phantoms, several organ volumes were found to be imprecisely declared when compared to ICRP Publication 89 (2002). These discrepancies were found by comparing the track-length estimated volume with the declared volume. Corrections were made whenever the disparity was greater than 3 percent.

Selected revisions to other organ volumes in the original ORNL series were made for consistency with organ masses given in ICRP Publication 89 (2002). In those cases where a mass difference was found between the ORNL organ mass and the ICRP Publication 89 organ mass, a change in organ volume was attempted, noting slight changes as well in ICRU tissue densities (ICRU, 1992) from the three-tissue composition in the original ORNL series. Volume decreases were easily accommodated within the mathematical phantom series, while volume increases were constrained by the need to avoid organ boundary overlap within the rigid structure of the phantoms. For newly introduced organs, such as the larynx and pharynx walls, a decision was made to preserve the reference wall thickness (for electron transport simulations), and then match reference organ masses as closely as feasible using only the length of the organ in the +*z* and –*z* directions. For sections of the large colon, wall thicknesses in the original ORNL series were set artificially high in order to match ICRP Publication 23 (1975) reference wall masses, because reference colon lengths could not be accommodated within the stylized abdomen. For similar reasons, these wall thicknesses and sectional lengths were retained in the revised phantom series.

The tissue density of the lungs given in both ICRU Report 46 (1992) and ICRP Publication 89 (2002) is 0.26 g cm^{-3} and represents an effective density for the homogenized lung (tissue parenchyma, pulmonary blood, and airway contents). This value is lower than the value of 0.296 g cm^{-3} adopted in the original ORNL phantom series and was found to yield inconsistencies between original ORNL phantom lung volumes and ICRP Publication 89 (2002) reference lung masses (inclusive of their blood content). Attempts were made to adjust lung volumes in the ORNL series using this lower recommended effective density, but this effort proved difficult because many of the lung volumes had to be expanded beyond the dimensions permitted by the fixed geometries of the rib cage and heart. Consequently, one of two options was available: (1) assign a unique effective lung density to each phantom to force agreement with ICRP Publication 89 (2002) reference masses, or (2) optimize the assignment of a single effective lung density across the entire age-range of ORNL phantoms. Physiologically, it can be argued that under option 1, effective lung densities in the phantoms should systematically decrease with increasing phantom age as the lung tree more fully develops, resulting in a larger fraction of total lung volume occupied by the pulmonary airways. Option 1, however, yielded effective lung densities that varied erratically with phantom age; thus, option 2 was deemed the more appropriate choice. The final value on the effective lung density adopted in this study was 0.352 g cm^{-3}.

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 0 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 tedious because of the complexity of the bremsstrahlung cross section formulas. 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. Seltzer and Berger (1986) used the results of Pratt and colleagues to address neutral atoms with atomic number Z = 1 to 100 and extended the electron energy range to 10 GeV. The cross section values are believed to be accurate within 10 percent.

Tables of 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 100 were prepared. These 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 Seltzer and Berger (1986) for electrons from 1 keV 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 0 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

$$Y = \int_0^T \frac{k}{T}\, S(k,T)\, dk = \frac{1}{100} \int_0^T S'(k,T)\, dk \qquad \text{(C-1)}$$

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 $S_\beta(k,T_0)$ 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

$$S_\beta(k,T_0) = \int_k^{T_0} Y_\beta(T)\, S(k,T)\, dT = \int_k^{T_0} Y_\beta(T)\, \frac{S'(k,T)}{100\ k/T}\ dT \qquad \text{(C-2)}$$

- Chapter 3, Section 3.4.2: Additional details added to describe how skeletal dosimetry was performed to derive the dose rate coefficients for bone surface and red marrow.
- Table 4-1: revised dose coefficients for ground surface.
- Table 4-2: revised dose coefficients for soil to 1 cm.
- Table 4-3: revised dose coefficients for soil to 5 cm.
- Table 4-4: revised dose coefficients for soil to 15 cm.
- Table 4-5: revised dose coefficients for soil to infinite depth.
- Table 4-6: revised dose coefficients for air submersion.
- Table 4-7: revised dose coefficients for water immersion.
- Appendix A: Table of radionuclide decay data removed; brief explanation provided.
- Appendix D: Example calculations have been revised with the new dose coefficients values provided in this report.

The 2025 revisions to FGR 15 supersede those implemented in 2019. The 2019 revision of FGR 15 corrected: (1) a coding error which caused an omission of bremsstrahlung emissions for low-energy beta emitting radionuclides in soil; and (2) the use of an interim set of monoenergetic dose coefficients to generate radionuclide-specific dose coefficients for soil. The 2019 text revisions that remain unaltered by the 2025 revisions listed above include:

- Preface and Chapter 1: The following footnote "This also includes cosmic rays that are low linear energy transfer (LET)" was removed from the passage that read: "…radionuclides distributed in air,* water and soil."
- Figure 1-1: Caption text was slightly modified to indicate the comparison between ICRP Publications 60 and 103.
- Chapter 1, Section 1.1, Para. 6: The following sentence, at the end of the paragraph, was removed: "The effective dose coefficients tabulated in this report are sex-averaged per the definition of this quantity in ICRP Publication 103 (2007)."
- Table 2-1 and Section 3.2.2.4: Removal of text indicating that radionuclide-specific dose coefficients for a smooth (0 mm) infinite plane would be available online.
- Chapter 3, Section 3.2.2.3: Section header was changed from, "Ground plane depths" to "Soil depths considered."
- Chapter 5, Section 5.5: The following sentence was added: "However, bremsstrahlung generated as the emitted electrons stop within the soil does contribute to the dose to skin and other tissues."
- Appendix A: equation (A-4) erroneously duplicated equation (A-3). Equation (A-4) now reads as follows:

$$E = A_1^0 \frac{1 - e^{-\lambda_1 T}}{\lambda_1} \sum_{i=1}^{n} e_{E,i}^{gs} \prod_{j=1}^{i-1} f_{j,j+1}$$

- Appendix A: Removal of text indicating that characteristic gamma emissions for 1,252 radionuclides would be available online.

The dose coefficients in this report—as well as the methods used to generate them—went through a rigorous and comprehensive review. If you have questions or would like further information, please contact radiation.questions@epa.gov.

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

The beta spectrum Y_β of ICRP Publication 107 (2008) is used in this work. Figure 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 soil. We applied the above to positron emissions, 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 slightly overestimates the bremsstrahlung contribution for beta emitters on the soil surface at an effective depth of 3 mm.

Table C-1. Scaled external bremsstrahlung spectra from electrons for air.

Tabulated quantities are in units of photons per MeV.

k/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
T (keV)												
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.

Tabulated quantities are in units of photons per MeV.

k/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
T (keV)												
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	0.0370	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	0.2817	0.1868	0.1184	0.0698	0.0353	0.0122	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.

Tabulated quantities are in units of photons per MeV.

k/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
T (keV)												
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

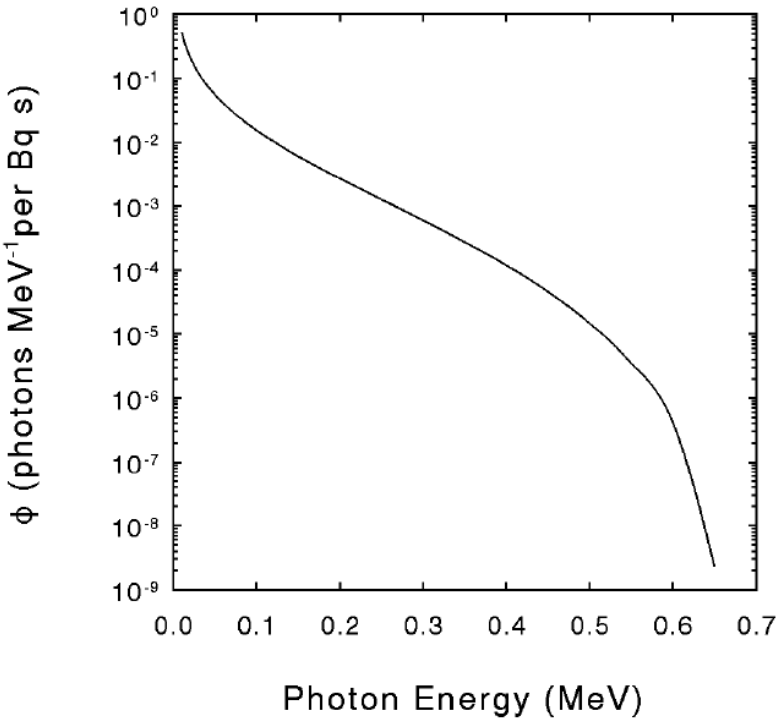


Figure C-1. External bremsstrahlung spectrum of ^{85}Kr in air.

APPENDIX D. EXAMPLE CALCULATIONS

This appendix illustrates applications of the external dose rate coefficients tabulated in this report. 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 an instructional nature.

Example 1. The concentration of ^{85}Kr in the atmosphere, C_{Kr}, at a location in the environs of a fuel reprocessing plant is estimated to be 1,000 Bq m^{-3}. Compute the annual effective dose to an adult at that location. Assume the exposure is continuous and without benefit of any shielding by structures.

From Table 4-6, the effective dose rate coefficient, e_E, for air submersion for ^{85}Kr is 2.40 × 10^{-16} Sv m^3 Bq^{-1} s^{-1}. The annual effective dose, E, can be estimated as the product of the dose rate and the exposure duration of 3.15 × 10^7 s (1 year) as

$$E = e_E \, C_{Kr} \, t$$

$$= 2.40 \times 10^{-16} \frac{Sv\, m^3}{Bq\, s} \times 10^3 \frac{Bq}{m^3} \times 3.15 \times 10^7 \, s$$

$$= 8 \times 10^{-6} \, Sv \ .$$

Example 2. **In the planning phase of a construction project, it was determined that 30 hours of underwater welding are needed. The average concentrations of ^{60}Co and ^{137}Cs in the water during the planned welding period are 1,000 Bq m^{-3} and 7,000 Bq m^{-3}, respectively. Assuming no radionuclide ingestion, what is the estimated effective dose to the worker if only one welder is used to complete the job?**

From Table A-1, assume that ^{137m}Ba is in secular equilibrium with ^{137}Cs. First, calculate the concentration of ^{137m}Ba. The secular equilibrium concentration of ^{137m}Ba is the ^{137}Cs concentration × ^{137m}Ba fractional yield:

$$C_{Ba137m} = 7{,}000 \frac{Bq}{m^3} \times 0.944 = 6{,}608 \frac{Bq}{m^3} \ .$$

Next, calculate the dose rate contributions of individual radionuclides. The dose rate is average concentration × dose rate coefficient. Because the welder is being exposed to contaminated water, the water immersion dose rate coefficients are most appropriate. From Table 4-7, the effective dose rate coefficients for ^{60}Co, ^{137}Cs and ^{137m}Ba are 2.53 × 10^{-16}, 1.03 × 10^{-19} and 5.55 × 10^{-17} Sv s^{-1} Bq^{-1} m^3, respectively.

$$^{60}\text{Co dose rate} = 1{,}000 \frac{Bq}{m^3} \times 2.53 \times 10^{-16} \frac{Sv\, m^3}{Bq\, s} = 2.53 \times 10^{-13} \frac{Sv}{s}$$

$$^{137}\text{Cs dose rate} = 7{,}000 \frac{Bq}{m^3} \times 1.03 \times 10^{-19} \frac{Sv\, m^3}{Bq\, s} = 7.21 \times 10^{-16} \frac{Sv}{s}$$

$$^{137m}\text{Ba dose rate} = 6{,}608 \frac{Bq}{m^3} \times 5.55 \times 10^{-17} \frac{Sv\, m^3}{Bq\, s} = 3.67 \times 10^{-13} \frac{Sv}{s} \ .$$

Next, determine the total dose rate for the radionuclide mixture. The total average dose rate is the sum of the individual radionuclide dose rates, or ^{60}Co dose rate + ^{137}Cs dose rate + ^{137m}Ba dose rate:

$$Total\ dose\ rate = 2.53 \times 10^{-13}\frac{Sv}{s} + 7.21 \times 10^{-16}\frac{Sv}{s} + 3.67 \times 10^{-13}\frac{Sv}{s}$$

$$= 6.21 \times 10^{-13}\frac{Sv}{s}\ .$$

Finally, calculate the total dose to the worker. The duration of exposure in seconds is 30 hours × 3,600 seconds per hour = 108,000 seconds. The total dose to the welder is dose rate × exposure duration.

$$Total\ dose = 6.21 \times 10^{-13}\frac{Sv}{s} \times 108{,}000\ s$$

$$= 7 \times 10^{-8}\ Sv\ .$$

Example 3. A pilot is given an assignment to fly an aircraft through a large radioactive plume for forensic sample collection. The estimated radionuclide concentrations are 1 MBq m^{-3} of ^{131}I and 2 GBq m^{-3} of ^{192}Ir. Assuming no shielding from the airplane and clothing, how long can the pilot stay inside the cloud before the external effective dose exceeds 50 mSv?

First, calculate the dose rate contribution of the individual radionuclides. The dose rate is estimated concentration × dose rate coefficient. From Table 4-6, the effective dose rate coefficients for air submersion for ^{131}I and ^{192}Ir are 1.68 × 10^{-14} and 3.57 × 10^{-14} Sv s^{-1} m^3 Bq^{-1}, respectively.

$$^{131}\text{I dose rate} = 1\ \frac{MBq}{m^3}\ \text{x}\ \frac{10^6\ Bq}{MBq} \times\ 1.68 \times 10^{-14}\ \frac{Sv\ m^3}{Bq\ s} = 1.7 \times 10^{-8}\ \frac{Sv}{s}$$

$$^{192}\text{Ir dose rate} = 2\ \frac{GBq}{m^3}\ \text{x}\ \frac{10^9\ Bq}{GBq} \times\ 3.57 \times 10^{-14}\ \frac{Sv\ m^3}{Bq\ s} = 7.1 \times 10^{-5}\ \frac{Sv}{s}\ .$$

Next, determine the total dose rate for the radionuclide mixture. The total dose rate is the sum of the individual radionuclide dose rates, or ^{131}I dose rate + ^{192}Ir dose rate:

$$Total\ dose\ rate = 1.7 \times 10^{-8}\ \frac{Sv}{s} + 7.1 \times 10^{-5}\ \frac{Sv}{s} = 7.1 \times 10^{-5}\ \frac{Sv}{s}\ .$$

Finally, to calculate the duration of exposure before exceeding 50 mSv, divide the dose by the dose rate:

$$\frac{Dose}{Dose\ rate} = \frac{0.05\ Sv}{7.1 \times 10^{-5}\frac{Sv}{s}}$$

$$= 700\ seconds\ .$$

Example 4. Consider that at time 0 the ground surface was uniformly contaminated with pure ^{137}Cs at a surface concentration of 2 Bq m^{-2}. Calculate the effective dose rate, $\dot{E}$, for an adult at time 0 and at 10 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 ~30.2 years, undergoes beta decay, and emits, as electrons, a total energy of 0.1884 MeV per nuclear transformation (*nt*). No alpha radiation is emitted and energy associated with photon emissions is less than 10^{-7} MeV nt^{-1}. In 94.4 percent 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 0.0653 and 0.5963 MeV *nt*$^{-1}$, respectively. The energies listed in Table A-1, and quoted above, represent the energy of all radiations of that type emitted per nuclear transformation. A nuclide emitting a single photon of energy 1 MeV in 1 percent of its transformations releases the same energy in photon radiation as another nuclide emitting photons of 0.01 MeV in 100 percent of its transformations. The dosimetric significance of these photons, however, can be quite different. Barium-137m emits a gamma ray of 0.6617 MeV in 89.74 percent of its nuclear transformations; the total energy emitted is 0.6617 × 0.8974 or 0.594 MeV *nt*$^{-1}$. The tabulated value of 0.5963 MeV includes the contribution from K x-rays emitted following the internal conversion of the 0.6617 MeV photon. Note that the sum of the emitted energies (0.0653 + 0.5963) is 0.6616 MeV, essentially the same as 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 4-1, the effective dose rate coefficient, e_{Cs-137}, for ^{137}Cs distributed on the ground surface is 3.01 × 10^{-18} Sv Bq^{-1} s^{-1} m^2. Note that the dose rate coefficient is stated here as an instantaneous dose rate per activity concentration. The dose rate at time 0 is

$$\dot{E} = 3.01 \times 10^{-18} \frac{Sv\ m^2}{Bq\ s} \times 2.0 \frac{Bq}{m^2}$$

$$= 6.02 \times 10^{-18} \frac{Sv}{s}\ .$$

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 indicates virtually no emission of photons by ^{137}Cs.

To compute the effective dose rate after 10 years, we first compute the activities of ^{137}Cs and ^{137m}Ba on the ground surface at that time. For ^{137}Cs the activity is calculated as

$$A_{Cs137}(t) = A_{Cs137}(0)e^{-\lambda_{Cs137}t}$$

where $A_{Cs137}(0)$ is the activity of ^{137}Cs on the ground surface at $t = 0$.

The decay constant for ^{137}Cs, λ_{Cs137}, is

$$\lambda_{Cs137} = \frac{\ln(2)}{T_{½}} = \frac{0.693}{30.2\ y\ \times\ 3.15 \times 10^{7}\ \frac{s}{y}} = 7.28 \times 10^{-10}\ s^{-1}$$

and for ^{137m}Ba, with $T_{½}$ of 2.552 minutes, the decay constant is 4.53×10^{-3} s^{-1}. The activity of ^{137}Cs on the ground surface at 10 years (3.15×10^{8} s) is

$$A_{Cs137}(10\ y) = 2.0\ e^{-7.28 \times 10^{-10}\ s^{-1} \times 3.15 \times 10^{8} s} = 1.59\ \frac{Bq}{m^2}$$

and that of ^{137}Ba is 0.944 times that of ^{137}Cs because ^{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 (0.944). Using the dose rate coefficient from Table 4-1, we obtain

$$\dot{E}(10\ y) = e_{Cs137}\ A_{Cs137}(10\ y) + e_{Ba137m}\ A_{Ba137m}(10\ y)$$

$$= 3.01 \times 10^{-18}\ \frac{Sv\ m^2}{Bq\ s} \times 1.59\ \frac{Bq}{m^2} + 3.87 \times 10^{-16}\ \frac{Sv\ m^2}{Bq\ s} \times 1.50\ \frac{Bq}{m^2}$$

$$= 5.85 \times 10^{-16}\ \frac{Sv}{s}\ .$$

The annual effective dose after 1 year of exposure is just the integral of the dose rate, or

$$E(1\ y) = \int_0^1 \dot{E}(t)\ dt = e_{Cs137} \int_0^1 A_{Cs137}(t)\ dt + e_{Ba137m} \int_0^1 A_{Ba137m}(t)\ dt\ .$$

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

$$\int_0^T A_{Cs137}(t)\ dt = A_{Cs137}(0)\frac{\left[1 - e^{-\lambda_{Cs137}T}\right]}{\lambda_{Cs137}} = 6.23 \times 10^{7}\ \frac{Bq - s}{m^2}$$

and that of ^{137m}Ba is

$$\int_0^T A_{Ba137m}(t)\ dt$$

$$= \int_0^T A_{Cs137}(0) \frac{f_{Cs137,Ba137m}\ \lambda_{Ba137m}}{\lambda_{Ba137m} - \lambda_{Cs137}} \left[e^{-\lambda_{Cs137} t} - e^{-\lambda_{Ba137m} t}\right]\ dt$$

$$= A_{Cs137}(0) \frac{f_{Cs137,Ba137m}\ \lambda_{Ba137m}}{\lambda_{Ba137m} - \lambda_{Cs137}} \left[\frac{(1 - e^{-\lambda_{Cs137} T})}{\lambda_{Cs137}} - \frac{(1 - e^{-\lambda_{Ba137m} T})}{\lambda_{Ba137m}}\right]$$

$$= 5.88 \times 10^7\ \frac{Bq\ s}{m^2}\ .$$

The annual effective dose, *E*, is

$$E = 3.01 \times 10^{-18}\ \frac{Sv\ m^2}{Bq\ s} \times\ 6.23 \times 10^7\ \frac{Bq\ s}{m^2} + 3.87 \times 10^{-16}\ \frac{Sv\ m^2}{Bq\ s} \times\ 5.88 \times 10^7\ \frac{Bq\ s}{m^2}$$

$$= 2 \times 10^{-8}\ Sv\ .$$

APPENDIX E. LIST OF ACRONYMS

Bq	becquerel (unit)
CT	computed tomography
DOE	U.S. Department of Energy
DOSFACTER	Dose Rate Conversion Factors for Photon and Electron Exposure
EC	electron capture
ENDF	Evaluated Nuclear Data File
EPA	U.S. Environmental Protection Agency
Gy	gray (unit)
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units and Measurements
IT	isomeric transition
JAERI	Japan Atomic Energy Research Institute
keV	kilo-electronvolt (unit)
LET	linear energy transfer
MCNP	Monte Carlo N-Particle Transport Code
MIRD	Committee on Medical Internal Radiation Dose
μCi	microcurie (unit)
mrem	millirem (unit)
NAS-NRC	National Academy of Sciences–National Research Council
NCRP	National Council on Radiation Protection and Measurements
NRC	U.S. Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
RBE	relative biological effectiveness
SF	spontaneous fission
SI	International System of Units
Sv	sievert (unit)
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation

SUMMARY OF REVISIONS

In 2023, the Environmental Science Division at Argonne National Laboratory (ANL) published a report, *ANL-23/37*, summarizing a review of FGR 15 conducted as part of a quality assurance effort related to the RESRAD suite of codes (Gnanapragasam et al., 2023). In response to *ANL-23/37*, the Center for Radiation Protection Knowledge (CRPK) at Oak Ridge National Laboratory (ORNL) performed a thorough review of FGR 15 external dose rate coefficients. This entailed review of intended methods, Monte Carlo simulations, tissue equivalent dose rate coefficients for exposure to monoenergetic photons, bremsstrahlung spectra calculations, and radionuclide-specific dose rate coefficients. As a result of this review, CRPK recalculated all FGR 15 tissue equivalent and effective dose rate coefficients for both monoenergetic and radionuclide-specific sources using the intended methodology. The following revisions were made:

- Calculation of dose rate due to bremsstrahlung was corrected for the air submersion and soil contamination scenarios.
- Representation of adult female with the 15-y-old hermaphrodite phantom was applied consistently across all exposure scenarios.
- Methods for calculating bone surface and red marrow equivalent dose rate coefficients from exposure to monoenergetic photons were applied consistently across all exposure scenarios.
- Calculation of lung dose rates from monoenergetic photons sources in water with energies less than 30 keV was corrected.
- The number of histories run in Monte Carlo simulations were increased to obtain lower statistical uncertainty.
- Monte Carlo results were not smoothed (with respect to age or energy) for development of monoenergetic dose rate coefficients.
- Salivary glands, rather than lungs, are now used as a surrogate for the extrathoracic region to improve dose estimates.

Detailed explanation of the review can be found in ORNL/SPR-2025/3803, *2025 Review and Revision of Federal Guidance Report 15* (Samuels and Leggett, 2025). To reflect these changes, the text of FGR 15 was edited in the following sections:

- Title page: New document number; author list was updated to include Caleigh E. Samuels and Keith F. Eckerman is now listed as last author. Revision Date was updated.
- Preface: Contact information for all comments and suggested revisions was updated.
- Chapter 3, Section 3.2.1: Clarifying edit; closed surface geometry of cylinder was only used for soil sources.
- Chapter 3, Table 3-1: Entries in table were updated (a) to reflect that salivary glands in the phantom were used as a surrogate for the extrathoracic region and (b) to correct a text error that suggested a surrogate tissue was used for the thymus; the thymus was explicitly modeled.
- Chapter 3, Section 3.2.2.6: Clarifying edit in section title; “coupling surface” replaced “cylinder”.
- Chapter 3, Section 3.2.3.2: This paragraph was updated to provide additional details governing the radiation transport methods for estimating absorbed doses and the resulting statistical errors.
- Chapter 3, Section 3.3.1 and Section 3.3.2.3: Clarifying edit; text added to specify geometry of the coupling surface.
- Chapter 3, Section 3.3.3: This paragraph was updated to provide additional details governing the radiation transport methods for estimating absorbed doses and the resulting statistical errors.

- Chapter 3, Section 3.4.2: Additional details added to describe how skeletal dosimetry was performed to derive the dose rate coefficients for bone surface and red marrow.
- Table 4-1: revised dose coefficients for ground surface.
- Table 4-2: revised dose coefficients for soil to 1 cm.
- Table 4-3: revised dose coefficients for soil to 5 cm.
- Table 4-4: revised dose coefficients for soil to 15 cm.
- Table 4-5: revised dose coefficients for soil to infinite depth.
- Table 4-6: revised dose coefficients for air submersion.
- Table 4-7: revised dose coefficients for water immersion.
- Appendix A: Table of radionuclide decay data removed; brief explanation provided.
- Appendix D: Example calculations have been revised with the new dose coefficients values provided in this report.

The 2025 revisions to FGR 15 supersede those implemented in 2019. The 2019 revision of FGR 15 corrected: (1) a coding error which caused an omission of bremsstrahlung emissions for low-energy beta emitting radionuclides in soil; and (2) the use of an interim set of monoenergetic dose coefficients to generate radionuclide-specific dose coefficients for soil. The 2019 text revisions that remain unaltered by the 2025 revisions listed above include:

- Preface and Chapter 1: The following footnote "This also includes cosmic rays that are low linear energy transfer (LET)" was removed from the passage that read: "…radionuclides distributed in air,* water and soil."
- Figure 1-1: Caption text was slightly modified to indicate the comparison between ICRP Publications 60 and 103.
- Chapter 1, Section 1.1, Para. 6: The following sentence, at the end of the paragraph, was removed: "The effective dose coefficients tabulated in this report are sex-averaged per the definition of this quantity in ICRP Publication 103 (2007)."
- Table 2-1 and Section 3.2.2.4: Removal of text indicating that radionuclide-specific dose coefficients for a smooth (0 mm) infinite plane would be available online.
- Chapter 3, Section 3.2.2.3: Section header was changed from, "Ground plane depths" to "Soil depths considered."
- Chapter 5, Section 5.5: The following sentence was added: "However, bremsstrahlung generated as the emitted electrons stop within the soil does contribute to the dose to skin and other tissues."
- Appendix A: equation (A-4) erroneously duplicated equation (A-3). Equation (A-4) now reads as follows:

$$E = A_1^0 \frac{1 - e^{-\lambda_1 T}}{\lambda_1} \sum_{i=1}^{n} e_{E,i}^{gs} \prod_{j=1}^{i-1} f_{j,j+1}$$

- Appendix A: Removal of text indicating that characteristic gamma emissions for 1,252 radionuclides would be available online.

The dose coefficients in this report—as well as the methods used to generate them—went through a rigorous and comprehensive review. If you have questions or would like further information, please contact radiation.questions@epa.gov.

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