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No. 44

Derivation of Activity Concentration Values for Exclusion, Exemption and Clearance

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DERIVATION OF ACTIVITY CONCENTRATION VALUES FOR EXCLUSION, EXEMPTION AND CLEARANCE

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FOREWORD

In September 2000, the General Conference of the International Atomic Energy Agency requested the IAEA Secretariat to develop radiological criteria for long lived radionuclides in commodities, particularly foodstuffs and wood (Resolution GC(44)/RES/15). This was to be accomplished by using the IAEA's radiation protection advisory mechanisms, and in collaboration with the competent organs of the United Nations and the specialized agencies concerned.

The present Safety Report has been prepared to support a related Safety Guide which partially fulfils that request. The information provided in this Safety Report can be applied to all commodities other than foodstuffs and drinking water. In order to comply with the request relating to foodstuffs, the Codex Alimentarius Commission of the Food and Agriculture Organization of the United Nations and the World Health Organization has been requested to review its radiological criteria for foodstuffs.

This Safety Report provides the basis for the activity concentration levels given in the related Safety Guide. It presents the detailed scenario descriptions and parameters that were used.

The assistance of all contributors to the drafting and review of this Safety Report is gratefully acknowledged. The technical officer responsible for its preparation was D. Reisenweaver of the Division of Radiation, Transport and Waste Safety.

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CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

Regulatory systems for radiation protection are intended to ensure the protection of people from harm arising from exposure to ionizing radiation. However, there are some human activities involving exposure to radiation that do not warrant regulatory control. Such circumstances arise when the resources that would need to be expended in regulating the activity would be excessive in relation to any benefit that might ensue in terms of reduced risk. The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (the BSS) [1] define and explain the use of the concepts of exclusion, exemption and clearance for establishing the scope of regulatory control. A Safety Guide on the Application of the Concepts of Exclusion, Exemption and Clearance [2] provides an elaboration of these concepts and guidance for their application. This Safety Report supports the Safety Guide [2] and provides the basis for the activity concentration values for exclusion and exemption of bulk[1] amounts of material, which can also be used for clearance.

This Safety Report deals with all bulk amounts of solid material[2], including commodities for which exemption may be applied. It covers the removal from control of material containing very low levels of radioactivity originating from regulated practices[3], i.e. installations (nuclear fuel cycle and others), hospitals and research institutes, and of material from interventions[4]. It

[1] Any amount of material that is greater than a moderate quantity. Moderate quantities are defined in Ref. [3] as being quantities that "are at the most of the order of a tonne" of material.

[2] The term 'material' is defined as the matter from which a thing is made.

[3] A practice is any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed.

[4] An intervention is any action intended to reduce or avert exposure or the likelihood of exposure to sources which are not part of a controlled practice or which are out of control as a consequence of an accident.

also addresses material that contains radionuclides of natural origin[5] that need to be considered for exclusion.

This Safety Report derives activity concentration[6] levels for deciding if a certain material should be excluded, exempted or cleared. These levels are derived in such a way that they are valid for all types of solid material containing radionuclides of artificial or natural origin except foodstuffs (they are not valid for drinking water). Because the levels are applicable to a wide range of material, they have been derived on the basis of several scenarios and assumptions.

The main basis for the derivation of the activity concentration values for radionuclides of artificial origin is a set of radiological scenarios referring to external irradiation, dust inhalation and ingestion that are deemed to encompass all typical exposure situations for all material types. These scenarios relate the activity concentration in the material to individual doses. The scenarios are determined by taking existing radiological studies (e.g. those used for deriving clearance and exemption levels) and using them to develop a framework of generalized scenarios. The approach to encompass the variety of situations that may be found in Member States around the world necessarily requires a degree of conservatism. In order to cover various exposure scenarios, more than one scenario has been considered for each pathway to reflect the range of material characteristics and exposed individuals. Each scenario therefore contains a set of parameter values and represents a range of exposure situations.

A scenario based approach was not used in the case of material that contains radionuclides of natural origin. Instead the activity concentration values applicable to these types of radionuclide were derived using a pragmatic approach that places greater emphasis on optimization of protection. This involved consideration of the worldwide distribution of the concentration of radionuclides of natural origin present in material that is found in the environment.

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[5] The term 'radionuclides of natural origin' means radionuclides that occur naturally in significant quantities on Earth. The term is usually used to refer to the primordial radionuclides ^{40}K, ^{235}U, ^{238}U and ^{232}Th (the decay product of primordial ^{236}U) and their radioactive decay products, but could also include tritium and ^{14}C, low concentrations of which are generated by natural activation processes.

[6] The term 'activity concentration' means the amount of a radionuclide per unit mass or volume of a material.

1.2. OBJECTIVE

The objective of this Safety Report is to provide the methodology and parameters that were used to develop the activity concentration values provided in Safety Guide RS-G-1.7 [2].

1.3. SCOPE

The values of activity concentration derived in this Safety Report can be used in the practical application of the concepts of exclusion, exemption and clearance as established in the BSS and presented in Safety Guide RS-G-1.7 [2]. The values of activity concentration provided in this Safety Report do not apply to the following:

— Foodstuffs, drinking water, animal feed and any material intended for use in food or animal feed; specific levels for drinking water and specific levels for foodstuffs applicable for up to one year after an accident;
— Radon in air;
— ^{40}K in the body;
— Material in transport.

The values of activity concentration provided in this Safety Report are not intended to be applied to the control of radioactive discharges of liquid and airborne effluents from authorized practices, or to radioactive residues in the environment.

1.4. STRUCTURE

Section 2 describes the radiological basis used to develop the activity concentration values. Section 3 discusses the general approach that was used to derive the activity concentration values. The actual development of the activity concentration values for radionuclides of artificial origin is presented in Section 4 along with the general parameters and scenarios considered. Section 5 describes the actual development of the exclusion activity concentration values for radionuclides of natural origin. Section 6 presents the derived activity concentration values. Two appendices that provide the calculations for the realistic and low probability scenarios for radionuclides of artificial origin, as well as the weighting factors, are included on a CD-ROM at the end of this book.

2. RADIOLOGICAL BASIS FOR ACTIVITY CONCENTRATION VALUES

For each radionuclide of artificial origin in material, the activity concentration value has been determined such that individual effective doses to a critical group (i.e. the public and workers[7]) would be of the order of 10 μSv/a and would have only a very low probability of approaching an individual dose of 1 mSv/a. A dose of 10 μSv/a corresponds to a trivial level of risk [1].

While no activity concentration values have been derived in this Safety Report for foodstuffs and drinking water, the water and food pathways have been taken into account in the scenarios for radionuclides of artificial origin, in order to address the radiological consequences from these pathways. Specific levels for foodstuffs have been developed by the Codex Alimentarius Commission [4] and for drinking water by the World Health Organization [5].

The calculations of the activity concentration values for radionuclides of artificial origin are based on the evaluation of a selected set of typical exposure scenarios for all material, encompassing external irradiation, dust inhalation and ingestion (direct and indirect). The resulting activity concentration values were derived on the basis of these scenarios as the lower of the values obtained from:

(a) The use of realistic parameter values applying an effective dose criterion of 10 μSv/a;
(b) The use of low probability parameter values applying an effective dose criterion of 1 mSv/a and a skin equivalent dose limit of 50 mSv/a.

The derived results from the scenario calculations are sufficient to ensure an adequate degree of protection in both occupational and public exposure situations.

If radionuclide specific activity concentration values for radionuclides of natural origin are derived on the basis of the same radiological criteria, the values will in many cases be lower than concentrations that occur in much natural environmental material. Thus many human activities previously unregulated from a radiological standpoint, such as the construction of houses from natural building material or even the use of land in many areas, could be subject to regulation. Establishing levels for radionuclides of natural origin that

[7] The term 'workers' is taken here to mean those workers who could be inadvertently exposed to ionizing radiation while at work, such as foundry or landfill workers.

entail such widespread regulatory consideration, in circumstances where in many cases it is unlikely to achieve any improvement in protection, is not an optimum use of regulatory resources. Therefore derivation of activity concentration values for radionuclides of natural origin is based on a methodology that places greater emphasis on optimization of protection, including optimization of regulatory resources.

The objective in defining material that contains radionuclides of natural origin that should be excluded is to identify that material of significant radiological risk where regulation can achieve real improvements in protection. At the same time, the number of materials involved should not be so great as to make regulation essentially unmanageable. The application of a dose criterion of 10 μSv/a is not practical for radionuclides of natural origin. In selecting levels for material that contains radionuclides of natural origin, a major issue is that high levels that would exclude the majority of natural material in the environment would also allow a number of situations, such as the release of phosphate slags, to be excluded without further consideration. Conversely, selecting a low value would trigger an unnecessary application of the BSS. Therefore the activity concentration values were derived from consideration of the worldwide distribution of concentrations of radionuclides of natural origin given in Ref. [6].

Activity concentration values for radionuclides of natural origin represent the total of the background and any added radioactivity. Doses to individuals as a consequence of the use of these levels are unlikely to exceed about 1 mSv in a year, excluding the emanation of radon and cases of bulk volumes contaminating water pathways, which could require case by case evaluation of possible doses.

3. GENERAL APPROACH FOR DERIVING ACTIVITY CONCENTRATION VALUES

3.1. RADIONUCLIDES OF ARTIFICIAL ORIGIN

3.1.1. Choice of radionuclides and dose coefficients

The radionuclides for which activity concentration values are calculated are those for which exemption levels exist in the BSS [1]. This set contains those nuclides that are most relevant to nuclear installations, such as nuclear

power plants or fuel cycle facilities, and the application of radionuclides, including short lived radionuclides, in research, industry and medicine. A number of additional radionuclides are also considered because of their practical relevance in some cases (e.g. ^{41}Ca and ^{79}Se). Radionuclides of natural origin (^{40}K and the decay chains of ^{238}U, ^{235}U and ^{232}Th) are also included.

A number of radionuclides that are considered in this Safety Report decay into unstable short lived radionuclides. The way in which decay products are treated is discussed in Section 3.1.2.

In general, dose coefficients are used to calculate (annual) doses from a given activity. More specifically, dose coefficients are used for the following exposure pathways:

(a) *External exposure.* The dose from external irradiation is caused by photons from gamma emitting radionuclides and beta particles from beta emitting radionuclides absorbed by the human body. Therefore the relationship between dose and radioactivity is complicated, depending not only on the radionuclide but also on the geometry in which the radioactivity is distributed, on shielding effects, on self-absorption effects, and on the distance and direction to the source. Dose coefficients for external irradiation are expressed as dose rate (μSv/h) per activity content of the source (Bq/g). For this Safety Report, suitable dose coefficients are calculated for each radionuclide and each exposure geometry. These dose coefficients are presented in Appendix I, Table I-III.

The exposure scenarios consider adults and children of an age between one and two years, which are the most critical age groups for external exposure. A correction of the dose coefficients calculated for adults is required for children to take account of the higher effective dose as compared with adults in the same exposure situations (i.e. for the same air kerma). The factor applied is estimated from figure 12 in Ref. [7], comparing the effective dose per unit air kerma for different age groups in an isotropic irradiation geometry. For the relevant range of photon energies above 100 keV, the ratio between children of 1 year of age and adults is about 1.2. This factor is used in the scenario calculations for children.

(b) *Inhalation exposure.* Dose coefficients for inhalation are contained in Appendix I, Table I-IV. The dose coefficients relate the individual effective dose (in Sv) to the inhaled quantity of radioactivity (in Bq). The inhalation dose coefficients have been determined on the basis of the default lung types recommended by the International Commission on Radiological Protection.

(c) *Ingestion exposure.* Dose coefficients for ingestion are also contained in Appendix I, Table I-V. The dose coefficients relate the individual effective dose (in Sv) to the ingested quantity of radioactivity (in Bq).

(d) *Skin exposure.* Dose coefficients for the skin relate the skin equivalent dose to the concentration of radionuclides on the skin. Skin dose coefficients are listed in Ref. [8] and are taken conservatively for a skin surface weight of 4 mg/cm^2. These dose coefficients are contained in Appendix I, Table I-VI.

3.1.2. Decay chains and progeny ingrowth

For radionuclides possessing progeny radionuclides that have a non-negligible dose coefficient in comparison with the parent radionuclides, dose coefficients are calculated as the weighted sum of parent and progeny radionuclides. Weighting is done by using the activity ratios given in Appendix II for the progeny radionuclides indicated. This ensures that the effect of the progeny radionuclides is properly taken into account in the dose calculations.

A number of the radionuclides considered in this Safety Report decay into unstable short lived radionuclides. These progeny radionuclides also contribute to the dose caused by the parent radionuclide after release from regulatory control. For progeny radionuclides with short half-lives, equilibrium with the parent nuclides is reached in a very short time, for example within 30 minutes for the pair ^{137}Cs/^{137m}Ba or within 20 days for the pair ^{90}Sr/^{90}Y. However, there are some important progeny radionuclides with longer half-lives that yield a high dose contribution, for example ^{241}Pu/^{241}Am. In Fig. 1(a) the activity as a function of time is shown for an initial quantity of 1 Bq of ^{241}Pu. The activity maximum of the progeny radionuclide ^{241}Am occurs at about 70 years, at which time the total activity represents only a fraction of the initial activity. In Fig. 1(b) the inhalation dose coefficient is plotted for material in which the initial activity of ^{241}Pu is 1 Bq. In contrast to the activity, the dose coefficient increases over time, reaching a maximum at around 60 years, although at this time the total activity has decreased to less than 0.1 Bq. This demonstrates that if material containing these radionuclides remains together for a prolonged period of time, the scenarios occurring many years after release of the material from regulatory control can lead to higher doses than those calculated for the first year after release, owing to the ingrowth of progeny radionuclides. Therefore the relevant progeny radionuclide is taken into account in the calculations.

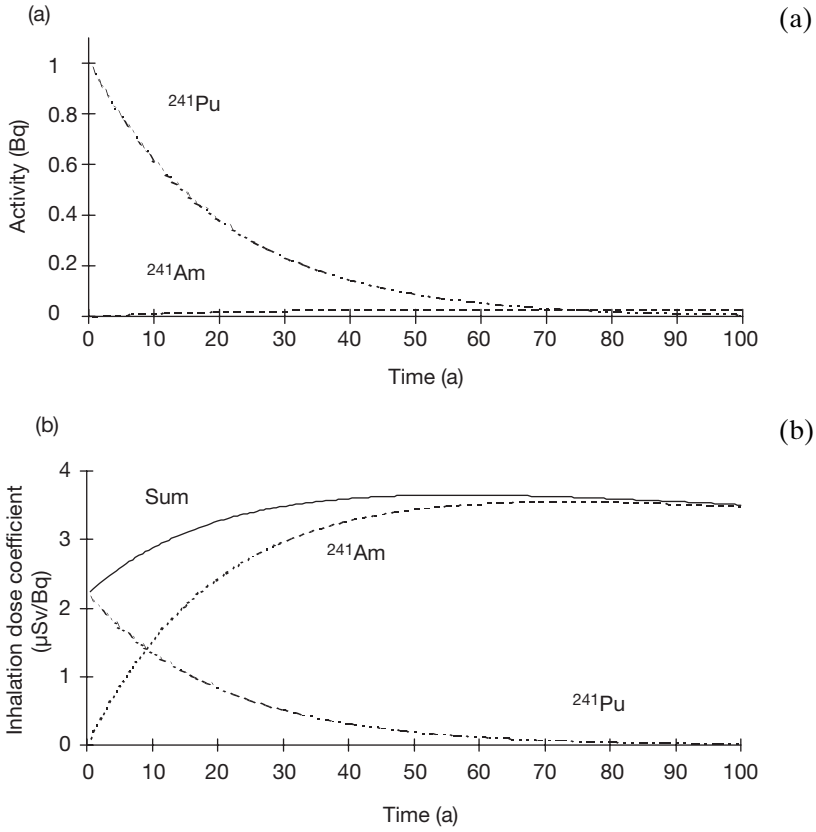

FIG. 1. Development of activity and dose coefficient of the radionuclide pair $^{241}Pu/^{241}Am$ over time.

The dose contribution from progeny radionuclides is included in the calculations in order not to underestimate doses. This is ensured by adding the dose coefficients of the progeny radionuclides to the dose coefficients of the parent radionuclides, using the appropriate weighting factors for the dose coefficients of the progeny radionuclides. The weighting factors for the progeny nuclides are taken as the maximum activity ratio that the respective progeny radionuclides will reach during a time span of 100 years, as illustrated in Fig. 2, which shows the point of maximum activity of the progeny radionuclide. A time span of 100 years is necessary to ensure that material that does not exceed the activity concentration values at a certain time will also not do so at any later point in time, within a reasonable time frame.[8]

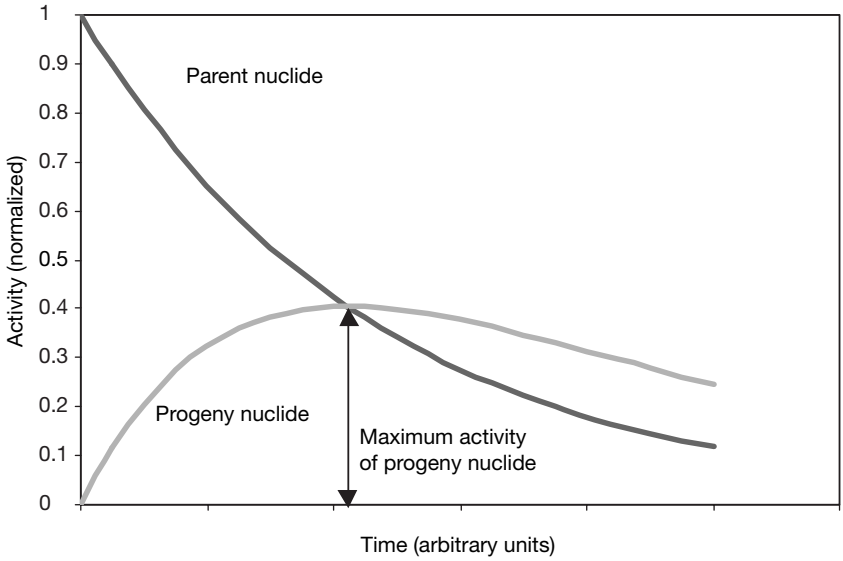

FIG. 2. Activity of arbitrary parent and progeny radionuclide with time. The point of maximum activity of the progeny radionuclide is indicated.

The time at which the activity of the first decay product is at a maximum is derived as follows.

If the activity of the progeny as a function of time is designated as $A_2(t)$, then

$$A_2(t) = A_1(0)\lambda_2 \frac{(e^{-\lambda_1 t} - e^{-\lambda_2 t})B_2}{\lambda_2 - \lambda_1}$$

[8] This approach does not take account of the fact that in situations like the ^{241}Pu/^{241}Am example given in Fig. 1, the parent nuclide already has decayed to a large extent when the progeny nuclide reaches its activity maximum. Consequently the dose factor for the mixture of parent and progeny nuclides will be overestimated in such situations (by a factor of about 1.7 in the example). However, an approach avoiding this potential overestimation would be complicated, in particular when several progeny nuclides are involved. Therefore the approach presented is considered appropriate, satisfying the overall goals of the dose assessments presented here, namely not to underestimate doses and to the extent possible to use simple and concise models.

where

$A_2(t)$ is the activity of the progeny at time *t;*
$A_1(0)$ is the initial activity of the parent;
λ_1 is the radioactive decay constant of the parent;
λ_2 is the radioactive decay constant of the progeny;
B_2 is the branching ratio of the progeny.

Setting the derivative with respect to time to zero

$$\frac{\mathrm{d}A_2(t)}{\mathrm{d}t} = \frac{A_1(0)\lambda_2}{\lambda_2 - \lambda_1}(\lambda_2 e^{-\lambda_2 t} - \lambda_1 e^{-\lambda_1 t})B_2 = 0$$

and solving for t, one obtains

$$t_{\max} = \frac{\log(\lambda_2/\lambda_1)}{\lambda_2 - \lambda_1}$$

where $t_{\max}$ is the time of maximum.

The weighting factors that are calculated in this way are provided in Appendix II.

As the activity concentration values derived in this Safety Report already take into account dose contributions from progeny radionuclides, it is also possible to provide a list of those progeny radionuclides that are fully accounted for in the activity concentration values of the parent radionuclide. The following set of criteria is convenient for defining when this is the case for a particular progeny radionuclide:

(1) The half-life of the progeny radionuclide must be shorter than that of the parent radionuclide;

AND

(2) The half-life of the progeny radionuclide is less than 1 day;
OR
(3) The half-life of the progeny radionuclide is less than 10% of the half-life of the parent radionuclide AND the half-life of the progeny radionuclide is less than 10 years.

This means that a progeny radionuclide need not be treated separately if criterion 1 is fulfilled together with at least one of the criteria 2 and 3. Table 1

provides a list of parent and progeny radionuclides that fulfil the above criteria. For decay chains (i.e. more than one progeny radionuclide), the process of including progeny radionuclides in this way is carried on until a radionuclide is reached which fails to meet the criteria. All progeny radionuclides up to this point are then taken into account in the dose calculations. The parent radionuclides are marked with a plus sign (+) to indicate that the derived activity concentration level also includes progeny radionuclides. When applying the activity concentration values, the progeny radionuclides listed in Table 1 need not be considered separately.

TABLE 1. PROGENY RADIONUCLIDES THAT ARE TAKEN INTO ACCOUNT WITH THE PARENT RADIONUCLIDE

Parent radionuclide	Progeny radionuclide	Parent radionuclide	Progeny radionuclide
Fe-52+	Mn-52m	Sn-113+	In-113m
Zn-69m+	Zn-69	Sn-121m	Sn-121
Sr-90+	Y-90	Sb-125+	Te-125m
Sr-91+	Y-91m	Te-127m+	Te-127
Zr-95+	Nb-95m	Te-129m+	Te-129
Zr-97+	Nb-97m, Nb-97	Te-131m+	Te-131
Nb-97+	Nb-97m	Te-132+	I-132
Mo-99+	Tc-99m	Cs-137+	Ba-137m
Mo-101+	Tc-101	Ce-144+	Pr-144, Pr-144m
Ru-103+	Rh-103m	Pm-146	Sm-146
Ru-105+	Rh-105m	U-232sec	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208
Ru-106+	Rh-106		
Pd-103+	Rh-103m		
Pd-109+	Ag-109m	U-240+	Np-240m, Np-240
Ag-108m+	Ag-108	Np-237+	Pa-233
Ag-110m+	Ag-110	Pu-244+	U-240, Np-240m, Np-240
Cd-109+	Ag-109m	Am-242m+	Np-238
Cd-113m	In-113m, Cd-113	Am-243+	Np-239
Cd-115+	In-115m	Cm-247+	Pu-243
Cd-115m+	In-115m	Es-254+	Bk-250
In-114m+	In-114	Es-254m+	Fm-254

3.1.3. Calculations and scenarios

The sequence of calculations for deriving the activity concentration values for all material containing radionuclides of artificial origin, except foodstuffs and drinking water, proceeds along the following lines:

— Selection of radionuclides for which the calculations are carried out;
— Definition of suitable scenarios and parameter values;
— Calculation of annual doses relating to the unit specific activity (i.e. 1 Bq/g) for each radionuclide;
— Identification of the limiting scenario for each set of calculations, i.e. the one that gives the highest dose;
— Derivation of the radionuclide specific activity concentration values by dividing the reference dose level (10 μSv/a, 1 mSv/a or 50 mSv/a, as appropriate) by the annual dose calculated for 1 Bq/g for the limiting scenario for that nuclide;
— Application of rounding procedures to the activity concentration values.

The rounding[9] of ten is similar to the approach followed for the exemption levels. It implies that the radiological models do not possess such a level of accuracy that a higher precision of the result would be justified.

For the radionuclides of artificial origin, several evaluations were considered as described below. The scenarios described in this section serve to determine the exemption of bulk amounts of material.

Examination of a large number of scenarios from around the world revealed that the limiting cases for a significant number of radionuclides could be reduced to a few scenarios. Within these scenarios, different exposure pathways may account for the total exposure. These relevant exposure pathways are summed for each scenario to yield the total dose.

On a radionuclide by radionuclide basis, the dominant scenario depends on several parameters, such as exposure time, concentration of the radionuclide used in the exposure pathways and timing of the scenario with respect to radioactive decay. On the basis of these observations from specific and detailed scenarios, the following scenarios are used in the calculation of activity concentration values:

[9] If the calculated values lie between 3×10^x and $3 \times 10^{x+1}$, the rounded value is 10^{x+1}. This type of near logarithmic rounding was chosen in order to err by the same factor rather than by a factor of 2 upwards and 5 downwards as in conventional rounding.

Scenario WL

A worker is exposed from contaminated material dumped on a landfill. Exposure pathways encompass external irradiation from the material, the inhalation of contaminated dust and the inadvertent ingestion of contaminated material (e.g. by the hand to mouth pathway).

Scenario WF

A worker is employed in a foundry where contaminated metal is smelted. External exposures arise if the worker stays within the vicinity of piles of contaminated material. In addition, the worker is exposed to dust released from the material during the transport and melting process. This dust can be inhaled and inadvertently ingested.

Scenario WO

A worker (e.g. a truck driver) comes into contact with contaminated material on a regular basis. The worker is exposed externally from the material (e.g. from the load on the truck). This scenario also covers the exposure from a large piece of equipment that has been cleared from regulatory control and is reused in a workplace.

Scenarios RL-C and RL-A

Scenario RL considers individuals living near a landfill or other facility (C indicates a child, A an adult) who are exposed through contaminated dust released at the landfill or facility. In addition, it is assumed that the residents harvest foodstuffs in a private garden on the site that has become contaminated through the deposition of contaminated material.

Scenario RF

Since the exposure situation with respect to contaminated dust could be different near a foundry than in the residential scenario (RL), a scenario of a child being exposed to contaminated dust released by a foundry is considered. Unlike scenario RL, which covers a general situation, including landfills, no food consumption is considered here, because the presence of contaminated material off-site is already covered by scenario RL.

Scenario RH

Contaminated material (building rubble, slag, fly ash) may be used in the construction of buildings as concrete aggregate or cement substitute. This will lead to an external exposure of the building residents, which is addressed in this scenario. Other possible uses in private homes of material cleared from nuclear facilities are also covered by this scenario (e.g. the use of steel plates for the cladding of walls).

Scenario RP

If contaminated material is used for covering public places, residents will be subject to external exposure as well as to the inhalation and ingestion of contaminated dust, for example by playing children. This exposure situation is covered in this scenario.

Scenario RW

The presence of contaminated material may lead to a release of radionuclides into a groundwater aquifer. This may affect downstream wells, which may lead to the ingestion of contaminated drinking water or of contaminated foodstuffs produced in a private garden if the well water is used for irrigation. If the contaminated groundwater discharges into a river, the additional pathway of fish consumption has to be considered.

The identified scenarios encompass all plausible situations worldwide without specifying a particular situation. The scenarios are not intended to cover worst case scenarios, outlier scenarios or scenarios that apply to a very few individuals. In this sense the scenarios are not bounding.

Development of the scenarios is approached by the examination of the parameters of the dominant exposure pathways, and the parameters are adapted to ensure worldwide applicability to a variety of situations. Care is taken to ensure that the parameter values are internally consistent within a particular scenario.

The limiting scenario may be different for different countries, because of different exposure geometries, working hours, sizes of transportation vehicles, etc. Thus different sets of parameters could be chosen in different countries, but the linkage of all relevant parameters needs to be taken into account in developing the scenarios. There are balancing effects between sets of parameters; while one parameter may be higher in one set than in another, other parameters may be lower and compensate for the higher parameter. The

enveloping parameter set has been chosen carefully to avoid overconservatism. The most restrictive parameters are not necessarily all gathered into the enveloping scenario.

A number of scenarios are required which cover all relevant aspects of external irradiation, inhalation and ingestion in such a way that any exposure situation that is reasonable to assume would not lead to higher doses. Whereas the exact parameter values may be material specific, the general categories of scenarios and formulas are common to all material.

For each scenario, two distinct approaches have been applied:

— The first approach is to make the calculations with realistic scenario parameter values using an effective dose criterion of 10 μSv/a.
— The second approach is to use a set of low probability scenario parameter values with an effective dose criterion of 1 mSv/a and a skin equivalent dose limit of 50 mSv/a.

The approach applied differs from the derivation of clearance values or exemption levels made by other organizations [9], where only the predominant exposure pathway and not the sum of all exposures within an exposure situation is taken as the basis for comparison with the dose criterion. The reason for adopting this different approach is twofold:

(1) The original derivation of the 10 μSv/a criterion was based on a dose of 100 μSv/a, which was considered acceptable as a trivial risk. However, since an individual may be exposed to several exposure sources over different pathways, the criterion was divided by ten to take into account these possible multiple exposures. The derivation of activity concentration values presented here, however, also is based on the 1 mSv/a public dose criterion for the low probability parameter assumptions. In this case, no allowance can be made for multiple exposure pathways affecting one individual, because the dose criterion refers to the overall exposure of a member of the public. Therefore the sum of all exposures affecting one individual in a specific situation has to be considered.
(2) The scenarios have been defined combining only those exposure pathways that will occur simultaneously in a particular situation with a high probability. For example, a landfill worker dealing with contaminated material will in most cases be affected by external exposure as well as by dust inhalation and ingestion. Therefore it is considered prudent to base the derivation of the activity concentration values on the sum of exposure pathways having a high probability of affecting an individual simultaneously.

The situation could also occur that different defined scenarios affect one individual. For example, the landfill worker may happen to live in a house constructed with contaminated material. A further combination of these exposures to yield the hypothetical maximum exposure to an individual is not considered appropriate.

(a) For realistic parameters used in the scenarios, comparison is made with the 10 μSv/a criterion, allowing for possible multiple exposures as discussed above. Consequently the activity concentration values based on realistic parameters implicitly take account of such unlikely but possible multiple exposures.
(b) Comparing exposures with the 1 mSv/a dose criterion, on the other hand, involves low probability assumptions for each scenario. Therefore the assumption that one individual is exposed through two different scenarios — a situation that has in itself only a small probability of occurrence — together with the further assumption that in both scenarios the low probability parameters adequately describe the situation yields only a negligible overall probability of occurrence. It is therefore reasonable to assume that for one individual, one exposure scenario at a maximum will correspond to the low probability parameters. This scenario then dominates the assessment based on the 1 mSv/a dose criterion, and the possible simultaneous exposure through another scenario contributing only 10 μSv/a is of no consequence.

3.1.4. Short lived radionuclides

According to the overall concept outlined in the Safety Guide [2], the activity concentration values should be lower than or equal to the exemption levels given in the BSS, because the activity concentration values define whether or not regulatory control is warranted, while the exemption levels are criteria within the scope of the BSS for exemption from this regime for material with small activity concentrations and small total activities. This condition is satisfied by the results of the defined scenarios for most of the radionuclides, but not for all of them.

The calculated activity concentration values are higher than the exemption levels for a number of radionuclides with short half-lives. The reason for this lies in the fact that the scenarios used to determine the activity concentration values focus on the handling (transport, trade, use or deposition) of the material outside the facilities in which they arise (reactors, accelerators or laboratories), because these facilities will be under regulatory control in any case. As a consequence, the scenarios used for the activity concentration values

always consider a decay time before the start of the exposure (see Section 4.2), which is assumed to be at least one day (or considerably longer for some scenarios). The calculations on which the activity concentration values in the BSS are based do not consider decay times, because they also cover the direct handling of the material in the facilities where the material arises.

In order to cover the direct handling of the material in the derivation of the activity concentration values, scenarios could be added in analogy to those used for the BSS. However, this would not add any new information. Therefore it was decided to define the activity concentration values as the lesser of the scenario results presented and the exemption levels given in the BSS. This ensures that the case of direct handling of the material is adequately reflected in the activity concentration values also for the short lived radionuclides.

3.1.5. Effects of particle size

The activity concentration values are based on the average activity concentration in a material. For material exhibiting a particle size distribution (e.g. building rubble, soil, ashes), the average activity concentration is not necessarily identical with the activity in certain particle size fractions. A well known example is the distribution of the activity between ingot, slag and fume during the smelting of contaminated metal. Depending on the technical parameters and on the chemical properties of the radionuclides, a substantial enrichment of the activity concentration may be found in the slag or in the fume.

For much other material not arising from thermal processes, higher activity concentrations in fine fractions may be observed. For material consisting of individual particles, this phenomenon can occur through the transfer of dissolved radionuclides into the material with a fluid phase (e.g. contamination from spills). A non-uniform activity concentration over particle size may also be caused or further enhanced by a redistribution of the activity in the material through leaching by fluids. An enhanced activity concentration of the fine fraction also obviously results when the activity is brought into the material with fine particles (e.g. through deposition of dust or fumes on surfaces).

A higher activity concentration in the fine fraction has to be considered in assessments of the inhalation pathway. It is also relevant for the direct ingestion of contaminated material because this also refers to the fine fraction.

Several investigations have been performed concerning the smelting of metal. On the basis of these studies, element specific enrichment factors in the fumes of between 1 and 70 have been derived [10]. These are applied in the calculations performed here for the foundry scenarios WF and RF.

For material other than metal, the situation is more complicated. Investigation of the processes that may lead to an enriched activity in the fine fraction shows that the actual activity distribution over particle size will depend on many factors, such as the type of material, its physical and chemical properties, and the origin and possible later redistribution of the contamination. This obviously causes difficulties for a generic assessment. Nevertheless, it is considered more appropriate to take account of this phenomenon even in a crude fashion rather than to ignore it entirely.

On this basis, it is assumed that for material other than metal, the activity concentrations in the respirable fine fraction are a factor of 4 higher than the average for the material. For the dust that is subject to direct ingestion, a factor of 2 is assumed because this pathway on the average refers to coarser particles. These numbers are based on comprehensive investigations carried out on soil-like material in Germany [11]. It should be noted that the chosen factors do not correspond to the maximum values observed in these studies, but they are considered reasonable assumptions for covering the broad majority of material.

3.2. RADIONUCLIDES OF NATURAL ORIGIN

Scenarios were not used for calculating activity concentration values for radionuclides of natural origin. Rather, the values were based on consideration of the worldwide distribution of concentrations of radionuclides of natural origin.

3.3. MIXTURES

To apply the activity concentration values to a material containing a mixture of radionuclides (either artificial or naturally occurring), the concentrations should be determined as follows:

(1) Artificial

$$\sum_{i=1}^{n} \frac{C_{i(\text{artificial})}}{\text{activity concentration}} \leq 1$$

(2) Natural origin — For each radionuclide*:

$$\frac{C_{\text{natural}}}{\text{activity concentration}} \leq 1$$

* In the case of secular equilibrium, all C_{natural} of a chain are equal.

where $C_{i(\text{artificial})}$ is the concentration (Bq/g) of a radionuclide of artificial origin in the material, activity concentration$_i$ is the activity concentration value for the radionuclide of artificial origin in that material and n is the number of radionuclides in the mixture. For (2), C_{natural} is the concentration (Bq/g) of a radionuclide of natural origin in the material or, for those materials in secular equilibrium, it is the concentration of the parent nuclide, and activity concentration is the activity concentration value for the radionuclide of natural origin (or, for those in secular equilibrium, the parent nuclide).

If both (1) and (2) are satisfied, then the material should not be subject to radiation protection considerations. If either (1) or (2) is greater than one, the requirements of the BSS [1] should be applied to the material as given in Section 2 of this Safety Report. This type of relationship could be used by national regulatory bodies in their specific guidance on application of the BSS [1] to take into account situations where multiple radionuclides are present in mixtures.

It is worth noting that this is a conservative approach since the pathways of exposure of the critical group of exposed individuals are not necessarily the same for each nuclide, because of partitioning or separation of nuclides by processes.

3.4. AVERAGING PROCEDURE

When applying the derived activity concentrations, the regulatory body needs to consider methodologies for sampling, averaging, monitoring and detection of radionuclides. In doing this, the regulatory body needs to recognize that these activity concentrations were derived for bulk amounts and that the averaging should be done accordingly. Consideration should also be given to surface contamination levels that would equate to the specified dose criteria. The IAEA is currently preparing guidance on these issues.

3.5. SURFACE CONTAMINATION

The activity in a material is not in all cases fully characterized by the activity concentration. Apart from the particle size effects discussed above, a major portion of the activity may be concentrated on the surface of the material. This is in particular relevant for metals and buildings, but other materials may also exhibit surface contamination depending on their nature and on the origin of the contamination.

The difference between contaminants present preferentially on the surface compared with the bulk of a material plays only a minor role for the important pathways of external irradiation and food ingestion, and does not affect exposure estimates significantly. For the inhalation and ingestion of contaminated dust, however, this difference can become very important. A well known example is the massive release of surface-bound radionuclides during the thermal cutting of metals, which gives rise to several times the doses that would be expected if the radionuclides were evenly distributed throughout the bulk of the material.

This aspect has been intensively considered in several studies relating specifically to the clearance of material from nuclear installations [10, 12–14]. For the purpose of the generic derivation of activity concentration values, however, such factors cannot be taken into account. Therefore it has to be recognized that for specific situations such as the clearance of metal or the reuse of buildings from nuclear installations, additional criteria relating to the surface contamination may have to be applied that are not reflected in the derived activity concentration values. This may lead to a decision of the regulatory body not to release some material even if the activity concentration values are not exceeded for the bulk quantity.

4. DEVELOPMENT OF ACTIVITY CONCENTRATION VALUES FOR RADIONUCLIDES OF ARTIFICIAL ORIGIN

4.1. OVERVIEW

An overview of the scenarios considered in the derivation of activity concentration limits for radionuclides of artificial origin and the relevant pathways is given in Table 2. The basis for the exposure estimates and the parameters used for the realistic and low probability cases are described in the following sections. Section 4.2 presents scenario specific assumptions on exposure and decay times as well as dilution factors. Section 4.3 discusses the specific approaches for the modelling of the relevant exposure pathways.

TABLE 2. EXPOSURE SCENARIOS CONSIDERED AND RELEVANT PATHWAYS

Scenario	Description	Exposed individual	Relevant exposure pathway
WL	Worker on landfill or in other facility (other than foundry)	Worker	External exposure on landfill
			Inhalation on landfill
			Direct ingestion of contaminated material
WF	Worker in foundry	Worker	External exposure in foundry from equipment or scrap pile
			Inhalation in foundry
			Direct ingestion of contaminated material
WO	Other worker (e.g. truck driver)	Worker	External exposure from equipment or the load on the truck
RL-C	Resident near landfill or other facility	Child (1–2 a)	Inhalation near landfill or other facility
			Ingestion of contaminated foodstuffs grown on contaminated land
RL-A		Adult (>17 a)	Inhalation near landfill or other facility
			Ingestion of contaminated foodstuffs grown on contaminated land
RF	Resident near foundry	Child (1–2 a)	Inhalation near foundry
RH	Resident in house constructed of contaminated material	Adult (>17 a)	External exposure in house
RP	Resident near public place constructed with contaminated material	Child (1–2 a)	External exposure
			Inhalation of contaminated dust
			Direct ingestion of contaminated material
RW-C	Resident using water from private well or consuming fish from contaminated river	Child (1–2 a)	Ingestion of contaminated drinking water, fish and other foodstuffs
RW-A		Adult (>17 a)	

4.2. GENERAL PARAMETERS FOR SCENARIOS

For each scenario, general parameters are defined that characterize the exposure situation:

— Exposure time;
— Decay time allowed before the scenario starts;
— Decay time during the scenario.

The decay time before the scenario means the period of time between the determination of compliance with the activity concentration values for the material in question and the actual start of the exposure.

The decay time during the scenario defines the time intervals at which new material is brought into a facility or used for construction purposes. Since exposures in individual years are considered, a maximum of 365 days of decay can be taken into account during a scenario, even if the deposition of material is a single event or if there is no new material used, as in the case of a building after the construction is finished.

Decay times for the growing of foodstuffs on contaminated land are treated separately because the material in this case has to be present in the area concerned for a considerable period of time before the growing of plants is expected to start.

The following values for these parameters for the realistic assumptions and for the low probability case (see Section 2) are used:

Exposure times

— For all workplace scenarios except WO, a range between a quarter of a working year (realistic assumption) and a full working year (low probability assumption) is used. For scenario WO, an exposure time of 900 hours, corresponding to half a working year, is used in order to cover the case that a piece of equipment cleared from a nuclear facility is reused.
— The realistic time residents are exposed from a facility is set to 1000 hours per year, but since the dust within a building very close to a facility may also be impacted, a low probability assumption of a continuous exposure throughout a year is made. This covers, for example, the case of a child spending most of the time in the house or in its vicinity.
— With similar arguments, the low probability assumption for the scenario of living in a house constructed from the material is set to a continuous

exposure (8760 hours). As a realistic assumption, a time of 4500 hours is used.

— For the case of children playing on a public place covered with the material, exposure times are assumed as 400 (about 1 hour per day) to 1000 hours, the upper bound being sufficient to cover the case of children playing on this place for about 3 hours every day.

Decay times

— Decay times are chosen identically for all scenarios in which the exposure is due to material brought into a facility for processing or deposition. For the realistic case, a decay time before the scenario of 30 days and a decay time during the scenario of 365 days are used. The latter corresponds to the assumption that the facility receives such material only once, or at least infrequently. A facility processing such material on a routine basis is covered by the low probability assumptions with only a one day decay time before the scenario and no decay during the scenario.

— The two scenarios considered where the material has been used for construction purposes (building or public place) assume a decay time before the start of the scenario of 100 days. This allows for the preparation of the building material and the construction phase. Since no new material will be brought in after the construction is complete, a 365 day decay time during the scenario is assumed.

— For the growing of foodstuffs on an area contaminated by the material, a decay time of 365 days before the start of the scenario is assumed. Since new material will not be added (or will be added only infrequently as, for example, in the case of wood chips), the decay time during the scenario is also set to 365 days.

— For the water pathways, decay times are considered within the model applied (see Section 4.3.4). General assumptions are therefore not required.

The parameter values are provided in Table 3.

4.3. MODELLING OF EXPOSURE PATHWAYS

In the following sections, the exposure models and the parameters used are described for all pathways relevant to the exposure scenarios considered. The results of the calculations are presented in Appendix I. The activity concentration values are shown in Table 15 for radionuclides of artificial origin.

TABLE 3. GENERAL PARAMETERS OF EXPOSURE SCENARIOS

	Unit	Case	WL	WF	WO	RL	RF	RH	RP
			Worker landfill	Worker foundry	Other worker	Resident landfill	Resident foundry	Resident house	Resident place
Exposure time (t_e)	h/a	Realistic	450	450	900	1000	1000	4500	400
		Low prob.	1800	1800	1800	8760	8760	8760	1000
Decay time before scenario (t_1)	d	Realistic	30	30	30	30	30	100	100
		Low prob.	1	1	1	1	1		
Decay time during scenario (t_2)	d	Realistic	365	365	365	365	365	365	365
		Low prob.	0	0	0	0	0		
Decay time before food scenario (t_{f1})	d	Realistic	n.a.	n.a.	n.a.	365	n.a.	n.a.	n.a.
Decay time during food scenario (t_{f2})	d	Realistic	n.a.	n.a.	n.a.	365	n.a.	n.a.	n.a.

Note: n.a.: not applicable.

4.3.1. External exposure

Exposure situations in which external exposure is relevant are quite varied and may include, for example, exposure on a landfill or garden where waste that has been released from regulatory control is disposed, working near a large piece of cleared equipment, or staying in a building that was constructed using building rubble or other material (e.g. slag or fly ash) that had been released from regulatory control as an aggregate for the new concrete or as a substitute for cement in the concrete. The scenarios considered are defined to cover these and similar situations.

The dose from external exposure is calculated according to:

$$E_{\text{ext,C}} = \dot{e}_{\text{ext}} t_{\text{e}} f_{\text{d}} e^{-\lambda t_1} \frac{1 - e^{-\lambda t_2}}{\lambda t_2} \quad (1)$$

where

$E_{\text{ext,C}}$ [(μSv/a)/(Bq/g)] is the committed effective dose in a year from external exposure per unit activity concentration in the material;
$\dot{e}_{\text{ext}}$ [(μSv/h)/(Bq/g)] is the average effective dose rate per unit activity concentration in the material, depending on geometry, distance, shielding, age group, etc.;
t_{e} [h/a] is the exposure time;
f_{d} [dimensionless] is the dilution factor;
λ [1/a] is the radioactive decay constant;
t_1 [a] is the decay time before the start of the scenario;
t_2 [a] is the decay time during the scenario.

External exposures are assessed for five of the scenarios identified in Table 2. These scenarios have the following parameters:

Dilution factor

— The realistic scenario uses a dilution factor of 1. It is realized that a dilution factor of 0.1 is more realistic for this scenario since there would most likely be some dilution at a landfill or near a large pile of scrap material. However, there could be situations where large volumes of waste from nuclear decommissioning activities may be undiluted. This change in dilution values causes a difference in the activity concentration values mainly in the actinide radionuclides, where the activity concentration would vary from 1 Bq/g (using a dilution factor of 0.1) to 0.1 Bq/g

(using a dilution factor of 1). Because of the unique nature of these radionuclides, and the concern about the public perception of these radionuclides, it has been decided to use the dilution factor of 1 for the realistic case. The use of this value brings the activity concentration values more in line with other proposed values (i.e. those proposed by the group of experts established under article 31 of the Euratom Treaty [15]).

— For the external irradiation in a foundry processing the material, it is assumed that a worker is in contact with a large piece of equipment or a pile of scrap. This also covers the case of a truck driver bringing material to a foundry or a landfill. The same range for the dilution factor is assumed as for the landfill scenario.
— In scenario RH it is assumed that a person spends time in a room or enclosure that is partially made from the material (e.g. through the use of building rubble, slag or ash as an aggregate or cement substitute in concrete). It is assumed that the material of which the room or enclosure is constructed will in realistic circumstances be mixed 1:10 with other material. Since the construction material can, for technological reasons, contain only a certain percentage of building rubble, ashes, etc., an upper limit for the dilution of 0.5 is assumed for the low probability case.
— Scenario RP considers children playing on a public place partially made from the material. A dilution factor of 0.1 for realistic parameters is assumed. For the low probability case a factor of 0.5 is chosen, because the public place is not likely to be covered with a deep layer of the material. Either the cover will consist of only a relatively thin layer of, for example, ashes or slag, or there will be some mixing with other material. A factor of 0.5 is considered to provide a sufficiently conservative upper estimate.

Density of the material

— The density of the material has only a relatively small effect on the results. For a higher density, more activity is present per volume of the material (with a given mass specific activity concentration). This increases the number of photons emitted; however, self-absorption of the gamma radiation by the material increases as well.
— On these grounds, a homogeneously distributed source in the material is assumed for which a density of 1.5 g/cm^3 is used for the dose calculations in all scenarios.

Geometry

- In the landfill scenario and for the public place, doses are calculated for a rotational exposure geometry at 1 m height above the ground.
- To estimate exposures from a large item (equipment, pile of scrap, truckload of material), the exposure geometry is chosen to be a slab 5 m × 2 m × 1 m. The dose coefficients for this exposure situation are almost identical to those for a smaller piece of equipment made of steel (density 7.8 g/cm^3) considered in other models set up for the derivation of clearance values. Thus the scenario presented here covers both situations.
- For the building constructed of contaminated material, the exposure geometry chosen is a room[10] of 3 m × 4 m with a height of 2.5 m. The calculations are based on two walls and a ceiling that are 20 cm thick. It is assumed that windows and doors account for the other two walls and that the floor is made of other material. Doses are calculated for a rotational geometry in the middle of the room at a height of 1 m. Doses calculated in clearance studies for the use of steel plates cleared from nuclear facilities are considerably smaller than those in the case considered here. Thus the case of steel plates is covered here as well.

Dose coefficients

- Doses are calculated for adults in the workplace scenarios and for the residents in the house. For the public place, dose calculations are performed for children between 1 and 2 years of age.[11]

The parameter values are provided in Table 4.

[10] The actual size of the room is of minor importance. If, for example, the room is much longer in one dimension, say 8 m instead of 3 m, the dose coefficient increases by only 10%.

[11] The inclusion of children between one and two years of age in the reference groups is consistent with a strict interpretation of the exemption criteria (10 μSv/a) as relating to any single year of exposure; in terms of radiological risk from protracted low level exposure, a much longer integrated period could be considered so that children of a specific age group would normally not be in the most restrictive age group.

TABLE 4. PARAMETERS FOR EXTERNAL IRRADIATION SCENARIOS

	Unit	Case	WL	WF/WO	RH	RP
			Worker landfill	Foundry or other worker	Resident house	Resident place
Dilution factor (f_d)	[a]	Realistic	1	0.1	0.1	0.1
		Low prob.	1	1	0.5	0.5
Density of material	g/cm^3		1.5	1.5	1.5	1.5
Geometry			1 m above ground, semi-infinite source	1 m from load or item 5 m × 2 m × 1 m, no shielding	Ceiling, two walls, 3 m × 4 m, 2.5 m height, 20 cm wall thickness	1 m above ground, semi-infinite source
Dose rate coefficient ($\dot{e}_{ext}$)	(μSv/h)/(Bq/g)		Adult	Adult	Adult	Child 1–2 a
			Dependent on radionuclide and geometry			

[a] Dimensionless.

4.3.2. Inhalation

Inhalation of contaminated dust can occur in many exposure situations. Therefore representative exposures for workplaces and for the general population are considered. A child (age group 1–2 a) is chosen as the reference age group in the latter case.

Doses from inhalation are calculated according to:

$$E_{\mathrm{inh,C}} = e_{\mathrm{inh}} t_{\mathrm{e}} f_{\mathrm{d}} f_{\mathrm{c}} C_{\mathrm{dust}} \dot{V} e^{-\lambda t_1} \frac{1 - e^{-\lambda t_2}}{\lambda t_2} \quad (2)$$

where

$E_{\mathrm{inh,C}}$ [(μSv/a)/(Bq/g)] is the committed effective dose in a year from inhalation per unit activity concentration in the material;
e_{inh} [μSv/Bq] is the effective dose coefficient for inhalation (see Section 3.1.1);
t_{e} [h/a] is the exposure time;
f_{d} [dimensionless] is the dilution factor;
f_{c} [dimensionless] is the concentration factor of specific activity in the fine fraction;
C_{dust} [g/m³] is the effective dust concentration in the air;
$\dot{V}$ [m³/h] is the breathing rate;
λ [1/a] is the radioactive decay constant;
t_1 [a] is the decay time before the start of the scenario;
t_2 [a] is the decay time during the scenario.

The inhalation pathway is relevant for most of the scenarios considered. The following parameters are used:

Dilution factor

— For the landfill, the same range (0.1–1) for the dilution factor is used as for external irradiation.

— The dilution factor for the foundry is chosen as 0.02 in the realistic case, taking into account the fact that typical foundries process large amounts of scrap material. For the low probability case, a factor of 0.1 is used.[12]
— For residents living in the vicinity of a landfill or other facility, the dilution factors are reduced by a factor of 10 as compared with the assumptions for within the facility. This takes into account the fact that several other sources will contribute to the airborne dust outside the facility.
— In the public place, a realistic dilution factor of 0.1 is assumed in accordance with the assumptions for the external exposure. However, the low probability assumption of the external exposure pathway of 0.5 dilution is not used for the inhalation pathway, because the material may have been used for covering the place with a thin layer (e.g. ash). Since the airborne dust in this case would be almost completely generated from the cover layer, no dilution is assumed in the low probability case.

Dust concentration in air

— For the workplaces, a realistic dust concentration in air of 5×10^{-4} g/m^3 and a low probability value of 10^{-3} g/m^3 are assumed.
— The values for the dust concentration in air for the scenarios outside the facilities are reduced to 10^{-4} g/m^3 for realistic assumptions and to 5×10^{-4} g/m^3 for low probability assumptions.

Concentration factor of specific activity in the fine fraction

— The higher activity in the fine fraction as compared with the material average is taken into account according to the discussion in Section 3.1.5. For metal smelting, an element dependent range between 1 and 70 is used, while for other materials a factor of 4 is used.

[12] It should be noted that for the external irradiation of a worker in the foundry, a dilution factor in the range 0.1–1 is used, corresponding to the landfill scenario. The reason for adopting a lower factor for the inhalation pathway is as follows: A worker in the foundry may be specialized in processing certain material types in preparation for smelting (e.g. of stainless steel). Consequently this worker may be exposed to the material of concern on a frequent basis, which is taken into account by the lower dilution considered for the external exposure as well as for the material ingestion scenarios. The radionuclide concentrations in the fumes present in the foundry, on the other hand, will be determined by the overall dilution of the material processed in the facility, which is expected to be considerably higher.

Breathing rate

— The breathing rate for workers and other adults is set to 1.2 m^3/h (assuming moderate physical activity). For children between one and two years of age, a breathing rate of 0.22 m^3/h is applied.

Dose coefficients

— Dose coefficients for workers are taken from the BSS [1] for 5 μm AMAD (activity median aerodynamic diameter). For the public, dose coefficients are taken from the BSS [1] for the default lung retention class specified in Ref. [16] and the appropriate age group.

The parameter values are provided in Table 5.

4.3.3. Ingestion

Two types of exposure pathway are considered for ingestion:

— Inadvertent direct ingestion of dust (e.g. via the hand to mouth pathway);
— Ingestion of crops which are grown in the material in question (e.g. soil), where the nuclides enter the crops via the roots of the plants.

The growing of plants in soil that contains material that has been released from regulatory control might occur in the following situations: released building rubble is present in soil in small fractions; released soil from a nuclear site is used in a garden or for covering a landfill site that is later used as a recreational area; or a former nuclear site is used for general purposes. The foodstuffs scenario RL-A covers the case of an adult who consumes vegetables grown in the material; RL-C covers the exposure of a child in the same situation.

The dose from ingestion is calculated according to:

$$E_{\mathrm{ing,C}} = e_{\mathrm{ing}} q f_{\mathrm{d}} f_{\mathrm{c}} f_{\mathrm{t}} e^{-\lambda t_1} \frac{1 - e^{-\lambda t_2}}{\lambda t_2} \tag{3}$$

where

$E_{\mathrm{ing,C}}$ [(μSv/a)/(Bq/g)] is the committed effective dose in a year from ingestion per unit activity concentration in the material;
e_{ing} [μSv/Bq] is the effective dose coefficient for ingestion (see Section 3.1.1);
q [g/a] is the quantity ingested per year;

TABLE 5. PARAMETERS FOR INHALATION SCENARIOS

	Unit	Case	WL	WF	RL-A	RL-C	RF	RP
			Worker landfill	Worker foundry	Resident landfill		Resident foundry	Resident place
Dilution factor (f_d)	[a]	Realistic	0.1	0.02	0.01	0.01	0.002	0.1
		Low prob.	1	0.1	0.1	0.1	0.01	1
Dust concentration in air (C_{dust})	g/m³	Realistic	5×10^{-4}	5×10^{-4}	10^{-4}	10^{-4}	10^{-4}	10^{-4}
		Low prob.	10^{-3}	10^{-3}	5×10^{-4}	5×10^{-4}	5×10^{-4}	5×10^{-4}
Concentration factor (f_c)	[a]		4	1–70	4	4	1–70	4
Breathing rate ($\dot{V}$)	m³/h		1.2	1.2	1.2	0.22	0.22	0.22
Dose coefficient (e_{inh})	µSv/Bq		5 µm, worker, see 3.1.1	5 µm, worker, see 3.1.1	Adult, see 3.1.1	Child (1–2 a), see 3.1.1	Child (1–2 a), see 3.1.1	Child (1–2 a), see 3.1.1

[a] Dimensionless.

f_d [dimensionless] is the dilution factor;
f_c [dimensionless] is the concentration factor in the fine fraction;
f_t [dimensionless] is the root transfer factor;
λ [1/a] is the radioactive decay constant;
t_1 [a] is the decay time before the start of the scenario;
t_2 [a] is the decay time during the scenario.

The factor f_t describes the transfer of elements from soil to plants for those circumstances where the growing of foodstuffs in soil mixed with material that has been released from regulatory control is considered. This factor takes into account the fact that the uptake of radionuclides in plants depends on the element. Values for f_t are given in Bq/kg in the plant per Bq/kg in the soil (i.e. they are dimensionless) and are provided in Ref. [17].

The following parameters are used for the ingestion scenarios:

Dilution factor

— Assumptions for the dilution of dust ingested inadvertently by a resident near a landfill are identical to those for the inhalation pathway. For the growing of foodstuffs, a realistic dilution of 0.01 and a low probability dilution of 0.1 are used. This dilution takes into account the fact that only part of the soil will consist of the material. It is also assumed that only a portion of the annual dietary intake will be grown in the garden. With the combination of these two factors, the assumed range is considered to be adequate.

Concentration factor of specific activity in the fine fraction

— This factor is only relevant for the direct ingestion of material. For the particle size fraction that may be subject to direct ingestion, a concentration factor of 2 is used according to the discussion in Section 3.1.5.

Root transfer factor

— This factor is only relevant for the ingestion of foodstuffs. Root transfer factors describing the transfer of radionuclides from the soil to the plants are provided in Ref. [17].

Annually ingested quantity

- For a worker, a quantity of 10 g/a is assumed for direct ingestion. A low probability approach is to use 50 g/a.
- The amount of dirt and dust which a small child may inadvertently swallow when playing on a public place covered with the material could amount, under realistic assumptions, to 25 g/a. The low probability approach is to assume an ingested quantity of 50 g/a.
- For the foodstuffs pathway the annual consumption of vegetables and fruits grown in the garden is considered.[13] The consumption quantities used for the realistic case are 68 kg/a for children and 88 kg/a for adults. In the low probability scenarios, consumption rates of 204 kg/a for children and 264 kg/a for adults are used. The derivation of these assumptions is provided in connection with other consumption parameters required for the water pathway model in Section 4.3.4. A dilution with foodstuffs from other sources has already been taken into account in the assumptions for the dilution factor.

Dose coefficients

- The ingestion dose coefficients are taken from the BSS [1] for workers or the appropriate age group of the public.

The parameter values are provided in Table 6.

4.3.4. Water pathway

Water pathways are included in the radiological assessments for those cases where bulk amounts of material have been removed from regulatory control and are disposed or stored in a single place where rain can carry away any residual contamination to a groundwater layer or surface water. The radionuclides can enter the human food chain if the water is used for drinking or

[13] This scenario does not consider other agricultural products such as grain, meat or milk. Such products would require substantially larger areas than the growing of vegetables or fruits in a private garden. This would lead to substantially higher dilution factors, because it cannot reasonably be assumed that large agricultural areas are contaminated in total with the material. Therefore the consideration of a private garden with limited types of foodstuffs produced represents the enveloping scenario for the food pathway.

TABLE 6. PARAMETERS FOR INGESTION SCENARIOS

	Unit	Case	WL/WF	RP	RL-A	RL-C
			Landfill or foundry worker	Resident place	Resident landfill	
Dilution factor (f_d)	[a]	Realistic	0.1	0.1	0.01	0.01
		Low prob.	1	1	0.1	0.1
Concentration factor (f_c)	[a]		2	2	n.a.	n.a.
Root transfer factor (f_t)	[a]		n.a.[b]	n.a.[b]	[12]	[12]
Annually ingested quantity (q)	g/a or kg/a	Realistic	10 g/a	25 g/a	88 kg/a	68 kg/a
		Low prob.	50 g/a	50 g/a	264 kg/a	204 kg/a
Dose coefficient (e_{ing})	µSv/Bq		Worker, see 3.1.1	Child (1–2 a), see 3.1.1	Adult, see 3.1.1	Child (1–2 a), see 3.1.1

[a] Dimensionless.
[b] n.a.: not applicable.

irrigation. In the case of groundwater contamination, it is conceivable that the water is taken from a private well that is not subject to any legal requirements concerning the water quality, while in the case of surface water contamination, the water might be used by a municipal waterworks. The private well supplying groundwater to a family is assumed to be the most restrictive of the various water pathways. If the contaminated water is discharged into surface water, an additional exposure pathway to be taken into account is the ingestion of contaminated fish.

Modelling a water pathway requires assumptions about the quantity of material that is stored or disposed, the location (landfill site, public area, etc.) where it is placed and the characteristics of the environment (e.g. hydrogeology). These factors are highly site specific, making the generic modelling of the water pathway difficult. Nevertheless, it is considered more appropriate to include the water pathway in the assessment in spite of this difficulty than to disregard this pathway entirely.

In line with the overall approach, in the model used for the water pathway, a realistic case and a low probability case are considered. Assumptions for the latter case represent unfavourable site and exposure conditions, so that the modelling results are considered to cover all situations that are reasonably to be expected.

The models developed are based on the RESRAD computer model developed for estimates of radiation doses arising from residual radioactive material [18]. This computer model has been widely used for exposure assessments and has been benchmarked against other models. A direct use of RESRAD for modelling the water pathway was not possible, however, because not all of the nuclides relevant here are considered in RESRAD. Moreover, only a small subset of the models implemented in RESRAD actually are required here. Therefore it was decided to develop a new model based on algorithms and assumptions provided in the RESRAD documentation. In order to verify the model developed, its results were checked against RESRAD results for selected radionuclides.

4.3.4.1. Model equations

The modelling of the water pathway assumes an extended source of the material present in the catchment area of a groundwater aquifer. The material could be in a landfill or could have been used in a landscape construction project.

The model assumes conservatively that the whole inventory of radionuclides in the material is available for migration. The rate at which the radionuclides are released is determined using a K_d model [18]. Within this model the leach rate of radionuclide i from the source (L_i) is given as:

$$L_i = \frac{I}{\theta^{cz} z^{cz} R_i^{cz}} \tag{4}$$

where

I [m/a] is the infiltration rate;
θ^{cz} [dimensionless] is the volumetric water content of the contaminated zone;
z^{cz} [m] is the thickness of the contaminated zone;
R_i^{cz} [dimensionless] is the retardation factor for radionuclide i.

The retardation factor is given by:

$$R_i^{cz} = 1 + \frac{\rho^{cz} K_{di}}{\theta^{cz}} \tag{5}$$

where

ρ^{cz} [g/cm^3] is the density of the contaminated zone;
K_{di} [cm^3/g] is the distribution coefficient for radionuclide i.

The decisive parameter determining the leaching of different radionuclides from the contaminated zone is the distribution coefficient. This quantity is dependent on the chemical characteristics of the radionuclide and the geochemical properties of the soil. Values provided for different elements in the literature vary considerably. For the purposes of the generic model developed here, it is therefore necessary to select conservative estimates from the values published for different elements.

For the realistic scenario the default values in the RESRAD model are used. These are already reasonably conservative in comparison with other values published, for example in table E.4 in Ref. [17]. For some nuclides, however, lower values are reported in this table. The low probability scenario therefore uses the minimum values for the distribution coefficients provided in table E.4 of Ref. [17].

For some elements no measurements of distribution coefficients are available. In this case the approximation given in appendix H of Ref. [17] is used, estimating the distribution coefficient from the root transfer factor ($f_{t,i}$, see Section 4.3.3) as:

$$\ln K_{d\,i} = a + b \ln f_{t,i} \tag{6}$$

with $a = 2.11$ (valid for sandy soil) and $b = -0.56$.

The values of the distribution coefficient used for the different elements are given in Table 7. Values derived from Eq. (6) are indicated. The remaining values are based on measurements.

It should be noted that K_d values in specific situations may be considerably different from the numbers given in Table 7. It may also be the case that the linear K_d model is not adequate for certain site conditions (e.g. because of the presence of other chemical substances or because of adsorption saturation effects). Therefore it cannot be assumed that leach rates in all cases are covered by the model presented. This possibility, however, has to be seen in the overall context of the relatively conservative assumptions used, so that a higher leach rate for some radionuclides under specific site conditions does not necessarily mean that eventual exposures will be higher than predicted by the model.

The radionuclide concentration in the seepage (C_i^s) for radionuclide i can be calculated from the leach rate (L_i) as:

$$C_i^s = \frac{Mc_i L_i}{U^s} \tag{7}$$

where

TABLE 7. DISTRIBUTION COEFFICIENTS (cm^3/g)

Element	Realistic	Low probability	Element	Realistic	Low probability
Ag	0	0	Nb	0	0
Am	20	20	Ni	1 000	300
Ba	50	44[a]	Np	50[a]	5
Bi	0	0	Pd	30[a]	30
Bk	213[a]	213[a]	Pm	268[a]	240
C	0	0	Pt	12[a]	12[a]
Ca	50	5	Pu	2 000	550
Cd	0	0	Rb	20[a]	20[a]
Ce	1 000	500	Rh	44[a]	44[a]
Cf	109[a]	109[a]	Ru	0	0
Cl	3[a]	3[a]	Sb	0	0
Cm	395[a]	395[a]	Se	0	0
Co	1 000	60	Sm	182[a]	182[a]
Cs	1 000	270	Sn	0	0
Es	213[a]	213[a]	Sr	30	15
Eu	268[a]	240	Tb	182[a]	182[a]
Fe	1 000	160	Tc	0	0
Gd	182[a]	182[a]	Te	0	0
H	0	0	Th	60 000	1 378
Ho	182[a]	182[a]	Tl	0	0
I	0.1	0.1	Tm	213[a]	213[a]
La	213[a]	213[a]	U	50	15
Mn	200	50	Zn	0	0
Mo	20[a]	10	Zr	395[a]	280
Na	10	10			

[a] Value calculated using Eq. (6).

M [g] is the total mass of contaminated material;
c_i [Bq/g] is the specific activity of radionuclide i in the contaminated material;
L_i [1/a] is the leach rate for radionuclide i according to Eq. (4);
U^{s} [m^3/a] is the volume of the seepage through the contaminated zone.

The volume of the seepage through the contaminated zone U^{s} is given by:

$$U^{\mathrm{s}} = IA^{\mathrm{cz}} \tag{8}$$

where

I [m/a] is the infiltration rate;
A^{cz} [m^2] is the surface area of the contaminated zone.

It is assumed that the seepage from the source is discharged into an aquifer. For the realistic scenario, it is assumed that there is an unsaturated zone between the contaminated material and the aquifer. Its presence will only have an effect on the eventual contaminant concentration in the seepage reaching the aquifer through radioactive decay of the radionuclides while migrating through the unsaturated zone. The transport time (t_i) through this zone is given by:

$$t_i = \frac{z^{\mathrm{uz}} R_i^{\mathrm{uz}} p^{\mathrm{uz}} R_{\mathrm{s}}^{\mathrm{uz}}}{I} \tag{9}$$

where

I [m/a] is the infiltration rate;
z^{uz} [m] is the thickness of the unsaturated zone;
R_i^{uz} [dimensionless] is the retardation factor for radionuclide i in the unsaturated zone;
p^{uz} [dimensionless] is the effective porosity of the unsaturated zone;
$R_{\mathrm{s}}^{\mathrm{uz}}$ [dimensionless] is the saturation ratio of the unsaturated zone.

The unsaturated zone retardation factor (R_i^{uz}) is given by:

$$R_i^{\mathrm{uz}} = 1 + \frac{\rho^{\mathrm{uz}} K_{\mathrm{d}i}}{\theta^{\mathrm{uz}}} \tag{10}$$

where

ρ^{uz} [g/cm^3] is the density of the unsaturated zone;
K_{di} [cm^3/g] is the distribution coefficient for radionuclide i;
θ^{uz} [dimensionless] is the volumetric water content of the unsaturated zone.

Distributions coefficients are chosen identical to those for the contaminated zone (see Table 7).

The transport time given by Eq. (9) will only be valid if the transport can be described as flow through a porous medium with the K_d concept being applicable. This will not be the case in all situations. For example, transport mechanisms such as fracture flow or colloidal transport may lead to a substantially faster transport of the radionuclides through the unsaturated zone. Therefore the low probability model does not take account of the presence of an unsaturated zone at all. This covers the situation where there is direct contact of the contaminated zone with the groundwater aquifer as well as the presence of fast transport mechanisms through an unsaturated zone.

The exposure assessment assumes a private well downstream of the source. This well is conservatively assumed to be so close to the source that no dilution with groundwater that has not been impacted by the source takes place. The transport modelling of the radionuclides in the aquifer does not consider dispersion or diffusion effects. This is also a conservative assumption.

Within these assumptions the radionuclide concentration in the well water is given by the dilution with the groundwater volume (U^{gw}) flowing underneath the area of the contaminated zone:

$$U^{gw} = z^{gw} w^{gw} v^{gw} p^{gw} \tag{11}$$

where

z^{gw} [m] is the thickness of the aquifer;
w^{gw} [m] is the width of the contaminated zone perpendicular to the flow of the aquifer;
v^{gw} [m/a] is the pore water velocity of the groundwater;
p^{gw} [dimensionless] is the effective porosity of the aquifer.

From Eqs (7–9, 11) the concentration of radionuclide i in the well water (c_i^w) is given by:

$$c_i^w = \frac{U^s}{U^{gw} + U^s} C_i^s e^{-\lambda_i t_i} \tag{12}$$

From this result the ingestion dose arising from the use of the well water as drinking water can be calculated.

For the assessment of the radiological impact of using this water for the irrigation of foodstuffs grown in a private garden, the transfer of the radionuclides from the water to the plants has to be considered. This is done using the transfer factor given in the following equation, derived in Ref. [17] and assuming an overhead irrigation of the plants:

$$f_{\mathrm{t}} = \frac{I_{\mathrm{rr}} f_{\mathrm{r}} T_{\mathrm{f}} \left(1 - e^{-\lambda_{\mathrm{w}} t_{\mathrm{e}}}\right)}{Y_{\mathrm{w}} \lambda_{\mathrm{w}}} + \frac{I_{\mathrm{rr}} \left(1 - f_{\mathrm{r}}\right) f_{\mathrm{t},i} \left(1 - e^{-L_i t_{\mathrm{e}}}\right)}{\rho^{\mathrm{e}} L_i} \tag{13}$$

where (with default assumptions used according to Ref. [16])

I_{rr} [m/a] is the irrigation rate;
f_{r} is the fraction of deposited radionuclides retained on vegetation (0.25);
T_{f} is the foliage to food transfer coefficient (0.1 for fruits and non-leafy vegetables and 1 for leafy vegetables);
λ_{w} is the weathering removal constant for vegetation (20 a^{-1});
t_{e} is the time of exposure during the growing season (0.17 a for fruits and non-leafy vegetables and 0.25 a for leafy vegetables);
Y_{w} is the wet weight crop yield (0.7 $\mathrm{kg/m^2}$ for fruits and non-leafy vegetables and 1.5 $\mathrm{kg/m^2}$ for leafy vegetables);
$f_{\mathrm{t},i}$ is the root transfer factor for radionuclide i (dimensionless, see Section 4.3.3);
L_i [1/a] is the leach rate for radionuclide i according to Eq. (4);
ρ^{e} is the effective surface density of soil (225 $\mathrm{kg/m^2}$).

The eventual discharge of the groundwater into a surface water body will also give rise to exposures if the surface water is used for drinking or irrigation. However, because of dilution, doses will be lower than in the case of the private well. Therefore it is not necessary to consider the use of surface water explicitly in the model. An additional exposure pathway arises, however, through the ingestion of fish from this surface water body. In analogy to Eq. (12), the radionuclide concentration in the river water (c_i^{r}) is determined from the flow rate of the river (U^{r})as:

$$c_i^{\mathrm{r}} = \frac{U^{\mathrm{s}}}{U^{\mathrm{r}} + U^{\mathrm{s}}} C_i^{\mathrm{s}} e^{-\lambda_i t_i} \tag{14}$$

From this concentration the radionuclides transferred into fish can be calculated using transfer factors given in table D.5 of Ref. [17].

4.3.4.2. Conditions at the model site

For the realistic scenario, the amount of material present on the site is assumed as 25 000 m^3, and for the low probability case, a total volume of 100 000 m^3 is considered. The thickness of the contaminated zone is assumed to be 5 m in both cases. These assumptions are considered to cover all cases of material containing radionuclides of artificial origin.[14]

In analogy to the foodstuffs scenarios, a decay time before the start of the scenario of one year is assumed. During the scenario the decay depends on the migration time of the contaminant calculated according to Section 4.3.4.1. After the water reaches the well or the river, no further decay is considered, because the dominating pathway is the direct ingestion of drinking water, which would occur within a day.

The infiltration rate is chosen as 0.2 m/a, corresponding to the default assumptions in RESRAD. This value is sufficient for a moderate climate. In the case of wet regions and corresponding soil conditions, higher infiltration rates are possible. However, in this case the flow rates of aquifers and surface water would be expected to be higher, too, so that the eventual dilution factor between the seepage from the contaminated material and ground or surface water should remain approximately the same.

For the realistic scenario, an unsaturated zone of 2 m thickness between the contaminated zone and the top of the aquifer is assumed. The low probability scenario assumes direct contact of the contaminated zone and the aquifer.

The porewater velocity of the groundwater in the aquifer is taken as 1000 m/a in the realistic case and 500 m/a in the low probability case. Lower groundwater velocities and consequently lower dilution may occur at some sites. However, within the overall context of the assumptions applied to the model site, this range is considered to be sufficiently conservative.

The groundwater in the private well is assumed to be used as drinking water and for irrigation purposes in a private garden. The irrigation rate is assumed as 0.2 m/a.

The river considered in the model is assumed to have a flow rate of 5 m^3/s, which is considered high enough to support a sufficient fish population to cover the annual fish consumption of the exposed persons.

The model calculations consider adults and children of the age group 1–2 a, in accordance with the ingestion scenarios presented in Section 4.3.3. Dietary

[14] For material with elevated levels of radionuclides of natural origin, higher masses are possible (e.g. in connection with mining operations). However, the models developed are not applied to radionuclides of natural origin.

parameters are also chosen consistent with these scenarios. The model presented requires input parameters for the consumption of:

— Drinking water;
— Leafy vegetables;
— Non-leafy vegetables and fruits;
— Fish.

IAEA Safety Reports Series No. 19 [17] provides only aggregate numbers for consumption (410 kg/a of fruits, vegetables and grain for adults). Since this is not sufficient for the models developed here, the ingestion quantities are based on detailed parameters provided in the German radiation protection ordinance [19], which give ingestion quantities for average cases and for low probability cases (approximately corresponding to the 95th percentile). These parameters are used for the realistic and the low probability scenarios, respectively. They are shown in Table 8. Considering that the overall consumption given in Ref. [16] of 410 kg/a also includes grain, the assumptions are consistent.

For the realistic scenario, it is assumed that 25% of the annual consumption of drinking water and foodstuffs is affected by the radionuclides from the contaminated material and that the remainder is obtained from other sources. In the low probability scenario, it is assumed that the total consumption of drinking water and foodstuffs as specified above is affected by the contaminated material.

A summary of the site parameters used is presented in Table 9.

TABLE 8. INGESTION PARAMETERS

	Consumption by children (1–2 a) (kg/a)		Consumption by adults (>17 a) (kg/a)	
	Realistic	Low prob.	Realistic	Low prob.
Drinking water	100	200	350	700
Leafy vegetables	6	18	13	39
Non-leafy vegetables	17	51	40	120
Fruits	45	135	35	105
Total vegetables and fruits	68	204	88	264
Fish	0.6	3	1.5	7.5

TABLE 9. SITE PARAMETERS FOR THE WATER PATHWAY MODEL

	Unit	Realistic	Low probability
Contaminated zone			
Decay time before start of scenario	a	1	1
Area of contaminated zone	m^2	5 000	20 000
Thickness of contaminated zone	m	5.00	5.00
Density of contaminated area	g/cm^3	1.80	1.80
Infiltration rate	m/a	0.20	0.20
Irrigation rate	m/a	0.20	0.20
Seepage through contaminated zone (calculated)	m^3/a	1 000	4 000
Total porosity of contaminated area		0.40	0.40
Saturated hydraulic conductivity	m/a	5 000	5 000
Volumetric water content		0.16	0.16
Unsaturated zone			
Thickness of unsaturated zone	m	2.00	0.00
Density of unsaturated zone	g/cm^3	1.80	1.80
Total porosity of unsaturated zone		0.40	0.40
Effective porosity of unsaturated zone		0.20	0.20
Volumetric water content		0.16	0.16
Groundwater aquifer			
Thickness of aquifer	m	5.00	5.00
Width of contaminated zone perpendicular to aquifer	m	100	100
Groundwater porewater velocity	m/a	1 000	500
Effective porosity of aquifer		0.25	0.25
Flow rate of aquifer (calculated)	m^3/a	1.25E+05	6.25E+04
Dilution factor between seepage and groundwater (calculated)		7.94E–03	6.02E–02
Surface water			
Flow rate of river	m^3/s	5.00	5.00
Dilution factor between seepage and river (calculated)		6.34E–06	2.54E–05
Irrigation parameter			
Length of growing season for non-leafy vegetables	a	0.17	0.17
Length of growing season for leafy vegetables	a	0.25	0.25
Weathering removal constant for vegetation	1/a	20	20
Fraction of radionuclides retained on vegetation		0.25	0.25
Foliage to food transfer coefficient for non-leafy vegetables		0.1	0.1
Foliage to food transfer coefficient for leafy vegetables		1	1
Effective surface density of soil	kg/m^2	225	225
Wet weight crop yield for non-leafy vegetables	kg/m^2	0.7	0.7
Wet weight crop yield for leafy vegetables	kg/m^2	1.5	1.5

TABLE 9. SITE PARAMETERS FOR THE WATER PATHWAY MODEL (cont.)

	Unit	Realistic	Low probability
Ingestion parameter			
Consumption of drinking water (1–2 a)	kg/a	100	200
Consumption of drinking water (>17 a)	kg/a	350	700
Consumption of non-leafy vegetables (1–2 a)	kg/a	17	51
Consumption of non-leafy vegetables (>17 a)	kg/a	40	120
Consumption of leafy vegetables (1–2 a)	kg/a	6	18
Consumption of leafy vegetables (>17 a)	kg/a	13	39
Consumption of fish (1–2 a)	kg/a	0.6	3
Consumption of fish (>17 a)	kg/a	1.5	7.5
Fraction of contaminated drinking water consumed		0.25	1
Fraction of contaminated vegetables consumed		0.25	1
Fraction of contaminated fish consumed		0.25	1

4.3.4.3. Radionuclides considered

Modelling is performed only for radionuclides with a half-life of greater than 0.5 year because radionuclides with a shorter half-life will not contribute significantly to the water pathway doses. Ingestion doses incurred from these short lived radionuclides will be dominated by the ingestion scenarios and/or other pathways presented in Section 4.3.3.

The ingrowth of progeny nuclides is considered as described in Section 3.1.2. However, for the water pathway it has to be considered that the leachability and groundwater mobility of a progeny nuclide may be higher than those of its parent nuclides. To take this effect into account the following approach is used:

(a) Progeny nuclides with a half-life of less than 0.05 year are treated in equilibrium with their parent nuclides in the water and foodstuffs consumed, because the processes relevant for the migration of the radionuclides and the plant uptake are slow enough to at least nearly achieve radioactive equilibrium in this case.
(b) Longer lived progeny nuclides are modelled independently and their dose contribution is added to the dose incurred from the parent nuclide. The ingrowth of progeny nuclides is considered in analogy to the other pathways using the model presented in Section 3.

4.3.4.4. Timescales

In the realistic scenario, an unsaturated zone is assumed to be present between the contaminated material and the groundwater aquifer. In this situation, migration processes of contaminants with a high K_d value are very slow. The time span between the deposition of the material and the contaminants' arrival in the well or the river may be hundreds or even thousands of years. The consideration of such long term exposures may be seen as contradicting the assumption concerning the ingrowth of progeny nuclides (see Section 3), where a period of 100 years has been used.

Examination of the results for those nuclides dominated by the water pathway within the realistic scenario showed, however, that the resulting activity concentration values do not change if a cut-off after 100 years is applied. Therefore the question of which timescale to use is not of practical relevance in this case.

4.3.4.5. Discussion of results

The results from the water pathway model presented in Appendix I show that for only some radionuclides does the water pathway dominate the activity concentration level. These are mobile nuclides with a long half-life, high ingestion dose factors and low external dose factors.

The exposures from these nuclides over the water pathway in real situations will depend on actual site conditions. As discussed above, the model used for the derivation of activity concentration values does not cover all potentially occurring individual site parameters. Nevertheless, the results are considered to be sufficiently conservative to cover the vast majority of cases:

(a) The volumes of contaminated material considered in the model are quite high.
(b) The exposure situation of residents using the contaminated groundwater downstream of the landfill without any additional dilution corresponds to unfavourable conditions.
(c) The model used does not take account of effects like dispersion that would lead to lower exposures.
(d) An intensive use of the contaminated water for drinking and irrigation purposes is assumed.

On this basis, the derived activity concentration values are considered appropriate also for sites where some of the relevant site factors are more unfavourable than assumed here.

4.3.5. Skin contamination

Skin contamination by dust containing radionuclides can occur with some significance only at workplaces in dusty environments. Such workplaces could include a scrapyard or metal recycling facility where metal is segmented, or a landfill site where workers come into contact with the dumped material.

The skin dose is calculated according to:

$$E_{\text{skin,C}} = \dot{e}_{\text{skin}} t_{\text{e}} L_{\text{dust}} f_{\text{d}} f_{\text{c}} \rho e^{-\lambda t_1} \frac{1 - e^{-\lambda t_2}}{\lambda t_2} \tag{15}$$

where

$E_{\text{skin,C}}$ [(μSv/a)/(Bq/g)] is the skin equivalent dose in a year from skin contamination with beta and gamma emitters per unit activity concentration in the material;
$\dot{e}_{\text{skin}}$ [(μSv/h)/(Bq/cm²)] is the sum of skin equivalent dose rate coefficients for beta emitters (4 mg/cm² skin density) and for gamma emitters [8] per surface specific unit activity;
t_{e} [h/a] is the exposure time (time during which the skin is contaminated);
L_{dust} [cm] is the thickness of the layer of dust loading on the skin;
f_{d} [dimensionless] is the dilution factor;
f_{c} [dimensionless] is the concentration factor;
ρ [g/cm³] is the density of the surface layer;
λ [1/a] is the radioactive decay constant;
t_1 [a] is the decay time before the start of the scenario;
t_2 [a] is the decay time during the scenario.

Contamination of the skin is assumed to occur during the entire working year (1800 h/a). The thickness of the dust layer is assumed to be 100 μm (0.01 cm), which is a thickness that would not be significantly disturbing while working and therefore would be removed by the worker only at the end of the working time.

No dilution has been assumed. This is a conservative assumption, but it is consistent with the low probability parameter used for the landfill scenario. In order to allow for a higher activity concentration in the fine fraction, a concentration factor of 2 is used (see Section 3.1.5). As the material causing skin contamination might have been recently cleared, no decay before or during the scenario is assumed. The density of the dust on the skin is set to 1.5 g/cm³.

The parameter values are provided in Table 10.

TABLE 10. SCENARIO PARAMETERS FOR SKIN CONTAMINATION

	Unit	Skin scenario
Exposure time (t_e)	h/a	1800
Layer thickness (L_{dust})	cm	0.01
Dust density (ρ)	g/cm^3	1.5
Dilution factor (f_d)	Dimensionless	1
Concentration factor (f_c)	Dimensionless	2
Decay time before scenario (t_1)	d	0
Decay time during scenario (t_2)	d	0
Dose rate coefficient ($\dot{e}_{skin}$)	(μSv/h)/(Bq/cm^2)	Dependent on radionuclide

The parameter values defined are in total quite conservative. Therefore the estimation of the skin dose has to be seen as a low probability scenario. The resulting dose therefore could be converted into an effective dose with the skin weighting factor of 0.01 and the fraction of the total skin being exposed (choosing this fraction as 0.1 would correspond to an exposure of about 2000 cm^2, approximately equivalent to the forearms and hands). The resulting effective dose could then be compared with the 1 mSv/a dose criterion.

However, this would not yield compliance with the skin dose limit of 50 mSv/a, corresponding to an effective dose of only 0.5 mSv/a with an assumption of an uncovered skin area of 2000 cm^2. Therefore it is necessary to use the BSS dose limit for the skin of 50 mSv/a as the criterion for the assessment of the skin dose. This limit compared with the equivalent dose of the exposed skin area (for which no size assumptions are required) is given by Eq. (15).

4.4. LIQUIDS

Liquids of concern generally carry radionuclides in a water-borne or organic-liquid-borne form. Radionuclides can be in the form of suspended solids or can be dissolved in solution from solids, liquids or gases. The release of liquids from regulatory control is treated as a discharge and Ref. [20] is used as the standard.

4.5. GASES

Calculations were not undertaken explicitly for gases. However, scenarios representing exposure from gas cylinders were taken into account in deriving the exemption concentrations for Schedule I in the BSS [1]. These calculations took account of exposure from a limited volume of gas, whereas exposure from bulk amounts of gas would in principle occur during transport or storage of gas cylinders. These exposures were taken into account in establishing exemption levels for the purposes of the Regulations for the Safe Transport of Radioactive Material [21], and it was decided to adopt the Schedule I values of the BSS [1] in the Regulations [21]. Therefore it was considered appropriate to use the Schedule I values for the activity concentration values.

5. DEVELOPMENT OF EXCLUSION ACTIVITY CONCENTRATION VALUES FOR RADIONUCLIDES OF NATURAL ORIGIN

The objective in defining material that contains radionuclides of natural origin that should be excluded from the requirements of the BSS is to identify that material of significant radiological risk where regulation will not achieve real improvements in protection. The application of a dose criterion of 10 μSv/a is not practical. In selecting values for material that contains radionuclides of natural origin, a major issue is the fact that high levels that would exclude the majority of natural material in the environment would also allow a number of situations, such as the release of phosphate slags, to be excluded without further consideration. Conversely, selecting a low value would trigger an unnecessary application of the BSS [1]. Therefore the values should be derived from consideration of the worldwide distribution of concentrations of radionuclides of natural origin.

In considering exclusion activity concentration values for radionuclides of natural origin, the intention is to exclude from regulation virtually all soils, but to not exclude from regulation ores, mineral sands, industrial residues and wastes which are recognized as having significant activity considerations.

Tables 11 presents data from the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) for concentrations of radionuclides of natural origin in normal soil material. The values for ^{238}U and ^{232}Th are for the 'head of chain', assuming that progeny are in equilibrium.

TABLE 11. NATURAL RADIONUCLIDES IN SOIL [6]

Region/country	Population in 1996 (10^6)	Concentration in soil (Bq/g)							
		K-40		U-238		Ra-226		Th-232	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range
Africa									
Algeria	28.78	0.37	0.066–1.15	0.03	0.002–0.11	0.050	0.005–0.18	0.025	0.002–0.14
Egypt	63.27	0.32	0.029–0.65	0.037	0.006–0.12	0.017	0.005–0.064	0.018	0.002–0.096
North America									
Costa Rica	3.50	0.14	0.006–0.38	0.046	0.011–0.13	0.046	0.011–0.13	0.011	0.001–0.042
United States of America	269.4	0.37	0.10–0.70	0.035	0.004–0.14	0.040	0.008–0.16	0.035	0.004–0.13
South America									
Argentina	35.22	0.65	0.540–0.750						
East Asia									
Bangladesh	120.1	0.35	0.13–0.61			0.034	0.021–0.043		
China	1232	0.44	0.009–1.80	0.033	0.002–0.69	0.032	0.002–0.44	0.041	0.001–0.36
—Hong Kong SAR	6.19	0.53	0.08–1.10	0.084	0.025–0.13	0.059	0.020–0.11	0.095	0.016–0.20
India	944.6	0.40	0.038–0.76	0.029	0.007–0.081	0.029	0.007–0.081	0.064	0.014–0.16
Japan	125.4	0.31	0.015–0.99	0.029	0.002–0.059	0.033	0.006–0.098	0.028	0.002–0.088
Kazakhstan	16.82	0.30	0.10–1.20	0.037	0.012–0.12	0.035	0.012–0.12	0.060	0.010–0.22
Korea, Rep. of	45.31	0.67	0.017–1.50						
Malaysia	20.58	0.31	0.17–0.43	0.066	0.049–0.086	0.067	0.038–0.094	0.082	0.063–0.11
Thailand	58.70	0.23	0.007–0.712	0.114	0.003–0.37	0.048	0.011–0.078	0.051	0.007–0.12

TABLE 11. NATURAL RADIONUCLIDES IN SOIL [6] (cont.)

Region/country	Population in 1996 (10^6)	Concentration in soil (Bq/g)							
		K-40		U-238		Ra-226		Th-232	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range
West Asia									
Armenia	3.64	0.36	0.31–0.42	0.046	0.020–0.078	0.051	0.032–0.077	0.030	0.029–0.06
Iran, Islamic Rep. of	69.98	0.64	0.25–0.98			0.028	0.008–0.055	0.022	0.005–0.042
Syrian Arab Republic	14.57	0.27	0.087–0.78	0.023	0.010–0.064	0.020	0.013–0.032	0.020	0.01–0.032
North Europe									
Denmark	5.24	0.46	0.24–0.61			0.017	0.009–0.029	0.019	0.008–0.03
Estonia	1.47	0.51	0.14–1.12			0.035	0.006–0.31	0.027	0.005–0.059
Lithuania	3.73	0.60	0.35–0.85	0.016	0.003–0.03			0.025	0.009–0.046
Norway	4.35	0.85		0.050		0.050		0.045	
Sweden	8.82	0.78	0.56–1.15			0.042	0.012–0.17	0.042	0.014–0.094
West Europe									
Belgium	10.16	0.38	0.07–0.90			0.026	0.005–0.05	0.027	0.005–0.05
Germany	81.92		0.04–1.34		0.011–0.33		0.005–0.20		0.007–0.134
Ireland	3.55	0.35	0.04–0.80	0.037	0.008–0.12	0.060	0.01–0.20	0.026	0.003–0.06
Luxembourg	0.41	0.62	0.08–1.80			0.035	0.006–0.052	0.050	0.007–0.07
Netherlands	15.58		0.12–0.73		0.005–0.053	0.023	0.006–0.063		0.008–0.077
Switzerland	7.22	0.37	0.04–1.00	0.040	0.010–0.15	0.040	0.01–0.90	0.025	0.004–0.07
United Kingdom	58.14		0–3.20		0.002–0.33	0.037			0.001–0.18

TABLE 11. NATURAL RADIONUCLIDES IN SOIL [6] (cont.)

Region/country	Population in 1996 (10^6)	Concentration in soil (Bq/g)							
		K-40		U-238		Ra-226		Th-232	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range
East Europe									
Bulgaria	8.47	0.40	0.04–0.80	0.040	0.008–0.19	0.045	0.012–0.21	0.030	0.007–0.160
Hungary	10.05	0.37	0.079–0.57	0.029	0.012–0.066	0.033	0.014–0.076	0.028	0.012–0.045
Poland	38.60	0.41	0.11–0.97	0.026	0.005–0.12	0.026	0.005–0.12	0.021	0.004–0.077
Romania	22.66	0.49	0.25–1.10	0.032	0.008–0.06	0.032	0.008–0.06	0.038	0.011–0.075
Russian Federation	148.1	0.52	0.10–1.40	0.019	0–0.067	0.027	0.001–0.076	0.030	0.002–0.079
Slovakia	5.35	0.52	0.20–1.38	0.032	0.015–0.13	0.032	0.012–0.12	0.038	0.012–0.08
South Europe									
Albania	3.40	0.36	0.015–1.15	0.023	0.006–0.096			0.024	0.004–0.16
Croatia	4.50	0.49	0.14–0.71	0.110	0.083–0.18	0.054	0.021–0.077	0.045	0.012–0.065
Cyprus	0.76	0.14	0–0.67			0.017	0–0.12		
Greece	10.49	0.36	0.012–1.57	0.025	0.001–0.24	0.025	0.001–0.24	0.021	0.001–0.19
Portugal	9.81	0.84	0.22–1.23	0.049	0.026–0.82	0.044	0.008–0.065	0.051	0.022–0.10
Slovenia	1.92	0.37	0.015–1.41			0.041	0.002–0.21	0.035	0.002–0.09
Spain	39.67	0.47	0.025–1.65			0.032	0.006–0.25	0.033	0.002–0.21
Median		0.40	0.140–0.850	0.035	0.016–0.11	0.035	0.017–0.06	0.030	0.011–0.064
Population weighted average		0.42		0.033		0.032		0.045	

Table 12 shows typical activity concentrations in various ores and raw materials that are used in industrial processes.

Residues from industrial processes may have elevated levels of radionuclides of natural origin. Phosphogypsum, a by-product of phosphate rock processing, can have activity concentrations of ^{226}Ra of up to 3 Bq/g. Residues from ore processing industries generally can have elevated levels of radionuclides of natural origin, but if these industries are subject to regulation because of the activity concentration in the feedstock, this may not be an issue. Examples are given in Table 13.

Although not explicitly considered, elevated levels of isotopes of polonium and lead can also occur in residues from industrial processes. For example, tin rich residues from metal extraction processes can contain up to 10 Bq/g of ^{210}Pb and ^{210}Po. Filter dusts from metal processing can also contain elevated concentrations of ^{210}Po as a result of volatilization during heating. For example, concentrations of ^{210}Po of up to 200 Bq/g have been observed in collected fumes from tin smelting.

TABLE 12. ACTIVITY CONCENTRATIONS (Bq/g) IN ORES AND RAW MATERIALS [6]

Ore/mineral sand	U-238 series	Th-232 series
Phosphate ore	0.2–1.5	0.02
Monazite	6–40	8–300
Rutile	3.8	0.56
Tin ore (cassiterite)	1	0.3
Pyrochlore	6–10	7–80
Titanium ore	0.07–9	0.07–9
Ilmenite	2.3	1.2
Zirconium sand	0.2–74	0.4–40
Bauxite	0.4–0.6	0.3–0.4
Marl	0.022	0.003
Schist	0.04	0.056
Portland clinker	0.08	0.05
Coal	0.01–0.025	0.01–0.025

TABLE 13. ACTIVITY CONCENTRATIONS (Bq/g) IN INDUSTRIAL RESIDUES AND WASTES [6, 21]

	U-238	Ra-226	Th-232
Tin slag (cassiterite)	1	1000–1200	4
Oil scale		1–1000	
TiO_2 production residues from ilmenite		Up to 400	Up to 1500 (scale)
Monazite processing residues		Up to 450	3000
Aluminium processing sludge	260–540	150–330	
Fly dust	0.4		0.2
Blast furnace slag from steel production	0.15		0.15

TABLE 14. ACTIVITY CONCENTRATIONS (Bq/g) IN PRODUCTS FROM PROCESSING MATERIAL WITH RADIONUCLIDES OF NATURAL ORIGIN [6, 22]

	U-238	Ra-226	Th-232	K-40
Phosphate fertilizer	0.30–3	0.2–1		Up to 6
Thoriated welding electrode			Up to ~100	
Gas mantle			~500	
Cement	0.05–0.11		0.03–0.1	
Thoriated glass			400	
Titanium oxide pigment			0.03	

Some products from the processing of radionuclides of natural origin may in themselves be radioactive. Examples are given in Table 14. The main issues appear to surround thorium-containing materials.

Unmodified concentrations of radionuclides in most raw materials are deemed to be excluded from the requirements of the BSS [1, para. 1.4]. In this Safety Report, the term 'unmodified concentrations' has been taken to mean virtually all unmodified soils, but not ores or mineral sands that are recognized as having significant activity concentrations. Activity concentration values have been chosen as the optimum boundary between, on the one hand, the

ubiquitous unmodified soil concentrations (Table 11) and, on the other hand, activity concentrations in ores, mineral sands, industrial residues and wastes (Tables 12–14). These values are judged to be about 1 Bq/g for radionuclides of natural origin. The only exception is ^{40}K, for which the level is 10 Bq/g.

It can be seen that these levels are around a factor of 20 higher than the population weighted average activity concentrations in Table 11, and are therefore unlikely to result in an unwarranted regulatory burden. Scenario based calculations made by the European Union demonstrate convergence with these numbers [23].

6. ACTIVITY CONCENTRATION VALUES

Table 15 provides the activity concentration values for bulk amounts of material containing radionuclides of artificial origin, and Table 16 provides the activity concentration levels for radionuclides of natural origin.

TABLE 15. ACTIVITY CONCENTRATION VALUES FOR BULK AMOUNTS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

Radionuclide	Concentration		Radionuclide	Concentration	
H-3	100		Sc-48	1	
Be-7	10		V-48	1	
C-14	1		Cr-51	100	
F-18	10	[a]	Mn-51	10	[a]
Na-22	0.1		Mn-52	1	
Na-24	1	[a]	Mn-52m	10	[a]
Si-31	1 000	[a]	Mn-53	100	
P-32	1 000		Mn-54	0.1	
P-33	1 000		Mn-56	10	[a]
S-35	100		Fe-52	10	[a]
Cl-36	1		Fe-55	1 000	
Cl-38	10	[a]	Fe-59	1	
K-42	100		Co-55	10	[a]
K-43	10	[a]	Co-56	0.1	
Ca-45	100		Co-57	1	
Ca-47	10		Co-58	1	
Sc-46	0.1		Co-58m	10 000	[a]
Sc-47	100		Co-60	0.1	

TABLE 15. ACTIVITY CONCENTRATION VALUES FOR BULK AMOUNTS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN (cont.)

Radionuclide	Concentration	
Co-60m	1 000	[a]
Co-61	100	[a]
Co-62m	10	[a]
Ni-59	100	
Ni-63	100	
Ni-65	10	[a]
Cu-64	100	[a]
Zn-65	0.1	
Zn-69	1 000	[a]
Zn-69m	10	[a]
Ga-72	10	[a]
Ge-71	10 000	
As-73	1 000	
As-74	10	[a]
As-76	10	[a]
As-77	1 000	
Se-75	1	
Br-82	1	
Rb-86	100	
Sr-85	1	
Sr-85m	100	[a]
Sr-87m	100	[a]
Sr-89	1 000	
Sr-90	1	
Sr-91	10	[a]
Sr-92	10	[a]
Y-90	1 000	
Y-91	100	
Y-91m	100	[a]
Y-92	100	[a]
Y-93	100	[a]
Zr-93	10	[a]
Zr-95	1	
Zr-97	10	[a]
Nb-93m	10	
Nb-94	0.1	
Nb-95	1	
Nb-97	10	[a]
Nb-98	10	[a]

Radionuclide	Concentration	
Mo-90	10	[a]
Mo-93	10	
Mo-99	10	
Mo-101	10	[a]
Tc-96	1	
Tc-96m	1 000	[a]
Tc-97	10	
Tc-97m	100	
Tc-99	1	
Tc-99m	100	[a]
Ru-97	10	
Ru-103	1	
Ru-105	10	[a]
Ru-106	0.1	
Rh-103m	10 000	[a]
Rh-105	100	
Pd-103	1 000	
Pd-109	100	
Ag-105	1	
Ag-110m	0.1	
Ag-111	100	
Cd-109	1	
Cd-115	10	
Cd-115m	100	
In-111	10	
In-113m	100	[a]
In-114m	10	
In-115m	100	[a]
Sn-113	1	
Sn-125	10	
Sb-122	10	
Sb-124	1	
Sb-125	0.1	
Te-123m	1	
Te-125m	1 000	
Te-127	1 000	
Te-127m	10	
Te-129	100	[a]
Te-129m	10	

TABLE 15. ACTIVITY CONCENTRATION VALUES FOR BULK AMOUNTS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN (cont.)

Radionuclide	Concentration	
Te-131	100	[a]
Te-131m	10	
Te-132	1	
Te-133	10	[a]
Te-133m	10	[a]
Te-134	10	[a]
I-123	100	
I-125	100	
I-126	10	
I-129	0.01	
I-130	10	[a]
I-131	10	
I-132	10	[a]
I-133	10	[a]
I-134	10	[a]
I-135	10	[a]
Cs-129	10	
Cs-131	1 000	
Cs-132	10	
Cs-134	0.1	
Cs-134m	1 000	[a]
Cs-135	100	
Cs-136	1	
Cs-137	0.1	
Cs-138	10	[a]
Ba-131	10	
Ba-140	1	
La-140	1	
Ce-139	1	
Ce-141	100	
Ce-143	10	
Ce-144	10	
Pr-142	100	[a]
Pr-143	1 000	
Nd-147	100	
Nd-149	100	[a]
Pm-147	1 000	
Pm-149	1 000	
Sm-151	1 000	

Radionuclide	Concentration	
Sm-153	100	
Eu-152	0.1	
Eu-152m	100	[a]
Eu-154	0.1	
Eu-155	1	
Gd-153	10	
Gd-159	100	[a]
Tb-160	1	
Dy-165	1 000	[a]
Dy-166	100	
Ho-166	100	
Er-169	1 000	
Er-171	100	[a]
Tm-170	100	
Tm-171	1 000	
Yb-175	100	
Lu-177	100	
Hf-181	1	
Ta-182	0.1	
W-181	10	
W-185	1 000	
W-187	10	
Re-186	1 000	
Re-188	100	[a]
Os-185	1	
Os-191	100	
Os-191m	1 000	[a]
Os-193	100	
Ir-190	1	
Ir-192	1	
Ir-194	100	[a]
Pt-191	10	
Pt-193m	1 000	
Pt-197	1 000	[a]
Pt-197m	100	[a]
Au-198	10	
Au-199	100	
Hg-197	100	
Hg-197m	100	

TABLE 15. ACTIVITY CONCENTRATION VALUES FOR BULK AMOUNTS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN (cont.)

Radionuclide	Concentration	
Hg-203	10	
Tl-200	10	
Tl-201	100	
Tl-202	10	
Tl-204	1	
Pb-203	10	
Bi-206	1	
Bi-207	0.1	
Po-203	10	[a]
Po-205	10	[a]
Po-207	10	[a]
At-211	1 000	
Ra-225	10	
Ra-227	100	
Th-226	1 000	
Th-229	0.1	
Pa-230	10	
Pa-233	10	
U-230	10	
U-231	100	
U-232	0.1	
U-233	1	
U-236	10	
U-237	100	
U-239	100	[a]
U-240	100	[a]
Np-237	1	
Np-239	100	
Np-240	10	[a]
Pu-234	100	[a]
Pu-235	100	[a]
Pu-236	1	
Pu-237	100	
Pu-238	0.1	
Pu-239	0.1	
Pu-240	0.1	
Pu-241	10	
Pu-242	0.1	
Pu-243	1 000	[a]
Pu-244	0.1	
Am-241	0.1	
Am-242	1 000	[a]
Am-242m	0.1	
Am-243	0.1	
Cm-242	10	
Cm-243	1	
Cm-244	1	
Cm-245	0.1	
Cm-246	0.1	
Cm-247	0.1	
Cm-248	0.1	
Bk-249	100	
Cf-246	1 000	
Cf-248	1	
Cf-249	0.1	
Cf-250	1	
Cf-251	0.1	
Cf-252	1	
Cf-253	100	
Cf-254	1	
Es-253	100	
Es-254	0.1	
Es-254m	10	
Fm-254	10 000	[a]
Fm-255	100	[a]

[a] Indicates a half-life of less than 1 d.

TABLE 16. ACTIVITY CONCENTRATION VALUES (Bq/g) FOR RADIONUCLIDES OF NATURAL ORIGIN

Radionuclide	Concentration
K-40	10
All other radionuclides of natural origin	1

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TABLE I-I: Parameter Values for Realistic Scenarios

Parameter	Unit	Value				
External Irradiation		**EXT-A WL**	**EXT-B RH**	**EXT-C WF**	**EXT-C1 WO**	**EXT-D RP**
		Landfill	**Building**	**Transport**	**Equipment**	**Child on Place**
Exposure time te	h/a	450	4500	450	900	400
Dilution factor fd	[-]	1	0.1	0.1	0.1	0.1
Concentration factor fc	[-]	1	1	1	1	1.2
Decay before scenario t1	d	30	100	30	30	100
Decay during scenario t2	d	365	365	365	365	365
Density	g/cm³	1.5	1.5	1.5	1.5	1.5
Geometry		1 m above ground, semi-infinite source	ceiling + 2 walls, 3x4 m², 20 cm wall thickness	1 m from load / item 5x2x1m³, no shielding	1 m from equip. / item 5x2x1m³, no shielding	1 m above ground, semi-infinite source

Inhalation		**INH-A WL**	**INH-A1 WF**	**INH-B RL-C**	**INH-B1 RF**	**INH-C RL-A**	**INH-D RP**
		worker general facility	**worker foundry**	**child (1-2a) near general facility**	**child (1-2a) near foundry**	**adult near general facility**	**child (1-2a) on public place**
Exposure time te	h/a	450	450	1000	1000	1000	400
Dilution factor fd	[-]	1	0.02	0.01	0.002	0.01	0.1
Concentration factor fc	[-]	4	1 - 70	4	1 - 70	4	4
Breathing Rate (dV/dt)	m³/h	1.2	1.2	0.22	0.22	1.2	0.22
Dust concentr. in air Cdust	g/m³	5.00E-04	5.00E-04	1.00E-04	1.00E-04	1.00E-04	1.00E-04
Decay before scenario t1	d	30	30	30	30	30	100
Decay during scenario t2	d	365	365	365	365	365	365
Dose coefficient		5 µm, worker	5 µm, worker	1-2 a, default	1-2 a, default	adult, default	1-2 a, default

Ingestion		**ING-A RL-A**	**ING-B RL-C**	**ING-C WL/WF**	**ING-D RP**
		food, adult	**food, 1-2a**	**dust, worker**	**dust, child**
Ingested quantity q	g/a	88,000	68,000	10	25
Dilution factor fd	[-]	0.01	0.01	1	0.1
Concentration factor fc	[-]	1	1	2	2
Decay before scenario t1	d	365	365	30	100
Decay during scenario t2	d	365	365	365	365

TABLE I-II: Parameter Values for Low Probability Scenarios

Parameter	Unit	Value				
External Irradiation		**EXT-A WL**	**EXT-B RH**	**EXT-C WF**	**EXT-C1 WO**	**EXT-D RP**
		Landfill	**Building**	**Transport**	**Equipment**	**Child on Place**
Exposure time te	h/a	1800	8760	1800	1800	1000
Dilution factor fd	[-]	1	0.5	1	1	0.5
Concentration factor fc	[-]	1	1	1	1	1.2
Decay before scenario t1	d	1	100	1	1	100
Decay during scenario t2	d	0	365	0	0	365
Density	g/cm³	1.5	1.5	1.5	1.5	1.5
Geometry		1 m above ground, semi-infinite source	ceiling + 2 walls, 3x4 m², 20 cm wall thickness	1 m from load / item 5x2x1m³, no shielding	1 m from equip. / item 5x2x1m³, no shielding	1 m above ground, semi-infinite source

Inhalation		**INH-A WL**	**INH-A1 WF**	**INH-B RL-C**	**INH-B1 RF**	**INH-C RL-A**	**INH-D RP**
		worker general facility	**worker foundry**	**child (1-2a) near general facility**	**child (1-2a) near foundry**	**adult near general facility**	**child (1-2a) on public place**
Exposure time te	h/a	1800	1800	8760	8760	8760	1000
Dilution factor fd	[-]	1	0.1	0.1	0.01	0.1	1
Concentration factor fc	[-]	4	1 - 70	4	1 - 70	4	4
Breathing Rate (dV/dt)	m³/h	1.2	1.2	0.22	0.22	1.2	0.22
Dust concentr. in air Cdust	g/m³	1.00E-03	1.00E-03	5.00E-04	5.00E-04	5.00E-04	5.00E-04
Decay before scenario t1	d	1	1	1	1	1	100
Decay during scenario t2	d	0	0	0	0	0	365
Dose coefficient		5 µm, worker	5 µm, worker	1-2 a, default	1-2 a, default	adult, default	1-2 a, default

Ingestion		**ING-A RL-A**	**ING-B RL-C**	**ING-C WL/WF**	**ING-D RP**
		food, adult	**food, 1-2a**	**dust, adult**	**dust, child**
Ingested quantity q	g/a	264,000	204,000	50	50
Dilution factor fd	[-]	0.1	0.1	1	1
Concentration factor fc	[-]	1	1	2	2
Decay before scenario t1	d	365	365	1	100
Decay during scenario t2	d	365	365	0	365

Skin contamination		**R-SKIN worker**
Exposure time te	h/a	1800
Layer thickness Ldust	cm	0.01
Dust density r	g/cm³	1.5
Dilution factor fd	[-]	1
Concentration factor fc	[-]	2
Decay before scenario t1	d	0
Decay during scenario t2	d	0

TABLE I-III: External Effective Dose Conversion Factors for various Geometries

Radio-nuclide	A-EXT-A/D WL/RP Landfill (µSv/h)/(Bq/g)	A-EXT-B RH Room (4x5m, 20 cm walls) (µSv/h)/(Bq/g)	A-EXT-C WF/WO transport / eqipment (µSv/h)/(Bq/g)	Half-life T1/2 [a]	Decay constant λ [1/α]
H 3	0.00E+00	0.00E+00	0.00E+00	1.20E+01	5.78E-02
Be 7	8.14E-03	1.56E-02	1.88E-03	1.50E-01	4.62E+00
C 14	0.00E+00	0.00E+00	0.00E+00	5.70E+03	1.22E-04
F 18	1.64E-01	3.13E-01	3.82E-02	2.10E-04	3.30E+03
Na 22	3.89E-01	6.94E-01	9.31E-02	2.60E+00	2.67E-01
Na 24	8.04E-01	1.26E+00	1.87E-01	1.70E-03	4.08E+02
Si 31	1.65E-04	2.81E-04	4.00E-05	3.00E-04	2.31E+03
P 32	0.00E+00	0.00E+00	0.00E+00	3.90E-02	1.78E+01
P 33	0.00E+00	0.00E+00	0.00E+00	7.00E-02	9.90E+00
S 35	0.00E+00	0.00E+00	0.00E+00	2.40E-01	2.89E+00
Cl 36	0.00E+00	0.00E+00	0.00E+00	3.00E+05	2.31E-06
Cl 38	2.89E-01	4.62E-01	6.83E-02	7.10E-05	9.76E+03
K 40	2.93E-02	4.88E-02	7.12E-03	1.30E+09	5.33E-10
K 42	5.21E-02	8.62E-02	1.26E-02	1.40E-03	4.95E+02
K 43	1.59E-01	3.04E-01	3.69E-02	2.60E-03	2.67E+02
Ca-41	0.00E+00	0.00E+00	0.00E+00	1.40E+05	4.95E-06
Ca 45	0.00E+00	0.00E+00	0.00E+00	4.50E-01	1.54E+00
Ca 47	2.02E-01	3.47E-01	4.82E-02	1.20E-02	5.78E+01
Sc 46	3.64E-01	6.47E-01	8.87E-02	2.30E-01	3.01E+00
Sc 47	1.30E-02	2.59E-02	1.17E-03	9.20E-03	7.53E+01
Sc 48	6.13E-01	1.07E+00	1.49E-01	5.00E-03	1.39E+02
V 48	5.26E-01	9.27E-01	1.27E-01	4.40E-02	1.58E+01
Cr 51	4.72E-03	9.27E-03	9.72E-04	7.60E-02	9.12E+00
Mn 51	1.64E-01	3.15E-01	3.84E-02	8.80E-05	7.88E+03
Mn 52	6.25E-01	1.10E+00	1.51E-01	1.50E-02	4.62E+01
Mn 52m	4.30E-01	7.58E-01	1.03E-01	4.00E-05	1.73E+04
Mn 53	0.00E+00	0.00E+00	0.00E+00	3.70E+06	1.87E-07
Mn 54	1.48E-01	2.70E-01	3.59E-02	8.60E-01	8.06E-01
Mn 56	3.14E-01	5.37E-01	7.54E-02	3.00E-04	2.31E+03
Fe 52	4.78E-01	8.60E-01	1.11E-01	9.40E-04	7.37E+02
Fe 55	0.00E+00	0.00E+00	0.00E+00	2.70E+00	2.57E-01
Fe 59	2.19E-01	3.78E-01	5.31E-02	1.20E-01	5.78E+00
Co 55	3.42E-01	6.25E-01	8.18E-02	2.00E-03	3.47E+02
Co 56	6.75E-01	1.13E+00	1.60E-01	2.20E-01	3.15E+00
Co 57	1.27E-02	2.53E-02	6.76E-04	7.40E-01	9.37E-01
Co 58	1.70E-01	3.14E-01	4.11E-02	1.90E-01	3.65E+00
Co 58m	8.86E-04	1.63E-03	2.14E-04	1.00E-03	6.93E+02
Co 60	4.65E-01	7.94E-01	1.13E-01	5.30E+00	1.31E-01
Co 60m	6.59E-04	1.15E-03	1.49E-04	2.00E-05	3.47E+04
Co 61	9.00E-03	1.75E-02	1.43E-03	1.90E-04	3.65E+03
Co 62m	4.99E-01	8.48E-01	1.21E-01	2.60E-05	2.67E+04
Ni 59	0.00E+00	0.00E+00	0.00E+00	7.50E+04	9.24E-06
Ni 63	0.00E+00	0.00E+00	0.00E+00	9.60E+01	7.22E-03
Ni 65	1.02E-01	1.73E-01	2.47E-02	2.90E-04	2.39E+03
Cu 64	3.14E-02	5.99E-02	7.36E-03	1.40E-03	4.95E+02
Zn 65	1.06E-01	1.86E-01	2.59E-02	6.70E-01	1.03E+00
Zn 69	9.84E-07	1.91E-06	2.22E-07	1.10E-04	6.30E+03
Zn 69m	6.69E-02	1.29E-01	1.52E-02	1.60E-03	4.33E+02

Radio-nuclide	A-EXT-A/D WL/RP Landfill (µSv/h)/(Bq/g)	A-EXT-B RH Room (4x5m, 20 cm walls) (µSv/h)/(Bq/g)	A-EXT-C WF/WO transport / eqipment (µSv/h)/(Bq/g)	Half-life T1/2 [a]	Decay constant λ [1/α]
Ga 72	5.05E-01	8.53E-01	1.20E-01	1.60E-03	4.33E+02
Ge 71	0.00E+00	0.00E+00	0.00E+00	3.20E-02	2.17E+01
As 73	1.75E-04	4.29E-04	2.03E-11	2.20E-01	3.15E+00
As 74	1.28E-01	2.44E-01	3.04E-02	4.90E-02	1.41E+01
As 76	7.46E-02	1.37E-01	1.78E-02	3.00E-03	2.31E+02
As 77	1.27E-03	2.48E-03	2.47E-04	4.40E-03	1.58E+02
Se 75	5.25E-02	1.04E-01	8.59E-03	3.30E-01	2.10E+00
Se-79	0.00E+00	0.00E+00	0.00E+00	6.50E+04	1.07E-05
Br 82	4.68E-01	8.46E-01	1.13E-01	4.00E-03	1.73E+02
Rb 86	1.73E-02	3.04E-02	4.21E-03	5.10E-02	1.36E+01
Rb-87	0.00E+00	0.00E+00	0.00E+00	4.70E+10	1.47E-11
Sr 85	8.45E-02	1.62E-01	1.98E-02	1.80E-01	3.85E+00
Sr 85m	2.94E-02	5.82E-02	4.65E-03	1.30E-04	5.33E+03
Sr 87m	5.00E-02	9.73E-02	1.11E-02	3.20E-04	2.17E+03
Sr 89	2.44E-05	4.42E-05	5.95E-06	1.40E-01	4.95E+00
Sr 90	0.00E+00	0.00E+00	0.00E+00	2.90E+01	2.39E-02
Sr 91	1.22E-01	2.21E-01	2.97E-02	1.10E-03	6.30E+02
Sr 92	2.64E-01	4.47E-01	6.40E-02	3.10E-04	2.24E+03
Y 90	0.00E+00	0.00E+00	0.00E+00	7.30E-03	9.50E+01
Y 91	6.68E-04	1.15E-03	1.63E-04	1.61E-01	4.31E+00
Y 91m	8.86E-02	1.69E-01	2.10E-02	9.40E-05	7.37E+03
Y 92	4.55E-02	8.05E-02	1.10E-02	4.00E-04	1.73E+03
Y 93	1.59E-02	2.75E-02	3.68E-03	1.20E-03	5.78E+02
Zr 93	6.22E-10	2.24E-06	0.00E+00	1.50E+06	4.62E-07
Zr 95	1.93E-01	3.56E-01	4.66E-02	1.70E-01	4.08E+00
Zr 97	4.90E-01	9.06E-01	1.18E-01	1.90E-03	3.65E+02
Nb 93m	6.27E-10	2.26E-06	0.00E+00	1.40E+01	4.95E-02
Nb 94	2.77E-01	5.08E-01	6.71E-02	2.00E+04	3.47E-05
Nb 95	1.34E-01	2.47E-01	3.24E-02	9.60E-02	7.22E+00
Nb 97	1.14E-01	2.13E-01	2.74E-02	1.40E-04	4.95E+03
Nb 98	4.48E-01	7.95E-01	1.08E-01	9.80E-05	7.07E+03
Mo 90	1.38E-01	2.61E-01	2.78E-02	6.50E-04	1.07E+03
Mo 93	4.13E-09	1.49E-05	0.00E+00	3.50E+03	1.98E-04
Mo 99	3.58E-02	6.79E-02	6.63E-03	7.50E-03	9.24E+01
Mo 101	2.89E-01	5.07E-01	6.80E-02	2.80E-05	2.48E+04
Tc 96	4.41E-01	8.06E-01	1.07E-01	1.20E-02	5.78E+01
Tc 96m	1.09E-02	1.96E-02	2.63E-03	9.80E-05	7.07E+03
Tc 97	5.46E-09	1.92E-05	0.00E+00	2.60E+06	2.67E-07
Tc 97m	2.73E-05	7.50E-05	1.95E-07	2.40E-01	2.89E+00
Tc 99	4.31E-08	8.59E-08	2.13E-10	2.10E+05	3.30E-06
Tc 99m	1.41E-02	2.81E-02	9.43E-04	6.90E-04	1.00E+03
Ru 97	3.14E-02	6.22E-02	5.20E-03	8.00E-03	8.66E+01
Ru 103	7.98E-02	1.53E-01	1.86E-02	1.10E-01	6.30E+00
Ru 105	1.34E-01	2.51E-01	3.16E-02	5.10E-04	1.36E+03
Ru 106	2.24E-02	4.21E-02	5.29E-03	1.00E+00	6.93E-01
Rh-102	3.66E-01	6.75E-01	8.76E-02	2.90E+00	2.39E-01
Rh 103m	4.43E-07	7.03E-06	0.00E+00	1.10E-04	6.30E+03
Rh 105	1.16E-02	2.28E-02	2.37E-03	4.00E-03	1.73E+02
Pd 103	1.90E-05	9.44E-05	3.69E-06	4.70E-02	1.47E+01
Pd-107	0.00E+00	0.00E+00	0.00E+00	6.50E+06	1.07E-07

Radio-nuclide	A-EXT-A/D WL/RP Landfill (µSv/h)/(Bq/g)	A-EXT-B RH Room (4x5m, 20 cm walls) (µSv/h)/(Bq/g)	A-EXT-C WF/WO transport / eqipment (µSv/h)/(Bq/g)	Half-life T1/2 [a]	Decay constant λ [1/α]
Pd 109	3.92E-04	8.23E-04	2.78E-05	1.50E-03	4.62E+02
Ag 105	8.24E-02	1.58E-01	1.79E-02	1.10E-01	6.30E+00
Ag-108m	2.71E-01	5.11E-01	6.43E-02	1.27E+02	5.46E-03
Ag 110m	4.87E-01	8.76E-01	1.18E-01	6.90E-01	1.00E+00
Ag 111	3.98E-03	7.79E-03	8.27E-04	2.00E-02	3.47E+01
Cd 109	2.87E-04	7.21E-04	1.22E-06	1.30E+00	5.33E-01
Cd-113m	3.98E-02	7.75E-02	8.85E-03	1.36E+01	5.10E-02
Cd 115	5.27E-02	1.02E-01	1.18E-02	6.10E-03	1.14E+02
Cd 115m	3.97E-03	7.03E-03	9.65E-04	1.20E-01	5.78E+00
In 111	5.15E-02	1.02E-01	7.68E-03	7.70E-03	9.00E+01
In 113m	3.98E-02	7.76E-02	8.87E-03	1.90E-04	3.65E+03
In 114m	1.88E-02	3.59E-02	4.07E-03	1.40E-01	4.95E+00
In 115m	2.39E-02	4.69E-02	5.03E-03	5.10E-04	1.36E+03
Sn 113	4.04E-02	7.89E-02	8.96E-03	3.10E-01	2.24E+00
Sn-121m	5.59E-06	2.24E-05	0.00E+00	5.50E+01	1.26E-02
Sn 125	5.59E-02	9.81E-02	1.35E-02	2.60E-02	2.67E+01
Sn-126	3.35E-01	6.30E-01	7.90E-02	1.00E+05	6.93E-06
Sb 122	7.46E-02	1.41E-01	1.77E-02	7.40E-03	9.37E+01
Sb 124	3.41E-01	5.90E-01	8.17E-02	1.70E-01	4.08E+00
Sb 125	6.86E-02	1.31E-01	1.59E-02	2.80E+00	2.48E-01
Te 123m	1.61E-02	3.21E-02	1.44E-03	3.30E-01	2.10E+00
Te 125m	8.53E-05	6.17E-04	8.46E-07	1.60E-01	4.33E+00
Te 127	7.59E-04	1.47E-03	1.68E-04	1.10E-03	6.30E+02
Te 127m	7.70E-04	1.64E-03	1.64E-04	3.00E-01	2.31E+00
Te 129	8.72E-03	1.66E-02	2.01E-03	1.30E-04	5.33E+03
Te 129m	1.10E-02	2.07E-02	2.58E-03	9.20E-02	7.53E+00
Te 131	6.64E-02	1.24E-01	1.38E-02	4.80E-05	1.44E+04
Te 131m	2.70E-01	4.88E-01	6.36E-02	3.40E-03	2.04E+02
Te 132	3.90E-01	7.17E-01	9.17E-02	8.90E-03	7.79E+01
Te 133	1.61E-01	2.92E-01	3.75E-02	2.40E-05	2.89E+04
Te 133m	4.26E-01	7.67E-01	1.01E-01	1.00E-04	6.93E+03
Te 134	2.94E-01	5.41E-01	6.85E-02	8.00E-05	8.66E+03
I 123	1.85E-02	3.69E-02	2.03E-03	1.50E-03	4.62E+02
I 125	6.39E-05	6.62E-04	0.00E+00	1.70E-01	4.08E+00
I 126	7.61E-02	1.44E-01	1.80E-02	3.60E-02	1.93E+01
I 129	7.15E-05	5.05E-04	0.00E+00	1.60E+07	4.33E-08
I 130	3.66E-01	6.83E-01	8.75E-02	1.40E-03	4.95E+02
I 131	5.93E-02	1.15E-01	1.30E-02	2.20E-02	3.15E+01
I 132	4.02E-01	7.35E-01	9.70E-02	2.60E-04	2.67E+03
I 133	1.03E-01	1.93E-01	2.43E-02	2.40E-03	2.89E+02
I 134	4.69E-01	8.42E-01	1.13E-01	1.00E-04	6.93E+03
I 135	3.03E-01	5.19E-01	7.24E-02	7.50E-04	9.24E+02
Cs 129	3.93E-02	7.69E-02	8.72E-03	3.70E-03	1.87E+02
Cs 131	4.45E-05	4.19E-04	0.00E+00	2.60E-02	2.67E+01
Cs 132	1.19E-01	2.23E-01	2.86E-02	1.80E-02	3.85E+01
Cs 134	2.69E-01	4.99E-01	6.48E-02	2.10E+00	3.30E-01
Cs 134m	1.85E-03	3.82E-03	1.08E-04	3.30E-04	2.10E+03
Cs 135	0.00E+00	0.00E+00	0.00E+00	2.30E+06	3.01E-07
Cs 136	3.79E-01	6.85E-01	9.02E-02	3.60E-02	1.93E+01
Cs 137	1.02E-01	1.91E-01	2.45E-02	3.00E+01	2.31E-02

Radio-nuclide	A-EXT-A/D WL/RP Landfill (µSv/h)/(Bq/g)	A-EXT-B RH Room (4x5m, 20 cm walls) (µSv/h)/(Bq/g)	A-EXT-C WF/WO transport / eqipment (µSv/h)/(Bq/g)	Half-life T1/2 [a]	Decay constant λ [1/α]
Cs 138	4.40E-01	7.39E-01	1.05E-01	6.10E-05	1.14E+04
Ba 131	6.88E-02	1.33E-01	1.46E-02	3.20E-02	2.17E+01
Ba-133	5.15E-02	1.01E-01	1.04E-02	1.07E+01	6.48E-02
Ba-139	3.48E-03	6.93E-03	3.44E-04	1.58E-04	4.40E+03
Ba 140	3.44E-01	5.92E-01	8.20E-02	3.50E-02	1.98E+01
La-137	0.00E+00	0.00E+00	0.00E+00	6.00E+04	1.16E-05
La 140	4.27E-01	7.26E-01	1.02E-01	4.60E-03	1.51E+02
Ce 139	1.64E-02	3.31E-02	1.63E-03	3.80E-01	1.82E+00
Ce 141	8.14E-03	1.63E-02	5.70E-04	8.90E-02	7.79E+00
Ce 143	3.88E-02	7.50E-02	8.31E-03	3.80E-03	1.82E+02
Ce 144	7.35E-03	1.29E-02	1.44E-03	7.80E-01	8.89E-01
Pr 142	1.11E-02	1.82E-02	2.68E-03	2.20E-03	3.15E+02
Pr 143	0.00E+00	0.00E+00	0.00E+00	3.70E-02	1.87E+01
Nd 147	1.81E-02	3.52E-02	3.68E-03	3.00E-02	2.31E+01
Nd 149	5.49E-02	1.07E-01	1.08E-02	2.00E-04	3.47E+03
Pm-145	3.69E-04	1.21E-03	3.69E-08	1.77E+01	3.92E-02
Pm-146	1.24E-01	2.33E-01	2.93E-02	5.53E+00	1.25E-01
Pm 147	3.66E-07	7.29E-07	1.71E-08	2.60E+00	2.67E-01
Pm 149	1.75E-03	3.41E-03	3.61E-04	6.00E-03	1.16E+02
Sm 151	1.60E-09	3.55E-08	0.00E+00	9.00E+01	7.70E-03
Sm 153	3.56E-03	7.52E-03	8.55E-05	5.30E-03	1.31E+02
Eu 152	1.98E-01	3.52E-01	4.67E-02	1.30E+01	5.33E-02
Eu 152m	5.38E-02	9.74E-02	1.28E-02	1.10E-03	6.30E+02
Eu 154	2.21E-01	3.92E-01	5.24E-02	8.80E+00	7.88E-02
Eu 155	4.34E-03	8.82E-03	4.95E-05	5.00E+00	1.39E-01
Gd 153	5.70E-03	1.22E-02	5.34E-05	6.60E-01	1.05E+00
Gd 159	5.15E-03	1.02E-02	1.08E-03	2.10E-03	3.30E+02
Tb-157	7.03E-05	1.98E-04	9.28E-16	1.50E+02	4.62E-03
Tb 160	1.89E-01	3.39E-01	4.51E-02	2.00E-01	3.47E+00
Dy 165	3.34E-03	6.44E-03	6.89E-04	2.70E-04	2.57E+03
Dy 166	4.35E-03	8.32E-03	6.47E-04	9.30E-03	7.45E+01
Ho 166	4.00E-03	6.89E-03	8.51E-04	3.10E-03	2.24E+02
Ho-166m	2.64E-01	4.93E-01	6.06E-02	1.20E+03	5.78E-04
Er 169	1.51E-07	3.01E-07	4.59E-09	2.50E-02	2.77E+01
Er 171	5.10E-02	1.00E-01	9.65E-03	8.60E-04	8.06E+02
Tm 170	2.82E-04	5.97E-04	5.75E-07	3.50E-01	1.98E+00
Tm 171	2.32E-05	5.56E-05	1.42E-09	1.90E+00	3.65E-01
Yb 175	5.68E-03	1.11E-02	1.16E-03	1.20E-02	5.78E+01
Lu 177	4.08E-03	8.17E-03	5.05E-04	1.80E-02	3.85E+01
Hf 181	8.27E-02	1.60E-01	1.76E-02	1.20E-01	5.78E+00
Ta 182	2.27E-01	3.96E-01	5.34E-02	3.10E-01	2.24E+00
W 181	1.59E-03	3.83E-03	1.82E-06	3.30E-01	2.10E+00
W 185	2.79E-06	5.57E-06	1.45E-07	2.10E-01	3.30E+00
W 187	7.69E-02	1.45E-01	1.78E-02	2.70E-03	2.57E+02
Re 186	1.89E-03	3.85E-03	1.14E-04	1.00E-02	6.93E+01
Re 188	8.40E-03	1.59E-02	1.55E-03	1.90E-03	3.65E+02
Os 185	1.15E-01	2.16E-01	2.72E-02	2.60E-01	2.67E+00
Os 191	5.56E-03	1.16E-02	2.05E-04	4.20E-02	1.65E+01
Os 191m	3.97E-04	8.74E-04	6.41E-06	1.50E-03	4.62E+02
Os 193	9.16E-03	1.79E-02	1.79E-03	3.40E-03	2.04E+02

Radio-nuclide	A-EXT-A/D WL/RP Landfill (µSv/h)/(Bq/g)	A-EXT-B RH Room (4x5m, 20 cm walls) (µSv/h)/(Bq/g)	A-EXT-C WF/WO transport / eqipment (µSv/h)/(Bq/g)	Half-life T1/2 [a]	Decay constant λ [1/α]
Ir 190	4.75E-01	9.09E-01	1.06E-01	3.30E-02	2.10E+01
Ir 192	1.27E-01	2.46E-01	2.73E-02	2.00E-01	3.47E+00
Ir 194	1.48E-02	2.77E-02	3.30E-03	2.20E-03	3.15E+02
Pt 191	3.56E-02	7.02E-02	6.73E-03	7.70E-03	9.00E+01
Pt-193	0.00E+00	0.00E+00	0.00E+00	5.00E+01	1.39E-02
Pt 193m	5.82E-04	1.27E-03	1.23E-06	1.20E-02	5.78E+01
Pt 197	1.98E-03	3.98E-03	1.32E-04	2.10E-03	3.30E+02
Pt 197m	8.97E-03	1.80E-02	1.48E-03	1.80E-04	3.85E+03
Au 198	6.41E-02	1.24E-01	1.44E-02	7.40E-03	9.37E+01
Au 199	1.00E-02	2.00E-02	9.56E-04	8.60E-03	8.06E+01
Hg 197	4.03E-03	8.47E-03	2.02E-05	7.30E-03	9.50E+01
Hg 197m	9.68E-03	1.95E-02	7.06E-04	2.70E-03	2.57E+02
Hg 203	3.21E-02	6.34E-02	5.99E-03	1.30E-01	5.33E+00
Tl 200	2.23E-01	4.02E-01	5.20E-02	3.00E-03	2.31E+02
Tl 201	6.64E-03	1.37E-02	2.39E-04	8.30E-03	8.35E+01
Tl 202	6.91E-02	1.34E-01	1.50E-02	3.30E-02	2.10E+01
Tl 204	6.46E-05	1.36E-04	2.73E-08	3.80E+00	1.82E-01
Pb 203	3.83E-02	7.59E-02	6.61E-03	6.00E-03	1.16E+02
Bi 206	5.72E-01	1.03E+00	1.36E-01	1.70E-02	4.08E+01
Bi 207	2.66E-01	4.80E-01	6.33E-02	3.80E+01	1.82E-02
Po 203	3.14E-01	5.61E-01	7.29E-02	7.00E-05	9.90E+03
Po 205	2.77E-01	4.96E-01	6.49E-02	2.10E-04	3.30E+03
Po 207	2.42E-01	4.40E-01	5.73E-02	6.70E-04	1.03E+03
At 211	3.27E-03	6.41E-03	1.90E-04	8.20E-04	8.45E+02
Ra 225	1.51E-02	2.87E-02	3.23E-03	4.10E-02	1.69E+01
Ra 227	2.74E-02	5.34E-02	5.79E-03	8.00E-05	8.66E+03
Th 226	9.56E-04	1.89E-03	1.03E-04	5.90E-05	1.17E+04
Th 229	4.20E-02	8.03E-02	7.73E-03	7.30E+03	9.50E-05
Pa 230	1.10E-01	2.01E-01	2.53E-02	4.80E-02	1.44E+01
Pa 233	2.92E-02	5.74E-02	5.30E-03	7.40E-02	9.37E+00
U 230	2.51E-03	4.94E-03	4.13E-04	5.70E-02	1.22E+01
U 231	5.81E-03	1.16E-02	1.12E-04	1.20E-02	5.78E+01
U 232	2.56E-01	4.21E-01	5.78E-02	7.20E+01	9.63E-03
U 233	4.14E-04	7.94E-04	7.31E-05	1.60E+05	4.33E-06
U 236	4.20E-06	9.17E-06	1.22E-09	2.30E+07	3.01E-08
U 237	1.36E-02	2.75E-02	1.22E-03	1.90E-02	3.65E+01
U 239	4.20E-03	8.32E-03	4.34E-04	4.50E-05	1.54E+04
U 240	4.09E-02	7.63E-02	9.76E-03	1.60E-03	4.33E+02
Np 237	3.10E-02	6.11E-02	5.36E-03	2.10E+06	3.30E-07
Np 239	1.95E-02	3.87E-02	2.38E-03	6.50E-03	1.07E+02
Np 240	1.95E-01	3.59E-01	4.54E-02	1.20E-04	5.78E+03
Pu 234	0.00E+00	0.00E+00	0.00E+00	1.00E-03	6.93E+02
Pu 235	1.34E-02	2.66E-02	4.88E-04	4.80E-05	1.44E+04
Pu 236	9.66E-03	1.59E-02	2.18E-03	2.80E+00	2.48E-01
Pu 237	4.16E-03	8.35E-03	6.84E-05	1.20E-01	5.78E+00
Pu 238	9.18E-07	2.26E-06	4.77E-11	8.80E+01	7.88E-03
Pu 239	5.32E-06	1.06E-05	1.84E-07	2.40E+04	2.89E-05
Pu 240	9.51E-07	2.34E-06	1.31E-13	6.50E+03	1.07E-04
Pu 241	2.64E-05	6.61E-05	7.11E-11	1.40E+01	4.95E-02
Pu 242	9.25E-07	2.29E-06	1.67E-13	3.80E+05	1.82E-06

Radio-nuclide	A-EXT-A/D WL/RP Landfill (µSv/h)/(Bq/g)	A-EXT-B RH Room (4x5m, 20 cm walls) (µSv/h)/(Bq/g)	A-EXT-C WF/WO transport / eqipment (µSv/h)/(Bq/g)	Half-life T1/2 [a]	Decay constant λ [1/α]
Pu 243	1.93E-03	3.83E-03	9.49E-05	5.60E-04	1.24E+03
Pu 244	4.26E-02	7.96E-02	1.02E-02	8.30E+07	8.35E-09
Am 241	8.93E-04	2.23E-03	2.40E-09	4.30E+02	1.61E-03
Am 242	1.22E-03	2.44E-03	2.58E-05	1.80E-03	3.85E+02
Am 242m	1.69E-03	3.28E-03	1.36E-04	1.50E+02	4.62E-03
Am 243	2.28E-02	4.55E-02	2.38E-03	7.40E+03	9.37E-05
Cm 242	9.42E-07	2.35E-06	2.07E-13	4.50E-01	1.54E+00
Cm 243	1.51E-02	2.99E-02	1.92E-03	2.90E+01	2.39E-02
Cm 244	6.10E-07	1.51E-06	1.14E-13	1.80E+01	3.85E-02
Cm 245	6.95E-03	1.39E-02	3.05E-04	8.50E+03	8.15E-05
Cm 246	2.20E-07	6.04E-07	3.65E-17	4.70E+03	1.47E-04
Cm 247	5.15E-02	1.00E-01	1.10E-02	1.60E+07	4.33E-08
Cm 248	5.37E-07	1.33E-06	9.42E-14	3.40E+05	2.04E-06
Bk 249	1.26E-04	2.45E-04	2.71E-05	8.80E-01	7.88E-01
Cf 246	1.66E-06	3.41E-06	4.88E-08	4.10E-03	1.69E+02
Cf 248	1.31E-07	3.73E-07	4.91E-15	9.20E-01	7.53E-01
Cf 249	5.03E-02	9.82E-02	1.08E-02	3.50E+02	1.98E-03
Cf 250	1.62E-06	3.28E-06	7.07E-10	1.30E+01	5.33E-02
Cf 251	1.28E-02	2.56E-02	1.18E-03	9.00E+02	7.70E-04
Cf 252	1.01E-06	2.22E-06	2.93E-10	2.60E+00	2.67E-01
Cf 253	2.58E-05	5.04E-05	4.75E-06	4.90E-02	1.41E+01
Cf 254	0.00E+00	0.00E+00	0.00E+00	1.70E-01	4.08E+00
Es 253	4.85E-05	9.62E-05	7.58E-06	5.60E-02	1.24E+01
Es 254	1.49E-01	2.66E-01	3.63E-02	7.60E-01	9.12E-01
Es 254m	9.59E-02	1.79E-01	2.30E-02	4.50E-03	1.54E+02
Fm 254	2.94E-06	6.52E-06	9.07E-09	3.70E-04	1.87E+03
Fm 255	1.08E-04	2.32E-04	1.75E-06	2.30E-03	3.01E+02

TABLE I-IV: Inhalation Effective Dose Coefficients for Public and Workers [Sv/Bq]

	Public						Workers			concen-tration factor for dust
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**	**e(g)1µm**	**e(g)5µm**	**Type**	
H-3	3.40E-10	2.70E-10	1.40E-10	8.20E-11	5.30E-11	4.50E-11	2.60E-10	2.60E-10	M	70
Be-7	2.80E-10	2.40E-10	1.40E-10	9.60E-11	6.80E-11	5.50E-11	5.20E-11	4.60E-11	S	1
C-14	8.30E-09	6.60E-09	4.00E-09	2.80E-09	2.50E-09	2.00E-09	5.80E-09	5.80E-09	M	70
F-18	4.20E-10	3.10E-10	1.50E-10	1.00E-10	7.30E-11	5.90E-11	6.00E-11	9.30E-11	S	70
Na-22	9.70E-09	7.30E-09	3.80E-09	2.40E-09	1.50E-09	1.30E-09	1.30E-09	2.00E-09	F	70
Na-24	2.30E-09	1.80E-09	9.30E-10	5.70E-10	3.40E-10	2.70E-10	2.90E-10	5.30E-10	F	70
Si-31	7.20E-10	4.70E-10	2.20E-10	1.40E-10	9.50E-11	7.90E-11	7.50E-11	1.10E-10	S	1
P-32	2.20E-08	1.50E-08	8.00E-09	5.30E-09	4.00E-09	3.40E-09	3.20E-09	2.90E-09	M	10
P-33	6.10E-09	4.60E-09	2.80E-09	2.10E-09	1.90E-09	1.50E-09	1.40E-09	1.30E-09	M	10
S-35	5.90E-09	4.50E-09	2.80E-09	2.00E-09	1.80E-09	1.40E-09	1.30E-09	1.10E-09	M	10
Cl-36	3.10E-08	2.60E-08	1.50E-08	1.00E-08	8.80E-09	7.30E-09	6.90E-09	5.10E-09	M	70
Cl-38	4.70E-10	3.00E-10	1.40E-10	8.50E-11	5.40E-11	4.50E-11	4.70E-11	7.30E-11	M	70
K-40	2.40E-08	1.70E-08	7.50E-09	4.50E-09	2.50E-09	2.10E-09	2.10E-09	3.00E-09	F	70
K-42	1.60E-09	1.00E-09	4.40E-10	2.60E-10	1.50E-10	1.20E-10	1.30E-10	2.00E-10	F	70
K-43	1.30E-09	9.70E-10	4.70E-10	2.90E-10	1.70E-10	1.40E-10	1.50E-10	2.60E-10	F	70
Ca-41	4.20E-10	2.60E-10	1.70E-10	1.70E-10	1.60E-10	9.50E-11	1.70E-10	1.90E-10	M	10
Ca-45	1.20E-08	8.80E-09	5.30E-09	3.90E-09	3.50E-09	2.70E-09	2.70E-09	2.30E-09	M	10
Ca-47	1.17E-08	8.88E-09	4.83E-09	3.36E-09	2.79E-09	2.21E-09	2.09E-09	2.41E-09	M	10
Sc-46	2.80E-08	2.30E-08	1.40E-08	9.80E-09	8.40E-09	6.80E-09	6.40E-09	4.80E-09	S	10
Sc-47	4.00E-09	2.80E-09	1.50E-09	1.10E-09	9.20E-10	7.30E-10	7.00E-10	7.30E-10	S	10
Sc-48	7.80E-09	5.90E-09	3.10E-09	2.00E-09	1.40E-09	1.10E-09	1.10E-09	1.60E-09	S	10
V-48	1.40E-08	1.10E-08	6.30E-09	4.30E-09	2.90E-09	2.40E-09	2.30E-09	2.70E-09	M	10
Cr-51	2.60E-10	1.90E-10	1.00E-10	6.40E-11	3.90E-11	3.20E-11	3.60E-11	3.60E-11	M	10
Mn-51	4.00E-10	2.70E-10	1.20E-10	7.80E-11	5.00E-11	4.10E-11	4.30E-11	6.80E-11	M	3.5
Mn-52	8.60E-09	6.80E-09	3.70E-09	2.40E-09	1.70E-09	1.40E-09	1.40E-09	1.80E-09	M	3.5
Mn-52m	2.80E-10	1.90E-10	8.70E-11	5.50E-11	3.40E-11	2.90E-11	3.00E-11	5.00E-11	M	3.5
Mn-53	4.60E-10	3.40E-10	1.70E-10	1.00E-10	6.40E-11	5.40E-11	2.90E-11	3.60E-11	M	3.5
Mn-54	7.50E-09	6.20E-09	3.80E-09	2.40E-09	1.90E-09	1.50E-09	1.50E-09	1.20E-09	M	3.5
Mn-56	1.10E-09	7.80E-10	3.70E-10	2.40E-10	1.50E-10	1.20E-10	1.30E-10	2.00E-10	M	3.5
Fe-52	6.04E-09	4.26E-09	1.98E-09	1.25E-09	7.70E-10	6.25E-10	6.56E-10	9.93E-10	M	1
Fe-55	1.90E-09	1.40E-09	9.90E-10	6.20E-10	4.40E-10	3.80E-10	3.70E-10	3.30E-10	M	1
Fe-59	1.80E-08	1.30E-08	7.90E-09	5.50E-09	4.60E-09	3.70E-09	3.50E-09	3.20E-09	M	1
Co-55	4.10E-09	3.10E-09	1.50E-09	9.80E-10	6.10E-10	5.00E-10	5.10E-10	7.80E-10	M	1
Co-56	2.50E-08	2.10E-08	1.10E-08	7.40E-09	5.80E-09	4.80E-09	4.60E-09	4.00E-09	M	1
Co-57	2.80E-09	2.20E-09	1.30E-09	8.50E-10	6.70E-10	5.50E-10	5.20E-10	3.90E-10	M	1
Co-58	7.30E-09	6.50E-09	3.50E-09	2.40E-09	2.00E-09	1.60E-09	1.50E-09	1.40E-09	M	1
Co-58m	1.48E-10	1.10E-10	5.62E-11	3.65E-11	2.64E-11	2.13E-11	2.08E-11	2.23E-11	M	1
Co-60	4.20E-08	3.40E-08	2.10E-08	1.50E-08	1.20E-08	1.00E-08	9.60E-09	7.10E-09	M	1
Co-60m	7.10E-12	4.70E-12	2.70E-12	1.80E-12	1.50E-12	1.20E-12	1.10E-12	1.20E-12	M	1
Co-61	4.30E-10	2.70E-10	1.20E-10	8.20E-11	5.70E-11	4.70E-11	4.80E-11	7.10E-11	M	1
Co-62m	1.90E-10	1.30E-10	6.10E-11	3.80E-11	2.40E-11	2.00E-11	2.10E-11	3.60E-11	M	1
Ni-59	7.90E-10	6.20E-10	3.40E-10	2.10E-10	1.40E-10	1.30E-10	1.30E-10	9.40E-11	M	1
Ni-63	2.50E-09	1.90E-09	1.10E-09	7.00E-10	5.30E-10	4.80E-10	4.40E-10	3.10E-10	M	1
Ni-65	7.70E-10	5.20E-10	2.40E-10	1.60E-10	1.00E-10	8.50E-11	8.70E-11	1.30E-10	M	1
Cu-64	5.80E-10	5.70E-10	2.90E-10	2.00E-10	1.30E-10	1.20E-10	1.10E-10	1.50E-10	S	1
Zn-65	8.50E-09	6.50E-09	3.70E-09	2.40E-09	1.90E-09	1.60E-09	2.90E-09	2.80E-09	M	70
Zn-69	2.20E-10	1.40E-10	6.50E-11	4.40E-11	3.10E-11	2.60E-11	2.80E-11	4.30E-11	M	70
Zn-69m	2.28E-09	1.62E-09	8.03E-10	5.36E-10	3.26E-10	2.61E-10	2.83E-10	3.65E-10	M	70
Ga-72	4.50E-09	3.30E-09	1.60E-09	1.00E-09	6.50E-10	5.30E-10	5.50E-10	8.40E-10	M	70
Ge-71	1.20E-10	8.60E-11	4.10E-11	2.40E-11	1.30E-11	1.10E-11	1.00E-11	1.10E-11	M	1
As-73	5.40E-09	4.00E-09	2.30E-09	1.50E-09	1.20E-09	1.00E-09	9.30E-10	6.50E-10	M	1
As-74	1.10E-08	8.40E-09	4.70E-09	3.30E-09	2.60E-09	2.10E-09	2.10E-09	1.80E-09	M	1
As-76	5.10E-09	4.60E-09	2.20E-09	1.40E-09	8.80E-10	7.40E-10	7.40E-10	9.20E-10	M	1
As-77	2.20E-09	1.70E-09	8.90E-10	6.20E-10	5.00E-10	3.90E-10	3.80E-10	4.20E-10	M	1
Se-75	7.80E-09	6.00E-09	3.40E-09	2.50E-09	1.20E-09	1.00E-09	1.40E-09	1.70E-09	F	10
Se-79	1.60E-08	1.30E-08	7.70E-09	5.60E-09	1.50E-09	1.10E-09	1.20E-09	1.60E-09	F	10
Br-82	3.80E-09	3.00E-09	1.70E-09	1.10E-09	7.90E-10	6.30E-10	6.40E-10	8.80E-10	M	1
Rb-86	1.20E-08	7.70E-09	3.40E-09	2.00E-09	1.10E-09	9.30E-10	9.60E-10	1.30E-09	F	1
Rb-87	6.00E-09	4.10E-09	1.80E-09	1.10E-09	6.00E-10	5.00E-10	5.10E-10	7.60E-10	F	1
Sr-85	4.30E-09	3.10E-09	1.80E-09	1.20E-09	8.80E-10	6.40E-10	7.70E-10	6.40E-10	M	10
Sr-85m	3.36E-11	2.69E-11	1.41E-11	8.72E-12	5.63E-12	4.48E-12	4.96E-12	7.78E-12	M	10
Sr-87m	1.60E-10	1.20E-10	5.90E-11	3.80E-11	2.50E-11	2.00E-11	2.20E-11	3.50E-11	M	10
Sr-89	3.30E-08	2.40E-08	1.30E-08	9.10E-09	7.30E-09	6.10E-09	7.50E-09	5.60E-09	M	10
Sr-90	1.63E-07	1.18E-07	6.90E-08	5.36E-08	5.17E-08	3.74E-08	1.51E-07	7.87E-08	M	10
Sr-91	3.10E-09	2.20E-09	1.10E-09	6.90E-10	4.40E-10	3.70E-10	4.10E-10	5.70E-10	M	10
Sr-92	2.51E-09	1.78E-09	8.26E-10	5.22E-10	3.17E-10	2.68E-10	2.94E-10	4.30E-10	M	10
Y-90	1.30E-08	8.40E-09	4.00E-09	2.60E-09	1.70E-09	1.40E-09	1.50E-09	1.70E-09	M	10
Y-91	4.30E-08	3.40E-08	1.90E-08	1.30E-08	1.00E-08	8.90E-09	8.40E-09	6.10E-09	S	10
Y-91m	9.98E-11	7.94E-11	4.24E-11	2.78E-11	2.00E-11	1.63E-11	1.60E-11	1.87E-11	S	10

	Public						Workers			concen-tration factor for dust
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**	**e(g)1µm**	**e(g)5µm**	**Type**	
Y-92	1.90E-09	1.20E-09	5.50E-10	3.50E-10	2.10E-10	1.80E-10	2.00E-10	2.80E-10	S	10
Y-93	4.60E-09	3.00E-09	1.40E-09	8.50E-10	5.00E-10	4.20E-10	4.30E-10	6.00E-10	S	10
Zr-93	6.37E-09	5.48E-09	4.09E-09	4.91E-09	8.08E-09	1.05E-08	1.01E-08	6.89E-09	M	1
Zr-95	2.33E-08	1.85E-08	1.12E-08	7.87E-09	6.82E-09	5.53E-09	5.18E-09	4.23E-09	M	1
Zr-97	8.10E-09	5.50E-09	2.90E-09	1.86E-09	1.14E-09	9.55E-10	9.76E-10	1.36E-09	M	1
Nb-93m	3.10E-09	2.40E-09	1.30E-09	8.20E-10	5.90E-10	5.10E-10	4.60E-10	2.90E-10	M	10
Nb-94	4.30E-08	3.70E-08	2.30E-08	1.60E-08	1.30E-08	1.10E-08	1.00E-08	7.20E-09	M	10
Nb-95	6.80E-09	5.20E-09	3.10E-09	2.20E-09	1.90E-09	1.50E-09	1.40E-09	1.30E-09	M	10
Nb-97	3.70E-10	2.50E-10	1.20E-10	7.70E-11	5.20E-11	4.30E-11	4.40E-11	6.90E-11	M	10
Nb-98	5.20E-10	3.60E-10	1.70E-10	1.10E-10	6.80E-11	5.60E-11	5.90E-11	9.60E-11	M	10
Mo-90	2.60E-09	2.00E-09	9.90E-10	6.50E-10	4.20E-10	3.40E-10	3.70E-10	5.60E-10	M	10
Mo-93	5.23E-09	4.14E-09	2.37E-09	1.59E-09	1.24E-09	1.09E-09	2.65E-09	1.48E-09	M	10
Mo-99	6.09E-09	4.47E-09	2.24E-09	1.52E-09	1.12E-09	9.03E-10	9.83E-10	1.12E-09	M	10
Mo-101	2.61E-10	1.76E-10	8.19E-11	5.28E-11	3.52E-11	2.95E-11	3.18E-11	5.28E-11	M	10
Tc-96	4.70E-09	3.90E-09	2.10E-09	1.30E-09	8.60E-10	6.80E-10	7.10E-10	1.00E-09	M	10
Tc-96m	9.31E-11	7.48E-11	3.96E-11	2.43E-11	1.61E-11	1.28E-11	1.33E-11	1.89E-11	M	10
Tc-97	1.20E-09	1.00E-09	5.70E-10	3.60E-10	2.80E-10	2.20E-10	2.10E-10	1.60E-10	M	10
Tc-97m	1.30E-08	1.00E-08	6.10E-09	4.40E-09	4.10E-09	3.20E-09	3.10E-09	2.70E-09	M	10
Tc-99	1.70E-08	1.30E-08	8.00E-09	5.70E-09	5.00E-09	4.00E-09	3.90E-09	3.20E-09	M	10
Tc-99m	1.30E-10	9.90E-11	5.10E-11	3.40E-11	2.40E-11	1.90E-11	1.90E-11	2.90E-11	M	10
Ru-97	7.70E-10	6.10E-10	3.10E-10	2.00E-10	1.30E-10	1.00E-10	1.10E-10	1.60E-10	M	70
Ru-103	1.10E-08	8.41E-09	5.01E-09	3.50E-09	3.00E-09	2.40E-09	2.30E-09	1.90E-09	M	70
Ru-105	1.52E-09	1.08E-09	5.24E-10	3.52E-10	2.42E-10	2.03E-10	2.02E-10	2.81E-10	M	70
Ru-106	1.40E-07	1.10E-07	6.40E-08	4.10E-08	3.10E-08	2.80E-08	2.60E-08	1.70E-08	M	70
Rh-102	5.40E-08	5.00E-08	3.50E-08	2.40E-08	2.00E-08	1.70E-08	1.60E-08	9.00E-09	S	70
Rh-103m	2.00E-11	1.30E-11	6.70E-12	4.30E-12	3.20E-12	2.70E-12	2.50E-12	2.50E-12	S	70
Rh-105	2.40E-09	1.70E-09	8.00E-10	5.60E-10	4.50E-10	3.50E-10	3.40E-10	4.40E-10	S	70
Pd-103	2.52E-09	1.81E-09	1.01E-09	6.84E-10	5.33E-10	4.53E-10	4.02E-10	2.92E-10	S	1
Pd-107	2.20E-09	2.00E-09	1.30E-09	7.80E-10	6.20E-10	5.90E-10	5.50E-10	2.90E-10	S	1
Pd-109	2.70E-09	1.90E-09	9.30E-10	6.30E-10	4.60E-10	3.70E-10	3.60E-10	5.00E-10	S	1
Ag-105	4.50E-09	3.50E-09	2.00E-09	1.30E-09	9.00E-10	7.30E-10	5.40E-10	8.00E-10	M	7
Ag-108m	3.30E-08	2.70E-08	1.70E-08	1.10E-08	8.60E-09	7.40E-09	7.00E-09	5.20E-09	M	7
Ag-110m	3.50E-08	2.80E-08	1.70E-08	1.20E-08	9.20E-09	7.60E-09	7.20E-09	5.90E-09	M	7
Ag-111	9.20E-09	6.60E-09	3.50E-09	2.40E-09	1.90E-09	1.50E-09	1.50E-09	1.50E-09	M	7
Cd-109	4.50E-08	3.70E-08	2.10E-08	1.40E-08	9.30E-09	8.10E-09	8.10E-09	9.60E-09	F	70
Cd-113m	3.00E-07	2.70E-07	1.80E-07	1.30E-07	1.10E-07	1.10E-07	1.10E-07	1.30E-07	F	70
Cd-115	7.58E-09	5.36E-09	2.73E-09	1.88E-09	1.36E-09	1.15E-09	1.15E-09	1.37E-09	S	70
Cd-115m	4.60E-08	3.20E-08	1.50E-08	1.00E-08	6.40E-09	5.30E-09	5.30E-09	6.40E-09	F	70
In-111	1.50E-09	1.20E-09	6.20E-10	4.10E-10	2.90E-10	2.30E-10	2.30E-10	3.10E-10	M	70
In-113m	1.60E-10	1.10E-10	5.50E-11	3.60E-11	2.40E-11	2.00E-11	2.00E-11	3.20E-11	M	70
In-114m	1.20E-07	7.70E-08	3.40E-08	1.90E-08	1.10E-08	9.30E-09	9.30E-09	1.10E-08	F	70
In-115m	4.70E-10	3.30E-10	1.60E-10	1.00E-10	7.20E-11	5.90E-11	6.00E-11	8.70E-11	M	70
Sn-113	1.32E-08	1.01E-08	5.85E-09	4.04E-09	3.22E-09	2.72E-09	2.52E-09	1.93E-09	M	70
Sn-121m	2.05E-08	1.61E-08	9.71E-09	6.76E-09	5.79E-09	4.73E-09	4.44E-09	3.58E-09	M	70
Sn-125	2.12E-08	1.52E-08	7.70E-09	5.07E-09	3.66E-09	3.15E-09	3.05E-09	2.84E-09	M	70
Sn-126	1.20E-07	1.00E-07	6.20E-08	4.10E-08	3.30E-08	2.80E-08	2.70E-08	1.80E-08	M	70
Sb-122	8.30E-09	5.70E-09	2.80E-09	1.80E-09	1.30E-09	1.00E-09	1.00E-09	1.20E-09	M	1
Sb-124	3.10E-08	2.40E-08	1.40E-08	9.60E-09	7.70E-09	6.40E-09	6.10E-09	4.70E-09	M	1
Sb-125	2.29E-08	1.81E-08	1.13E-08	7.73E-09	6.63E-09	5.46E-09	5.14E-09	3.86E-09	M	1
Te-123m	1.80E-08	1.30E-08	8.00E-09	5.70E-09	5.00E-09	4.00E-09	3.90E-09	3.40E-09	M	10
Te-125m	1.50E-08	1.10E-08	6.60E-09	4.80E-09	4.30E-09	3.40E-09	3.30E-09	2.90E-09	M	10
Te-127	1.00E-09	7.30E-10	3.60E-10	2.40E-10	1.60E-10	1.30E-10	1.20E-10	1.80E-10	M	10
Te-127m	3.60E-08	2.67E-08	1.53E-08	1.12E-08	9.35E-09	7.53E-09	7.32E-09	6.37E-09	M	10
Te-129	3.30E-10	2.20E-10	9.90E-11	6.50E-11	4.40E-11	3.70E-11	3.80E-11	5.70E-11	M	10
Te-129m	3.52E-08	2.61E-08	1.41E-08	9.84E-09	8.03E-09	6.62E-09	6.32E-09	5.44E-09	M	10
Te-131	4.11E-10	3.21E-10	1.59E-10	9.19E-11	5.81E-11	4.35E-11	5.40E-11	8.41E-11	M	10
Te-131m	1.59E-08	1.38E-08	7.09E-09	4.00E-09	2.42E-09	1.76E-09	1.94E-09	2.82E-09	M	10
Te-132	1.70E-08	1.39E-08	6.80E-09	4.20E-09	2.72E-09	2.08E-09	2.29E-09	3.18E-09	M	10
Te-133	3.82E-10	3.03E-10	1.41E-10	7.45E-11	4.51E-11	3.44E-11	4.14E-11	6.42E-11	M	10
Te-133m	1.60E-09	1.28E-09	6.04E-10	3.19E-10	1.97E-10	1.46E-10	1.80E-10	2.74E-10	M	10
Te-134	7.00E-10	5.11E-10	2.49E-10	1.52E-10	1.00E-10	8.07E-11	8.67E-11	1.36E-10	M	10
I-123	8.70E-10	7.90E-10	3.80E-10	1.80E-10	1.10E-10	7.40E-11	7.60E-11	1.10E-10	F	70
I-125	2.00E-08	2.30E-08	1.50E-08	1.10E-08	7.20E-09	5.10E-09	5.30E-09	7.30E-09	F	70
I-126	8.10E-08	8.30E-08	4.50E-08	2.40E-08	1.50E-08	9.80E-09	1.00E-08	1.40E-08	F	70
I-129	7.20E-08	8.60E-08	6.10E-08	6.70E-08	4.60E-08	3.60E-08	3.70E-08	5.10E-08	F	70
I-130	8.20E-09	7.40E-09	3.50E-09	1.60E-09	1.00E-09	6.70E-10	6.90E-10	9.60E-10	F	70
I-131	7.20E-08	7.20E-08	3.70E-08	1.90E-08	1.10E-08	7.40E-09	7.60E-09	1.10E-08	F	70
I-132	1.10E-09	9.60E-10	4.50E-10	2.20E-10	1.30E-10	9.40E-11	9.60E-11	2.00E-10	F	70
I-133	1.90E-08	1.80E-08	8.30E-09	3.80E-09	2.20E-09	1.50E-09	1.50E-09	2.10E-09	F	70
I-134	4.60E-10	3.70E-10	1.80E-10	9.70E-11	5.90E-11	4.50E-11	4.80E-11	7.90E-11	F	70

	Public						Workers			concen-tration factor for dust
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**	**e(g)1µm**	**e(g)5µm**	**Type**	
I-135	4.10E-09	3.70E-09	1.70E-09	7.90E-10	4.80E-10	3.20E-10	3.30E-10	4.60E-10	F	70
Cs-129	3.40E-10	2.80E-10	1.40E-10	8.70E-11	5.20E-11	4.20E-11	4.50E-11	8.10E-11	F	70
Cs-131	2.40E-10	1.70E-10	8.40E-11	5.30E-11	3.20E-11	2.70E-11	2.80E-11	4.50E-11	F	70
Cs-132	1.50E-09	1.20E-09	6.40E-10	4.10E-10	2.70E-10	2.30E-10	2.40E-10	3.80E-10	F	70
Cs-134	1.10E-08	7.30E-09	5.20E-09	5.30E-09	6.30E-09	6.60E-09	6.80E-09	9.60E-09	F	70
Cs-134m	1.32E-10	8.75E-11	3.90E-11	2.61E-11	1.73E-11	1.53E-11	1.64E-11	2.79E-11	F	70
Cs-135	1.70E-09	9.90E-10	6.20E-10	6.10E-10	6.80E-10	6.90E-10	7.10E-10	9.90E-10	F	70
Cs-136	7.30E-09	5.20E-09	2.90E-09	2.00E-09	1.40E-09	1.20E-09	1.30E-09	1.90E-09	F	70
Cs-137	8.80E-09	5.40E-09	3.60E-09	3.70E-09	4.40E-09	4.60E-09	4.80E-09	6.70E-09	F	70
Cs-138	2.60E-10	1.80E-10	8.10E-11	5.00E-11	2.90E-11	2.40E-11	2.60E-11	4.60E-11	F	70
Ba-131	3.80E-09	3.17E-09	1.63E-09	1.12E-09	9.83E-10	7.71E-10	2.41E-10	3.68E-10	M	70
Ba-133	1.50E-08	1.00E-08	6.40E-09	5.10E-09	5.50E-09	3.10E-09	1.50E-09	1.80E-09	M	70
Ba-139	5.40E-10	3.50E-10	1.60E-10	1.00E-10	6.60E-11	5.60E-11	3.50E-11	5.50E-11	M	70
Ba-140	3.35E-08	2.46E-08	1.33E-08	9.07E-09	7.16E-09	5.91E-09	1.81E-09	2.70E-09	M	70
La-137	8.60E-09	8.10E-09	5.60E-09	4.00E-09	3.60E-09	3.60E-09	8.60E-09	1.00E-08	F	10
La-140	8.80E-09	6.30E-09	3.10E-09	2.00E-09	1.30E-09	1.10E-09	1.10E-09	1.50E-09	M	10
Ce-139	7.50E-09	6.10E-09	3.60E-09	2.50E-09	2.10E-09	1.70E-09	1.60E-09	1.30E-09	M	10
Ce-141	1.40E-08	1.10E-08	6.30E-09	4.60E-09	4.10E-09	3.20E-09	3.10E-09	2.70E-09	M	10
Ce-143	6.62E-09	4.62E-09	2.30E-09	1.58E-09	1.16E-09	9.37E-10	9.20E-10	1.12E-09	M	10
Ce-144	1.90E-07	1.60E-07	8.81E-08	5.50E-08	4.10E-08	3.60E-08	3.40E-08	2.30E-08	M	10
Pr-142	5.50E-09	3.70E-09	1.70E-09	1.10E-09	6.60E-10	5.50E-10	5.60E-10	7.40E-10	S	10
Pr-143	1.30E-08	9.20E-09	5.10E-09	3.60E-09	3.00E-09	2.40E-09	2.30E-09	2.20E-09	S	10
Nd-147	1.22E-08	8.80E-09	5.02E-09	3.58E-09	3.06E-09	2.45E-09	2.35E-09	2.14E-09	S	10
Nd-149	8.64E-10	5.84E-10	2.82E-10	1.85E-10	1.36E-10	1.10E-10	1.11E-10	1.54E-10	S	10
Pm-145	1.10E-08	9.80E-09	6.40E-09	4.30E-09	3.70E-09	3.60E-09	3.40E-09	2.40E-09	M	10
Pm-146	6.40E-08	5.90E-08	3.90E-08	2.60E-08	2.20E-08	2.10E-08	1.90E-08	1.30E-08	M	10
Pm-147	2.10E-08	1.80E-08	1.10E-08	7.00E-09	5.70E-09	5.00E-09	4.70E-09	3.50E-09	M	10
Pm-149	5.30E-09	3.60E-09	1.80E-09	1.20E-09	9.00E-10	7.30E-10	7.20E-10	8.20E-10	S	10
Sm-151	1.10E-08	1.00E-08	6.70E-09	4.50E-09	4.00E-09	4.00E-09	3.70E-09	2.60E-09	M	10
Sm-153	4.20E-09	2.90E-09	1.50E-09	1.00E-09	7.90E-10	6.30E-10	6.10E-10	6.80E-10	M	10
Eu-152	1.10E-07	1.00E-07	7.00E-08	4.90E-08	4.30E-08	4.20E-08	3.90E-08	2.70E-08	M	10
Eu-152m	1.90E-09	1.30E-09	6.60E-10	4.20E-10	2.40E-10	2.20E-10	2.20E-10	3.20E-10	M	10
Eu-154	1.60E-07	1.50E-07	9.70E-08	6.50E-08	5.60E-08	5.30E-08	5.00E-08	3.50E-08	M	10
Eu-155	2.60E-08	2.30E-08	1.40E-08	9.20E-09	7.60E-09	6.90E-09	6.50E-09	4.70E-09	M	10
Gd-153	1.50E-08	1.20E-08	6.50E-09	3.90E-09	2.40E-09	2.10E-09	2.10E-09	2.50E-09	F	10
Gd-159	2.20E-09	1.50E-09	7.30E-10	4.90E-10	3.40E-10	2.70E-10	2.70E-10	3.90E-10	M	10
Tb-157	3.20E-09	3.00E-09	2.00E-09	1.40E-09	1.20E-09	1.20E-09	1.10E-09	7.90E-10	M	10
Tb-160	3.20E-08	2.50E-08	1.50E-08	1.00E-08	8.60E-09	7.00E-09	6.60E-09	5.40E-09	M	10
Dy-165	5.20E-10	3.40E-10	1.60E-10	1.10E-10	7.20E-11	6.00E-11	6.10E-11	8.70E-11	M	10
Dy-166	1.55E-08	1.06E-08	5.50E-09	3.70E-09	2.76E-09	2.28E-09	2.18E-09	2.28E-09	M	10
Ho-166	6.00E-09	4.00E-09	1.90E-09	1.20E-09	7.90E-10	6.50E-10	6.60E-10	8.30E-10	M	10
Ho-166m	2.60E-07	2.50E-07	1.80E-07	1.30E-07	1.20E-07	1.20E-07	1.10E-07	7.80E-08	M	10
Er-169	4.70E-09	3.50E-09	2.00E-09	1.50E-09	1.30E-09	1.00E-09	9.80E-10	9.20E-10	M	10
Er-171	1.80E-09	1.20E-09	5.91E-10	3.91E-10	2.71E-10	2.21E-10	2.21E-10	3.00E-10	M	10
Tm-170	3.60E-08	2.80E-08	1.60E-08	1.10E-08	8.50E-09	7.00E-09	6.60E-09	5.20E-09	M	10
Tm-171	6.80E-09	5.70E-09	3.40E-09	2.00E-09	1.60E-09	1.40E-09	1.30E-09	9.10E-10	M	10
Yb-175	3.70E-09	2.70E-09	1.50E-09	1.10E-09	9.20E-10	7.30E-10	7.00E-10	7.00E-10	S	10
Lu-177	5.70E-09	4.10E-09	2.40E-09	1.70E-09	1.50E-09	1.20E-09	1.10E-09	1.10E-09	S	10
Hf-181	2.20E-08	1.70E-08	9.90E-09	7.10E-09	6.30E-09	5.00E-09	4.70E-09	4.10E-09	M	10
Ta-182	4.20E-08	3.40E-08	2.10E-08	1.50E-08	1.30E-08	1.00E-08	9.70E-09	7.40E-09	S	10
W-181	2.50E-10	1.90E-10	9.20E-11	5.70E-11	3.20E-11	2.70E-11	2.80E-11	4.30E-11	F	10
W-185	1.40E-09	1.00E-09	4.40E-10	2.70E-10	1.40E-10	1.20E-10	1.40E-10	2.20E-10	F	10
W-187	2.00E-09	1.50E-09	7.00E-10	4.30E-10	2.30E-10	1.90E-10	2.00E-10	3.30E-10	F	10
Re-186	8.70E-09	5.70E-09	2.80E-09	1.80E-09	1.40E-09	1.10E-09	1.10E-09	1.20E-09	M	10
Re-188	6.50E-09	4.40E-09	1.90E-09	1.00E-09	6.10E-10	4.60E-10	5.50E-10	7.40E-10	F	10
Os-185	7.20E-09	5.80E-09	3.10E-09	1.90E-09	1.20E-09	1.10E-09	1.10E-09	1.40E-09	F	70
Os-191	9.00E-09	6.50E-09	3.90E-09	2.70E-09	2.30E-09	1.90E-09	1.80E-09	1.50E-09	S	70
Os-191m	1.13E-09	8.02E-10	4.61E-10	3.24E-10	2.72E-10	2.19E-10	2.06E-10	1.87E-10	S	70
Os-193	4.00E-09	2.70E-09	1.30E-09	9.00E-10	6.40E-10	5.20E-10	5.10E-10	6.80E-10	S	70
Ir-190	1.10E-08	8.60E-09	4.40E-09	3.10E-09	2.70E-09	2.10E-09	2.30E-09	2.50E-09	M	1
Ir-192	2.80E-08	2.20E-08	1.30E-08	9.50E-09	8.10E-09	6.60E-09	6.20E-09	4.90E-09	S	1
Ir-194	5.50E-09	3.70E-09	1.70E-09	1.10E-09	6.70E-10	5.60E-10	5.60E-10	7.50E-10	S	1
Pt-191	1.10E-09	7.90E-10	3.70E-10	2.30E-10	1.30E-10	1.10E-10	1.10E-10	1.90E-10	F	7
Pt-193	2.20E-10	1.60E-10	7.20E-11	4.30E-11	2.50E-11	2.10E-11	2.10E-11	2.70E-11	F	7
Pt-193m	1.60E-09	1.00E-09	4.50E-10	2.70E-10	1.40E-10	1.20E-10	1.30E-10	2.10E-10	F	7
Pt-197	1.10E-09	7.30E-10	3.10E-10	1.90E-10	1.00E-10	8.50E-11	9.10E-11	1.60E-10	F	7
Pt-197m	3.53E-10	2.28E-10	9.95E-11	6.15E-11	3.46E-11	2.96E-11	3.10E-11	5.36E-11	F	7
Au-198	5.40E-09	4.40E-09	2.00E-09	1.40E-09	1.10E-09	8.60E-10	8.40E-10	1.10E-09	S	7
Au-199	3.80E-09	2.80E-09	1.60E-09	1.20E-09	1.00E-09	7.90E-10	7.50E-10	7.60E-10	S	7
Hg-197	1.70E-09	1.20E-09	6.60E-10	4.60E-10	3.80E-10	3.00E-10	2.90E-10	2.80E-10	M	70

	Public						Workers			concen-tration factor for dust
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**	**e(g)1µm**	**e(g)5µm**	**Type**	
Hg-197m	3.83E-09	2.73E-09	1.23E-09	9.09E-10	7.43E-10	5.88E-10	5.66E-10	7.14E-10	M	70
Hg-203	1.00E-08	7.90E-09	4.70E-09	3.40E-09	3.00E-09	2.40E-09	2.30E-09	1.90E-09	M	70
Tl-200	1.00E-09	8.70E-10	4.60E-10	2.80E-10	1.60E-10	1.30E-10	1.40E-10	2.50E-10	F	10
Tl-201	4.50E-10	3.30E-10	1.50E-10	9.40E-11	5.40E-11	4.40E-11	4.70E-11	7.60E-11	F	10
Tl-202	1.50E-09	1.20E-09	5.90E-10	3.80E-10	2.30E-10	1.90E-10	2.00E-10	3.10E-10	F	10
Tl-204	5.00E-09	3.30E-09	1.50E-09	8.80E-10	4.70E-10	3.90E-10	4.40E-10	6.20E-10	F	10
Pb-203	1.30E-09	1.00E-09	5.40E-10	3.60E-10	2.50E-10	2.00E-10	9.10E-11	1.60E-10	M	70
Bi-206	1.00E-08	8.00E-09	4.40E-09	2.90E-09	2.10E-09	1.70E-09	1.70E-09	2.10E-09	M	1
Bi-207	2.30E-08	2.00E-08	1.20E-08	8.20E-09	6.50E-09	5.60E-09	5.20E-09	3.20E-09	M	1
Po-203	2.70E-10	2.10E-10	1.10E-10	6.70E-11	4.30E-11	3.50E-11	3.60E-11	6.10E-11	M	10
Po-205	4.00E-10	3.10E-10	1.70E-10	1.10E-10	8.10E-11	6.50E-11	6.40E-11	8.90E-11	M	10
Po-207	6.20E-10	5.10E-10	2.60E-10	1.60E-10	9.90E-11	7.80E-11	8.40E-11	1.50E-10	M	10
At-211	5.20E-07	3.70E-07	1.90E-07	1.40E-07	1.30E-07	1.10E-07	9.80E-08	1.10E-07	M	10
Ra-225	2.89E-05	2.15E-05	1.28E-05	9.57E-06	8.40E-06	6.70E-06	6.20E-06	5.26E-06	M	10
Ra-227	8.00E-10	6.70E-10	4.40E-10	3.20E-10	2.90E-10	2.80E-10	2.80E-10	2.10E-10	M	10
Th-226	3.10E-07	2.20E-07	1.20E-07	8.80E-08	7.50E-08	6.10E-08	5.90E-08	7.80E-08	S	10
Th-229	2.45E-04	2.16E-04	1.45E-04	9.80E-05	8.50E-05	7.82E-05	7.17E-05	5.38E-05	S	10
Pa-230	4.48E-06	3.39E-06	2.17E-06	1.58E-06	1.51E-06	1.18E-06	1.10E-06	8.92E-07	S	10
Pa-233	1.70E-08	1.30E-08	7.50E-09	5.50E-09	4.90E-09	3.90E-09	3.70E-09	3.20E-09	S	10
U-230	4.94E-05	3.73E-05	2.41E-05	1.81E-05	1.71E-05	1.31E-05	1.21E-05	1.01E-05	M	10
U-231	2.40E-09	1.70E-09	9.40E-10	5.50E-10	4.60E-10	3.80E-10	3.40E-10	3.70E-10	M	10
U-232	1.86E-04	1.50E-04	9.54E-05	6.46E-05	5.62E-05	4.69E-05	4.52E-05	3.60E-05	M	10
U-233	1.73E-05	1.30E-05	8.56E-06	5.82E-06	5.10E-06	4.34E-06	3.87E-06	2.71E-06	M	10
U-236	1.40E-05	1.00E-05	6.50E-06	4.50E-06	3.90E-06	3.20E-06	2.90E-06	1.90E-06	M	10
U-237	7.80E-09	5.70E-09	3.30E-09	2.40E-09	2.10E-09	1.70E-09	1.60E-09	1.50E-09	M	10
U-239	2.20E-10	1.48E-10	6.94E-11	4.74E-11	3.50E-11	2.82E-11	2.90E-11	4.04E-11	M	10
U-240	4.60E-09	3.10E-09	1.70E-09	1.10E-09	6.50E-10	5.30E-10	5.30E-10	7.90E-10	M	10
Np-237	4.41E-05	4.01E-05	2.80E-05	2.20E-05	2.20E-05	2.30E-05	2.10E-05	1.50E-05	M	10
Np-239	5.90E-09	4.20E-09	2.00E-09	1.40E-09	1.20E-09	9.30E-10	9.00E-10	1.10E-09	M	10
Np-240	6.30E-10	4.40E-10	2.20E-10	1.40E-10	1.00E-10	8.50E-11	8.70E-11	1.30E-10	M	10
Pu-234	7.80E-08	5.90E-08	3.70E-08	2.80E-08	2.60E-08	2.10E-08	1.90E-08	1.60E-08	M	10
Pu-235	1.30E-11	1.00E-11	5.00E-12	2.90E-12	1.90E-12	1.40E-12	1.60E-12	2.60E-12	M	10
Pu-236	5.49E-05	4.86E-05	3.26E-05	2.34E-05	2.11E-05	2.17E-05	1.97E-05	1.43E-05	M	10
Pu-237	1.90E-09	1.40E-09	8.20E-10	5.40E-10	4.30E-10	3.50E-10	3.30E-10	2.90E-10	M	10
Pu-238	7.80E-05	7.40E-05	5.60E-05	4.40E-05	4.30E-05	4.60E-05	4.30E-05	3.00E-05	M	10
Pu-239	8.00E-05	7.70E-05	6.00E-05	4.80E-05	4.70E-05	5.00E-05	4.70E-05	3.20E-05	M	10
Pu-240	8.00E-05	7.70E-05	6.00E-05	4.80E-05	4.70E-05	5.00E-05	4.70E-05	3.20E-05	M	10
Pu-241	3.07E-06	3.01E-06	2.43E-06	2.01E-06	2.04E-06	2.14E-06	2.00E-06	1.38E-06	M	10
Pu-242	7.60E-05	7.30E-05	5.70E-05	4.50E-05	4.50E-05	4.80E-05	4.40E-05	3.10E-05	M	10
Pu-243	5.60E-10	3.90E-10	1.90E-10	1.30E-10	8.70E-11	8.30E-11	8.20E-11	1.10E-10	M	10
Pu-244	7.48E-05	7.28E-05	5.66E-05	4.55E-05	4.45E-05	4.75E-05	4.45E-05	3.03E-05	M	10
Am-241	7.30E-05	6.90E-05	5.10E-05	4.00E-05	4.00E-05	4.20E-05	3.90E-05	2.70E-05	M	10
Am-242	1.49E-07	1.18E-07	7.23E-08	4.81E-08	4.21E-08	3.42E-08	3.18E-08	2.42E-08	M	10
Am-242m	9.73E-05	9.36E-05	6.96E-05	5.54E-05	5.53E-05	5.74E-05	5.40E-05	3.75E-05	M	10
Am-243	7.22E-05	6.82E-05	5.02E-05	4.01E-05	4.01E-05	4.11E-05	3.91E-05	2.71E-05	M	10
Cm-242	2.24E-05	1.84E-05	1.13E-05	7.52E-06	6.62E-06	5.43E-06	5.02E-06	3.85E-06	M	10
Cm-243	6.71E-05	6.11E-05	4.21E-05	3.11E-05	3.01E-05	3.11E-05	2.91E-05	2.00E-05	M	10
Cm-244	6.22E-05	5.72E-05	3.72E-05	2.71E-05	2.61E-05	2.71E-05	2.51E-05	1.71E-05	M	10
Cm-245	8.26E-05	7.82E-05	5.80E-05	4.66E-05	4.66E-05	4.79E-05	4.55E-05	3.08E-05	M	10
Cm-246	7.30E-05	6.90E-05	5.10E-05	4.10E-05	4.10E-05	4.20E-05	4.00E-05	2.70E-05	M	10
Cm-247	6.77E-05	6.36E-05	4.75E-05	3.74E-05	3.74E-05	3.94E-05	3.64E-05	2.53E-05	M	10
Cm-248	2.50E-04	2.40E-04	1.80E-04	1.40E-04	1.40E-04	1.50E-04	1.40E-04	9.50E-05	M	10
Bk-249	7.30E-07	7.05E-07	5.15E-07	3.80E-07	3.40E-07	3.35E-07	3.15E-07	2.13E-07	M	10
Cf-246	1.70E-06	1.30E-06	8.30E-07	6.10E-07	5.70E-07	4.50E-07	4.20E-07	3.50E-07	M	10
Cf-248	4.07E-05	3.45E-05	2.26E-05	1.52E-05	1.11E-05	9.97E-06	9.28E-06	6.84E-06	M	10
Cf-249	1.61E-04	1.51E-04	1.10E-04	8.03E-05	7.23E-05	7.03E-05	6.63E-05	4.52E-05	M	10
Cf-250	1.10E-04	9.82E-05	6.61E-05	4.21E-05	3.51E-05	3.41E-05	3.21E-05	2.21E-05	M	10
Cf-251	1.60E-04	1.50E-04	1.10E-04	8.10E-05	7.30E-05	7.10E-05	6.70E-05	4.60E-05	M	10
Cf-252	9.70E-05	8.70E-05	5.60E-05	3.20E-05	2.20E-05	2.00E-05	1.80E-05	1.30E-05	M	10
Cf-253	9.18E-06	6.96E-06	4.36E-06	3.18E-06	2.87E-06	2.23E-06	2.07E-06	1.73E-06	M	10
Cf-254	2.50E-04	1.90E-04	1.10E-04	7.00E-05	4.80E-05	4.10E-05	3.70E-05	2.20E-05	M	10
Es-253	1.10E-05	8.05E-06	5.13E-06	3.73E-06	3.42E-06	2.72E-06	2.52E-06	2.11E-06	M	10
Es-254	4.23E-05	3.58E-05	2.32E-05	1.50E-05	1.17E-05	1.03E-05	9.56E-06	7.07E-06	M	10
Es-254m	1.99E-06	1.51E-06	9.63E-07	7.21E-07	6.61E-07	5.29E-07	4.94E-07	4.38E-07	M	10
Fm-254	3.20E-07	2.30E-07	1.30E-07	9.80E-08	7.60E-08	6.10E-08	5.60E-08	7.70E-08	M	10
Fm-255	1.20E-06	7.30E-07	4.70E-07	3.50E-07	3.40E-07	2.70E-07	2.50E-07	2.60E-07	M	10

TABLE I-V: Ingestion Effective Dose Coefficients for Public and Workers [Sv/Bq]

	Public						Workers	Root Transfer Factor
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**		
H-3	1.20E-10	1.20E-10	7.30E-11	5.70E-11	4.20E-11	4.20E-11	4.20E-11	1
Be-7	1.80E-10	1.30E-10	7.70E-11	5.30E-11	3.50E-11	2.80E-11	2.80E-11	0.0015
C-14	1.40E-09	1.60E-09	9.90E-10	8.00E-10	5.70E-10	5.80E-10	5.80E-10	0.7
F-18	5.20E-10	3.00E-10	1.50E-10	9.10E-11	6.20E-11	4.90E-11	4.90E-11	0.006
Na-22	2.10E-08	1.50E-08	8.40E-09	5.50E-09	3.70E-09	3.20E-09	3.20E-09	0.055
Na-24	3.50E-09	2.30E-09	1.20E-09	7.70E-10	5.20E-10	4.30E-10	4.30E-10	0.055
Si-31	1.90E-09	1.00E-09	5.10E-10	3.00E-10	1.80E-10	1.60E-10	1.60E-10	0.0002
P-32	3.10E-08	1.90E-08	9.40E-09	5.30E-09	3.10E-09	2.40E-09	2.40E-09	1
P-33	2.70E-09	1.80E-09	9.10E-10	5.30E-10	3.10E-10	2.40E-10	2.40E-10	1
S-35	7.70E-09	5.40E-09	2.70E-09	1.60E-09	9.50E-10	7.70E-10	7.70E-10	0.6
Cl-36	9.80E-09	6.30E-09	3.20E-09	1.90E-09	1.20E-09	9.30E-10	9.30E-10	5
Cl-38	1.40E-09	7.70E-10	3.80E-10	2.20E-10	1.50E-10	1.20E-10	1.20E-10	5
K-40	6.20E-08	4.20E-08	2.10E-08	1.30E-08	7.60E-09	6.20E-09	6.20E-09	0.55
K-42	5.10E-09	3.00E-09	1.50E-09	8.60E-10	5.40E-10	4.30E-10	4.30E-10	0.55
K-43	2.30E-09	1.40E-09	7.60E-10	4.70E-10	3.00E-10	2.50E-10	2.50E-10	0.55
Ca-41	1.20E-09	5.20E-10	3.90E-09	4.80E-10	5.00E-10	1.90E-10	2.90E-10	0.35
Ca-45	1.10E-08	4.90E-09	2.60E-09	1.80E-09	1.30E-09	7.10E-10	7.60E-10	0.35
Ca-47	1.56E-08	1.09E-08	5.74E-09	3.51E-09	2.09E-09	1.83E-09	1.83E-09	0.35
Sc-46	1.10E-08	7.90E-09	4.40E-09	2.90E-09	1.80E-09	1.50E-09	1.50E-09	0.001
Sc-47	6.10E-09	3.90E-09	2.00E-09	1.20E-09	6.80E-10	5.40E-10	5.40E-10	0.001
Sc-48	1.30E-08	9.30E-09	5.10E-09	3.30E-09	2.10E-09	1.70E-09	1.70E-09	0.001
V-48	1.50E-08	1.10E-08	5.90E-09	3.90E-09	2.50E-09	2.00E-09	2.00E-09	0.0005
Cr-51	3.50E-10	2.30E-10	1.20E-10	7.80E-11	4.80E-11	3.80E-11	3.80E-11	0.001
Mn-51	1.10E-09	6.10E-10	3.00E-10	1.80E-10	1.20E-10	9.30E-11	9.30E-11	0.3
Mn-52	1.20E-08	8.80E-09	5.10E-09	3.40E-09	2.20E-09	1.80E-09	1.80E-09	0.3
Mn-52m	7.80E-10	4.40E-10	2.20E-10	1.30E-10	8.80E-11	6.90E-11	6.90E-11	0.3
Mn-53	4.10E-10	2.20E-10	1.10E-10	6.50E-11	3.70E-11	3.00E-11	3.00E-11	0.3
Mn-54	5.40E-09	3.10E-09	1.90E-09	1.30E-09	8.70E-10	7.10E-10	7.10E-10	0.3
Mn-56	2.70E-09	1.70E-09	8.50E-10	5.10E-10	3.20E-10	2.50E-10	2.50E-10	0.3
Fe-52	1.37E-08	9.48E-09	4.79E-09	2.91E-09	1.78E-09	1.46E-09	1.46E-09	0.001
Fe-55	7.60E-09	2.40E-09	1.70E-09	1.10E-09	7.70E-10	3.30E-10	3.30E-10	0.001
Fe-59	3.90E-08	1.30E-08	7.50E-09	4.70E-09	3.10E-09	1.80E-09	1.80E-09	0.001
Co-55	6.00E-09	5.50E-09	2.90E-09	1.80E-09	1.10E-09	1.00E-09	1.10E-09	0.08
Co-56	2.50E-08	1.50E-08	8.80E-09	5.80E-09	3.80E-09	2.50E-09	2.50E-09	0.08
Co-57	2.90E-09	1.60E-09	8.90E-10	5.80E-10	3.70E-10	2.10E-10	2.10E-10	0.08
Co-58	7.30E-09	4.40E-09	2.60E-09	1.70E-09	1.10E-09	7.40E-10	7.40E-10	0.08
Co-58m	2.38E-10	1.73E-10	9.15E-11	5.58E-11	3.37E-11	2.78E-11	2.78E-11	0.08
Co-60	5.40E-08	2.70E-08	1.70E-08	1.10E-08	7.90E-09	3.40E-09	3.40E-09	0.08
Co-60m	2.20E-11	1.20E-11	5.70E-12	3.20E-12	2.20E-12	1.70E-12	1.70E-12	0.08
Co-61	8.20E-10	5.10E-10	2.50E-10	1.40E-10	9.20E-11	7.40E-11	7.40E-11	0.08
Co-62m	5.30E-10	3.00E-10	1.50E-10	8.70E-11	6.00E-11	4.70E-11	4.70E-11	0.08
Ni-59	6.40E-10	3.40E-10	1.90E-10	1.10E-10	7.30E-11	6.30E-11	6.30E-11	0.3
Ni-63	1.60E-09	8.40E-10	4.60E-10	2.80E-10	1.80E-10	1.50E-10	1.50E-10	0.3
Ni-65	2.10E-09	1.30E-09	6.30E-10	3.80E-10	2.30E-10	1.80E-10	1.80E-10	0.3
Cu-64	5.20E-10	8.30E-10	4.20E-10	2.50E-10	1.50E-10	1.20E-10	1.20E-10	0.5
Zn-65	3.60E-08	1.60E-08	9.70E-09	6.40E-09	4.50E-09	3.90E-09	3.90E-09	2
Zn-69	3.50E-10	2.20E-10	1.10E-10	6.00E-11	3.90E-11	3.10E-11	3.10E-11	2
Zn-69m	1.59E-09	2.48E-09	1.29E-09	7.49E-10	4.42E-10	3.56E-10	3.56E-10	2
Ga-72	1.00E-08	6.80E-09	3.60E-09	2.20E-09	1.40E-09	1.10E-09	1.10E-09	0.003
Ge-71	1.20E-10	7.80E-11	4.00E-11	2.40E-11	1.50E-11	1.20E-11	1.20E-11	0.6
As-73	2.60E-09	1.90E-09	9.30E-10	5.60E-10	3.20E-10	2.60E-10	2.60E-10	0.08
As-74	1.00E-08	8.20E-09	4.30E-09	2.60E-09	1.60E-09	1.30E-09	1.30E-09	0.08
As-76	1.00E-08	1.10E-08	5.80E-09	3.40E-09	2.00E-09	1.60E-09	1.60E-09	0.08
As-77	2.70E-09	2.90E-09	1.50E-09	8.70E-10	5.00E-10	4.00E-10	4.00E-10	0.08
Se-75	2.00E-08	1.30E-08	8.30E-09	6.00E-09	3.10E-09	2.60E-09	2.60E-09	0.1
Se-79	4.10E-08	2.80E-08	1.90E-08	1.40E-08	4.10E-08	2.90E-09	2.90E-09	0.1
Br-82	3.70E-09	2.60E-09	1.50E-09	9.50E-10	6.40E-10	5.40E-10	5.40E-10	0.4
Rb-86	3.10E-08	2.00E-08	9.90E-09	5.90E-09	3.50E-09	2.80E-09	2.80E-09	0.2
Rb-87	1.50E-08	1.00E-08	5.20E-09	3.10E-09	1.80E-09	1.50E-09	1.50E-09	0.2

Nuclide	Public						Workers	Root Transfer Factor
	< 1 a	1-2 a	2-7 a	7-12 a	12-17 a	> 17 a		
Sr-85	7.70E-09	3.10E-09	1.70E-09	1.50E-09	1.30E-09	5.60E-10	5.60E-10	0.3
Sr-85m	4.96E-11	3.19E-11	1.80E-11	1.19E-11	8.58E-12	6.44E-12	6.44E-12	0.3
Sr-87m	2.40E-10	1.70E-10	9.00E-11	5.60E-11	3.60E-11	3.00E-11	3.30E-11	0.3
Sr-89	3.60E-08	1.80E-08	8.90E-09	5.80E-09	4.00E-09	2.60E-09	2.60E-09	0.3
Sr-90	2.61E-07	9.30E-08	5.70E-08	6.59E-08	8.33E-08	3.07E-08	3.07E-08	0.3
Sr-91	5.20E-09	4.00E-09	2.10E-09	1.20E-09	7.40E-10	6.50E-10	7.60E-10	0.3
Sr-92	5.29E-09	3.85E-09	1.98E-09	1.14E-09	6.78E-10	5.87E-10	6.47E-10	0.3
Y-90	3.10E-08	2.00E-08	1.00E-08	5.90E-09	3.30E-09	2.70E-09	2.70E-09	0.003
Y-91	2.80E-08	1.80E-08	8.80E-09	5.20E-09	2.90E-09	2.40E-09	2.40E-09	0.003
Y-91m	1.09E-10	7.08E-11	3.83E-11	2.41E-11	1.57E-11	1.24E-11	1.24E-11	0.003
Y-92	5.90E-09	3.60E-09	1.80E-09	1.00E-09	6.20E-10	4.90E-10	4.90E-10	0.003
Y-93	1.40E-08	8.50E-09	4.30E-09	2.50E-09	1.40E-09	1.20E-09	1.20E-09	0.003
Zr-93	2.69E-09	1.66E-09	9.66E-10	8.48E-10	1.01E-09	1.22E-09	3.99E-10	0.001
Zr-95	1.08E-08	7.17E-09	3.88E-09	2.44E-09	1.56E-09	1.23E-09	1.16E-09	0.001
Zr-97	2.26E-08	1.44E-08	7.49E-09	4.51E-09	2.67E-09	2.16E-09	2.16E-09	0.001
Nb-93m	1.50E-09	9.10E-10	4.60E-10	2.70E-10	1.50E-10	1.20E-10	1.20E-10	0.01
Nb-94	1.50E-08	9.70E-09	5.30E-09	3.40E-09	2.10E-09	1.70E-09	1.70E-09	0.01
Nb-95	4.60E-09	3.20E-09	1.80E-09	1.10E-09	7.40E-10	5.80E-10	5.80E-10	0.01
Nb-97	7.70E-10	4.50E-10	2.30E-10	1.30E-10	8.70E-11	6.80E-11	6.80E-11	0.01
Nb-98	1.20E-09	7.10E-10	3.60E-10	2.20E-10	1.40E-10	1.10E-10	1.10E-10	0.01
Mo-90	1.70E-09	1.20E-09	6.30E-10	4.00E-10	2.70E-10	2.20E-10	6.20E-10	0.2
Mo-93	9.36E-09	7.79E-09	5.45E-09	4.26E-09	3.55E-09	3.22E-09	2.72E-09	0.2
Mo-99	5.64E-09	3.59E-09	1.85E-09	1.13E-09	7.79E-10	6.15E-10	1.22E-09	0.2
Mo-101	5.70E-10	3.18E-10	1.53E-10	8.91E-11	6.10E-11	4.81E-11	4.91E-11	0.2
Tc-96	6.70E-09	5.10E-09	3.00E-09	2.00E-09	1.40E-09	1.10E-09	1.10E-09	5
Tc-96m	1.53E-10	1.05E-10	5.97E-11	3.88E-11	2.71E-11	2.07E-11	2.17E-11	5
Tc-97	9.90E-10	4.90E-10	2.40E-10	1.40E-10	8.80E-11	6.80E-11	8.30E-11	5
Tc-97m	8.70E-09	4.10E-09	2.00E-09	1.10E-09	7.00E-10	5.50E-10	6.60E-10	5
Tc-99	1.00E-08	4.80E-09	2.30E-09	1.30E-09	8.20E-10	6.40E-10	7.80E-10	5
Tc-99m	2.00E-10	1.30E-10	7.20E-11	4.30E-11	2.80E-11	2.20E-11	2.20E-11	5
Ru-97	1.20E-09	8.50E-10	4.70E-10	3.00E-10	1.90E-10	1.50E-10	1.50E-10	0.05
Ru-103	7.15E-09	4.63E-09	2.41E-09	1.51E-09	9.25E-10	7.34E-10	7.34E-10	0.05
Ru-105	3.07E-09	2.05E-09	1.03E-09	6.24E-10	3.73E-10	2.94E-10	2.94E-10	0.05
Ru-106	8.40E-08	4.90E-08	2.50E-08	1.50E-08	8.60E-09	7.00E-09	7.00E-09	0.05
Rh-102	1.90E-08	1.00E-08	6.40E-09	4.30E-09	3.00E-09	2.60E-09	2.60E-09	0.2
Rh-103m	4.70E-11	2.70E-11	1.30E-11	7.40E-12	4.80E-12	3.80E-12	3.80E-12	0.2
Rh-105	4.00E-09	2.70E-09	1.30E-09	8.00E-10	4.60E-10	3.70E-10	3.70E-10	0.2
Pd-103	2.25E-09	1.43E-09	7.33E-10	4.37E-10	2.45E-10	1.94E-10	1.94E-10	0.1
Pd-107	4.40E-10	2.80E-10	1.40E-10	8.10E-11	4.60E-11	3.70E-11	3.70E-11	0.1
Pd-109	6.30E-09	4.10E-09	2.00E-09	1.20E-09	6.80E-10	5.50E-10	5.50E-10	0.1
Ag-105	3.90E-09	2.50E-09	1.40E-09	9.10E-10	5.90E-10	4.70E-10	4.70E-10	0.01
Ag-108m	2.10E-08	1.10E-08	6.50E-09	4.30E-09	2.80E-09	2.30E-09	2.30E-09	0.01
Ag-110m	2.40E-08	1.40E-08	7.80E-09	5.20E-09	3.40E-09	2.80E-09	2.80E-09	0.01
Ag-111	1.40E-08	9.30E-09	4.60E-09	2.70E-09	1.60E-09	1.30E-09	1.30E-09	0.01
Cd-109	2.10E-08	9.50E-09	5.50E-09	3.50E-09	2.40E-09	2.00E-09	2.00E-09	0.5
Cd-113m	1.20E-07	5.60E-08	3.90E-08	2.90E-08	2.40E-08	2.30E-08	2.30E-08	0.5
Cd-115	1.48E-08	1.02E-08	5.14E-09	3.04E-09	1.79E-09	1.47E-09	1.47E-09	0.5
Cd-115m	4.10E-08	1.90E-08	9.70E-09	6.90E-09	4.10E-09	3.30E-09	3.30E-09	0.5
In-111	2.40E-09	1.70E-09	9.10E-10	5.90E-10	3.70E-10	2.90E-10	2.90E-10	0.003
In-113m	3.00E-10	1.80E-10	9.30E-11	6.20E-11	3.60E-11	2.80E-11	2.80E-11	0.003
In-114m	5.60E-08	3.10E-08	1.50E-08	9.00E-09	5.20E-09	4.10E-09	4.10E-09	0.003
In-115m	9.60E-10	6.00E-10	3.00E-10	1.80E-10	1.10E-10	8.60E-11	8.60E-11	0.003
Sn-113	8.10E-09	5.18E-09	2.69E-09	1.66E-09	9.56E-10	7.58E-10	7.58E-10	0.3
Sn-121m	7.20E-09	4.40E-09	2.24E-09	1.32E-09	7.50E-10	6.10E-10	6.10E-10	0.3
Sn-125	3.51E-08	2.21E-08	1.10E-08	6.72E-09	3.81E-09	3.11E-09	3.11E-09	0.3
Sn-126	5.00E-08	3.00E-08	1.60E-08	9.80E-09	5.90E-09	4.70E-09	4.70E-09	0.3
Sb-122	1.80E-08	1.20E-08	6.10E-09	3.70E-09	2.10E-09	1.70E-09	1.70E-09	0.001
Sb-124	2.50E-08	1.60E-08	8.40E-09	5.20E-09	3.20E-09	2.50E-09	2.50E-09	0.001
Sb-125	1.35E-08	7.32E-09	4.04E-09	2.47E-09	1.61E-09	1.27E-09	1.27E-09	0.001
Te-123m	1.90E-08	8.80E-09	4.90E-09	2.80E-09	1.70E-09	1.40E-09	1.40E-09	1

	Public						Workers	Root Transfer Factor
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**		
Te-125m	1.30E-08	6.30E-09	3.30E-09	1.90E-09	1.10E-09	8.70E-10	8.70E-10	1
Te-127	1.50E-09	1.20E-09	6.20E-10	3.60E-10	2.10E-10	1.70E-10	1.70E-10	1
Te-127m	4.24E-08	1.92E-08	1.01E-08	5.55E-09	3.20E-09	2.46E-09	2.46E-09	1
Te-129	7.50E-10	4.40E-10	2.10E-10	1.20E-10	8.00E-11	6.30E-11	6.30E-11	1
Te-129m	4.45E-08	2.43E-08	1.21E-08	6.68E-09	3.95E-09	3.04E-09	3.04E-09	1
Te-131	1.28E-09	1.04E-09	5.60E-10	2.99E-10	1.91E-10	1.33E-10	1.33E-10	1
Te-131m	4.00E-08	3.39E-08	1.89E-08	1.01E-08	6.47E-09	4.34E-09	4.34E-09	1
Te-132	5.07E-08	3.22E-08	1.72E-08	8.86E-09	5.67E-09	4.06E-09	3.96E-09	1
Te-133	1.31E-09	1.05E-09	5.51E-10	2.56E-10	1.75E-10	1.13E-10	1.13E-10	1
Te-133m	5.05E-09	4.14E-09	2.21E-09	1.03E-09	6.80E-10	4.51E-10	4.51E-10	1
Te-134	1.46E-09	9.95E-10	5.18E-10	2.89E-10	1.86E-10	1.46E-10	1.46E-10	1
I-123	2.20E-09	1.90E-09	1.10E-09	4.90E-10	3.30E-10	2.10E-10	2.10E-10	0.02
I-125	5.20E-08	5.70E-08	4.10E-08	3.10E-08	2.20E-08	1.50E-08	1.50E-08	0.02
I-126	2.10E-07	2.10E-07	1.30E-07	6.80E-08	4.50E-08	2.90E-08	2.90E-08	0.02
I-129	1.80E-07	2.20E-07	1.70E-07	1.90E-07	1.40E-07	1.10E-07	1.10E-07	0.02
I-130	2.10E-08	1.80E-08	9.80E-09	4.60E-09	3.00E-09	2.00E-09	2.00E-09	0.02
I-131	1.80E-07	1.80E-07	1.00E-07	5.20E-08	3.40E-08	2.20E-08	2.20E-08	0.02
I-132	3.00E-09	2.40E-09	1.30E-09	6.20E-10	4.10E-10	2.90E-10	2.90E-10	0.02
I-133	4.90E-08	4.40E-08	2.30E-08	1.00E-08	6.80E-09	4.30E-09	4.30E-09	0.02
I-134	1.10E-09	7.50E-10	3.90E-10	2.10E-10	1.40E-10	1.10E-10	1.10E-10	0.02
I-135	1.00E-08	8.90E-09	4.70E-09	2.20E-09	1.40E-09	9.30E-10	9.30E-10	0.02
Cs-129	4.40E-10	3.00E-10	1.70E-10	1.10E-10	7.20E-11	6.00E-11	6.00E-11	0.04
Cs-131	4.60E-10	2.90E-10	1.60E-10	1.00E-10	6.90E-11	5.80E-11	5.80E-11	0.04
Cs-132	2.70E-09	1.80E-09	1.10E-09	7.70E-10	5.70E-10	5.00E-10	5.00E-10	0.04
Cs-134	2.60E-08	1.60E-08	1.30E-08	1.40E-08	1.90E-08	1.90E-08	1.90E-08	0.04
Cs-134m	2.15E-10	1.23E-10	6.16E-11	3.78E-11	2.88E-11	2.38E-11	2.38E-11	0.04
Cs-135	4.10E-09	2.30E-09	1.70E-09	1.70E-09	2.00E-09	2.00E-09	2.00E-09	0.04
Cs-136	1.50E-08	9.50E-09	6.10E-09	4.40E-09	3.40E-09	3.00E-09	3.00E-09	0.04
Cs-137	2.10E-08	1.20E-08	9.60E-09	1.00E-08	1.30E-08	1.30E-08	1.30E-08	0.04
Cs-138	1.10E-09	5.90E-10	2.90E-10	1.70E-10	1.20E-10	9.20E-11	9.20E-11	0.04
Ba-131	4.39E-09	2.72E-09	1.46E-09	9.81E-10	6.48E-10	4.73E-10	4.73E-10	0.05
Ba-133	2.20E-08	6.20E-09	3.90E-09	4.60E-09	7.30E-09	1.50E-09	1.00E-09	0.05
Ba-139	1.40E-09	8.40E-10	4.10E-10	2.40E-10	1.50E-10	1.20E-10	1.20E-10	0.05
Ba-140	4.67E-08	2.76E-08	1.42E-08	8.89E-09	5.54E-09	4.07E-09	3.97E-09	0.05
La-137	1.10E-09	4.50E-10	2.50E-10	1.60E-10	1.00E-10	8.10E-11	8.10E-11	0.003
La-140	2.00E-08	1.30E-08	6.80E-09	4.20E-09	2.50E-09	2.00E-09	2.00E-09	0.003
Ce-139	2.60E-09	1.60E-09	8.60E-10	5.40E-10	3.30E-10	2.60E-10	2.60E-10	0.05
Ce-141	8.10E-09	5.10E-09	2.60E-09	1.50E-09	8.80E-10	7.10E-10	7.10E-10	0.05
Ce-143	1.31E-08	8.68E-09	4.44E-09	2.60E-09	1.52E-09	1.19E-09	1.19E-09	0.05
Ce-144	6.66E-08	3.94E-08	1.92E-08	1.11E-08	6.57E-09	5.25E-09	5.25E-09	0.05
Pr-142	1.50E-08	9.80E-09	4.90E-09	2.90E-09	1.60E-09	1.30E-09	1.30E-09	0.004
Pr-143	1.40E-08	8.70E-09	4.30E-09	2.60E-09	1.50E-09	1.20E-09	1.20E-09	0.004
Nd-147	1.20E-08	7.82E-09	3.91E-09	2.31E-09	1.30E-09	1.10E-09	1.11E-09	0.004
Nd-149	1.75E-09	1.08E-09	5.37E-10	3.24E-10	1.95E-10	1.49E-10	1.49E-10	0.004
Pm-145	1.50E-09	6.80E-10	3.70E-10	2.30E-10	1.40E-10	1.10E-10	1.10E-10	0.002
Pm-146	1.00E-08	5.10E-09	2.80E-09	1.80E-09	1.10E-09	9.00E-10	9.00E-10	0.002
Pm-147	3.60E-09	1.90E-09	9.60E-10	5.70E-10	3.20E-10	2.60E-10	2.60E-10	0.002
Pm-149	1.20E-08	7.40E-09	3.70E-09	2.20E-09	1.20E-09	9.90E-10	9.90E-10	0.002
Sm-151	1.50E-09	6.40E-10	3.30E-10	2.00E-10	1.20E-10	9.80E-11	9.80E-11	0.004
Sm-153	8.40E-09	5.40E-09	2.70E-09	1.60E-09	9.20E-10	7.40E-10	7.40E-10	0.004
Eu-152	1.60E-08	7.40E-09	4.10E-09	2.60E-09	1.70E-09	1.40E-09	1.40E-09	0.002
Eu-152m	5.70E-09	3.60E-09	1.80E-09	1.10E-09	6.20E-10	5.00E-10	5.00E-10	0.002
Eu-154	2.50E-08	1.20E-08	6.50E-09	4.10E-09	2.50E-09	2.00E-09	2.00E-09	0.002
Eu-155	4.30E-09	2.20E-09	1.10E-09	6.80E-10	4.00E-10	3.20E-10	3.20E-10	0.002
Gd-153	2.90E-09	1.80E-09	9.40E-10	5.80E-10	3.40E-10	2.70E-10	2.70E-10	0.004
Gd-159	5.70E-09	3.60E-09	1.80E-09	1.10E-09	6.20E-10	4.90E-10	4.90E-10	0.004
Tb-157	4.90E-10	2.20E-10	1.10E-10	6.80E-11	4.10E-11	3.40E-11	3.40E-11	0.004
Tb-160	1.60E-08	1.00E-08	5.40E-09	3.30E-09	2.00E-09	1.60E-09	1.60E-09	0.004
Dy-165	1.30E-09	7.90E-10	3.90E-10	2.30E-10	1.40E-10	1.10E-10	1.10E-10	0.004
Dy-166	2.83E-08	1.78E-08	9.02E-09	5.40E-09	2.99E-09	2.41E-09	2.41E-09	0.004

Nuclide	Public						Workers	Root Transfer Factor
	< 1 a	1-2 a	2-7 a	7-12 a	12-17 a	> 17 a		
Ho-166	1.60E-08	1.00E-08	5.20E-09	3.10E-09	1.70E-09	1.40E-09	1.40E-09	0.004
Ho-166m	2.60E-08	9.30E-09	5.30E-09	3.50E-09	2.40E-09	2.00E-09	2.00E-09	0.004
Er-169	4.40E-09	2.80E-09	1.40E-09	8.20E-10	4.70E-10	3.70E-10	3.70E-10	0.004
Er-171	4.00E-09	2.50E-09	1.30E-09	7.60E-10	4.50E-10	3.60E-10	3.60E-10	0.004
Tm-170	1.60E-08	9.80E-09	4.90E-09	2.90E-09	1.60E-09	1.30E-09	1.30E-09	0.003
Tm-171	1.50E-09	7.80E-10	3.90E-10	2.30E-10	1.30E-10	1.10E-10	1.10E-10	0.003
Yb-175	5.00E-09	3.20E-09	1.60E-09	9.50E-10	5.40E-10	4.40E-10	4.40E-10	0.003
Lu-177	6.10E-09	3.90E-09	2.00E-09	1.20E-09	6.60E-10	5.30E-10	5.30E-10	0.003
Hf-181	1.20E-08	7.40E-09	3.80E-09	2.30E-09	1.40E-09	1.10E-09	1.10E-09	0.0002
Ta-182	1.40E-08	9.40E-09	5.00E-09	3.10E-09	1.90E-09	1.50E-09	1.50E-09	0.0025
W-181	6.30E-10	4.70E-10	2.50E-10	1.60E-10	9.50E-11	7.60E-11	8.20E-11	0.01
W-185	4.40E-09	3.30E-09	1.60E-09	9.70E-10	5.50E-10	4.40E-10	5.00E-10	0.01
W-187	5.50E-09	4.30E-09	2.20E-09	1.30E-09	7.80E-10	6.30E-10	7.10E-10	0.01
Re-186	1.90E-08	1.10E-08	5.50E-09	3.00E-09	1.90E-09	1.50E-09	1.50E-09	0.35
Re-188	1.70E-08	1.10E-08	5.40E-09	2.90E-09	1.80E-09	1.40E-09	1.40E-09	0.35
Os-185	3.80E-09	2.60E-09	1.50E-09	9.80E-10	6.50E-10	5.10E-10	5.10E-10	0.0035
Os-191	6.30E-09	4.10E-09	2.10E-09	1.20E-09	7.00E-10	5.70E-10	5.70E-10	0.0035
Os-191m	1.30E-09	8.38E-10	4.15E-10	2.47E-10	1.42E-10	1.14E-10	1.14E-10	0.0035
Os-193	9.30E-09	6.00E-09	3.00E-09	1.80E-09	1.00E-09	8.10E-10	8.10E-10	0.0035
Ir-190	1.00E-08	7.10E-09	3.90E-09	2.50E-09	1.60E-09	1.20E-09	1.20E-09	0.015
Ir-192	1.30E-08	8.70E-09	4.60E-09	2.80E-09	1.70E-09	1.40E-09	1.40E-09	0.015
Ir-194	1.50E-08	9.80E-09	4.90E-09	2.90E-09	1.70E-09	1.30E-09	1.30E-09	0.015
Pt-191	3.10E-09	2.10E-09	1.10E-09	6.90E-10	4.20E-10	3.40E-10	3.40E-10	0.5
Pt-193	3.70E-10	2.40E-10	1.20E+10	6.90E-10	3.90E-11	3.10E-11	3.10E-11	0.5
Pt-193m	5.20E-09	3.40E-09	1.70E-09	9.90E-10	5.60E-10	4.50E-10	4.50E-10	0.5
Pt-197	4.70E-09	3.00E-09	1.50E-09	8.80E-10	5.10E-10	4.00E-10	4.00E-10	0.5
Pt-197m	1.31E-09	8.08E-10	3.99E-10	2.38E-10	1.44E-10	1.10E-10	1.10E-10	0.5
Au-198	1.00E-08	7.20E-09	3.70E-09	2.20E-09	1.30E-09	1.00E-09	1.00E-09	0.1
Au-199	4.50E-09	3.10E-09	1.60E-09	9.50E-10	5.50E-10	4.40E-10	4.40E-10	0.1
Hg-197	2.50E-09	1.60E-09	8.30E-10	5.00E-10	2.90E-10	2.30E-10	2.30E-10	0.3
Hg-197m	5.39E-09	3.52E-09	1.76E-09	1.04E-09	6.14E-10	4.90E-10	5.14E-10	0.3
Hg-203	1.50E-08	1.10E-08	5.70E-09	3.60E-09	2.30E-09	1.90E-09	1.90E-09	0.3
Tl-200	1.30E-09	9.10E-10	5.30E-10	3.50E-10	2.40E-10	2.00E-10	2.00E-10	2
Tl-201	8.40E-10	5.50E-10	2.90E-10	1.80E-10	1.20E-10	9.50E-11	9.50E-11	2
Tl-202	2.90E-09	2.10E-09	1.20E-09	7.90E-10	5.40E-10	4.50E-10	4.50E-10	2
Tl-204	1.30E-08	8.50E-09	4.20E-09	2.50E-09	1.50E-09	1.20E-09	1.30E-09	2
Pb-203	1.60E-09	1.30E-09	6.80E-10	4.30E-10	2.70E-10	2.40E-10	2.40E-10	0.02
Bi-206	1.40E-08	1.00E-08	5.70E-09	3.70E-09	2.40E-09	1.90E-09	1.90E-09	0.1
Bi-207	1.00E-08	7.10E-09	3.90E-09	2.50E-09	1.60E-09	1.30E-09	1.30E-09	0.1
Po-203	2.90E-10	2.40E-10	1.30E-10	8.50E-11	5.80E-11	4.60E-11	5.20E-11	0.002
Po-205	3.50E-10	2.80E-10	1.60E-10	1.10E-10	7.20E-11	5.80E-11	5.90E-11	0.002
Po-207	4.40E-10	5.70E-10	3.20E-10	2.10E-10	1.40E-10	1.10E-10	1.40E-10	0.002
At-211	1.20E-07	7.80E-08	3.80E-08	2.30E-08	1.30E-08	1.10E-08	1.10E-08	0.2
Ra-225	7.30E-06	1.28E-06	6.51E-07	5.24E-07	4.53E-07	1.10E-07	1.06E-07	0.04
Ra-227	1.10E-09	4.30E-10	2.50E-10	1.70E-10	1.30E-10	8.10E-11	8.40E-11	0.04
Th-226	4.40E-09	2.40E-09	1.20E-09	6.70E-10	4.50E-10	3.50E-10	3.60E-10	0.001
Th-229	1.86E-05	2.38E-06	1.48E-06	1.17E-06	1.00E-06	6.13E-07	5.99E-07	0.001
Pa-230	5.82E-08	1.78E-08	9.24E-09	6.01E-09	3.92E-09	3.10E-09	2.87E-09	0.01
Pa-233	9.70E-09	6.20E-09	3.20E-09	1.90E-09	1.10E-09	8.70E-10	8.70E-10	0.01
U-230	8.80E-07	3.33E-07	1.68E-07	1.12E-07	7.52E-08	6.11E-08	5.77E-08	0.01
U-231	3.10E-09	2.00E-09	1.00E-09	6.10E-10	3.50E-10	2.80E-10	2.80E-10	0.01
U-232	8.44E-06	1.81E-06	1.13E-06	9.60E-07	9.18E-07	4.60E-07	4.58E-07	0.01
U-233	5.54E-07	1.62E-07	1.06E-07	8.90E-08	8.74E-08	5.68E-08	5.56E-08	0.01
U-236	3.50E-07	1.30E-07	8.40E-08	7.00E-08	7.00E-08	4.70E-08	4.60E-08	0.01
U-237	8.30E-09	5.40E-09	2.80E-09	1.60E-09	9.50E-10	7.60E-10	7.70E-10	0.01
U-239	4.00E-10	2.28E-10	1.12E-10	6.54E-11	4.17E-11	3.24E-11	3.34E-11	0.01
U-240	1.30E-08	8.10E-09	4.10E-09	2.40E-09	1.40E-09	1.10E-09	1.10E-09	0.01
Np-237	2.01E-06	2.17E-07	1.44E-07	1.12E-07	1.11E-07	1.11E-07	1.11E-07	0.04
Np-239	8.90E-09	5.70E-09	2.90E-09	1.70E-09	1.00E-09	8.00E-10	8.00E-10	0.04
Np-240	8.70E-10	5.20E-10	2.60E-10	1.60E-10	1.00E-10	8.20E-11	8.20E-11	0.04

	Public						Workers	Root Transfer Factor
Nuclide	**< 1 a**	**1-2 a**	**2-7 a**	**7-12 a**	**12-17 a**	**> 17 a**		
Pu-234	2.10E-09	1.10E-09	5.50E-10	3.30E-10	2.00E-10	1.60E-10	1.60E-10	0.001
Pu-235	2.20E-11	1.30E-11	6.50E-12	3.90E-12	2.70E-12	2.10E-12	2.10E-12	0.001
Pu-236	2.41E-06	2.86E-07	1.81E-07	1.35E-07	1.18E-07	1.03E-07	1.02E-07	0.001
Pu-237	1.10E-09	6.90E-10	3.60E-10	2.20E-10	1.30E-10	1.00E-10	1.00E-10	0.001
Pu-238	4.00E-06	4.00E-07	3.10E-07	2.40E-07	2.20E-07	2.30E-07	2.30E-07	0.001
Pu-239	4.20E-06	4.20E-07	3.30E-07	2.70E-07	2.40E-07	2.50E-07	2.50E-07	0.001
Pu-240	4.20E-06	4.20E-07	3.30E-07	2.70E-07	2.40E-07	2.50E-07	2.50E-07	0.001
Pu-241	1.66E-07	1.67E-08	1.35E-08	1.16E-08	1.07E-08	1.07E-08	1.06E-08	0.001
Pu-242	4.00E-06	4.00E-07	3.20E-07	2.60E-07	2.30E-07	2.40E-07	2.40E-07	0.001
Pu-243	1.00E-09	6.20E-10	3.10E-10	1.80E-10	1.10E-10	8.50E-11	8.50E-11	0.001
Pu-244	4.06E-06	4.23E-07	3.28E-07	2.65E-07	2.34E-07	2.44E-07	2.44E-07	0.001
Am-241	3.70E-06	3.70E-07	2.70E-07	2.20E-07	2.00E-07	2.00E-07	2.00E-07	0.002
Am-242	5.00E-09	2.20E-09	1.10E-09	6.40E-10	3.70E-10	3.00E-10	3.40E-10	0.002
Am-242m	4.99E-06	5.04E-07	3.71E-07	3.04E-07	2.80E-07	2.81E-07	2.81E-07	0.002
Am-243	3.62E-06	3.77E-07	2.74E-07	2.22E-07	2.02E-07	2.02E-07	2.02E-07	0.002
Cm-242	6.10E-07	7.80E-08	4.06E-08	2.52E-08	1.61E-08	1.32E-08	1.32E-08	0.001
Cm-243	3.20E-06	3.30E-07	2.20E-07	1.60E-07	1.40E-07	1.50E-07	1.51E-07	0.001
Cm-244	2.91E-06	2.91E-07	1.91E-07	1.41E-07	1.21E-07	1.21E-07	1.21E-07	0.001
Cm-245	4.20E-06	4.20E-07	3.18E-07	2.61E-07	2.39E-07	2.39E-07	2.38E-07	0.001
Cm-246	3.70E-06	3.70E-07	2.80E-07	2.20E-07	2.10E-07	2.10E-07	2.10E-07	0.001
Cm-247	3.43E-06	3.54E-07	2.63E-07	2.12E-07	1.92E-07	1.92E-07	1.92E-07	0.001
Cm-248	1.40E-05	1.40E-06	1.00E-06	8.40E-07	7.70E-07	7.70E-07	7.70E-07	0.001
Bk-249	4.45E-08	5.08E-09	3.50E-09	2.58E-09	2.05E-09	1.85E-09	1.85E-09	0.003
Cf-246	5.00E-08	2.40E-08	1.20E-08	7.30E-09	4.10E-09	3.30E-09	3.30E-09	0.01
Cf-248	1.63E-06	1.73E-07	1.07E-07	6.61E-08	3.82E-08	3.32E-08	3.32E-08	0.01
Cf-249	9.03E-06	8.73E-07	6.42E-07	4.72E-07	3.82E-07	3.52E-07	3.52E-07	0.01
Cf-250	5.71E-06	5.51E-07	3.71E-07	2.31E-07	1.71E-07	1.61E-07	1.61E-07	0.01
Cf-251	9.10E-06	8.80E-07	6.50E-07	4.70E-07	3.90E-07	3.60E-07	3.60E-07	0.01
Cf-252	5.00E-06	5.10E-07	3.20E-07	1.90E-07	1.00E-07	9.00E-08	9.00E-08	0.01
Cf-253	1.60E-07	2.66E-08	1.40E-08	8.58E-09	4.48E-09	3.56E-09	3.56E-09	0.01
Cf-254	1.10E-05	2.60E-06	1.40E-06	8.40E-07	5.00E-07	4.00E-07	4.00E-07	0.01
Es-253	1.73E-07	4.53E-08	2.32E-08	1.42E-08	7.73E-09	6.22E-09	6.22E-09	0.003
Es-254	1.68E-06	1.88E-07	1.16E-07	7.14E-08	4.14E-08	3.59E-08	3.59E-08	0.003
Es-254m	6.32E-08	3.27E-08	1.64E-08	9.91E-09	5.70E-09	4.60E-09	4.60E-09	0.003
Fm-254	5.60E-09	3.20E-09	1.60E-09	9.30E-10	5.60E-10	4.40E-10	4.40E-10	0.003
Fm-255	3.30E-08	1.90E-08	9.50E-09	5.60E-09	3.20E-09	2.50E-09	2.50E-09	0.003

TABLE I-VI: Skin Equivalent Dose Coefficients (Sv/a)/(Bq/cm^2) for Various Skin Depths (1 a = 8760 h)

Radio-nuclide	4 mg/cm^2 (KOC87 / RP65)	40 mg/cm^2 (KOC87 / RP65)	7 mg/cm^2 (KOC87 / interpoliert)	gamma (RP65)	TÜV90
H 3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-07
Be 7	0.00E+00	0.00E+00	0.00E+00	2.40E-05	3.20E-07
C 14	7.90E-03	0.00E+00	2.90E-03	0.00E+00	1.60E-03
F 18	2.30E-02	4.60E-03	1.80E-02	5.20E-04	1.60E-02
Na 22	2.10E-02	3.30E-03	1.70E-02	1.10E-03	1.60E-02
Na 24	2.40E-02	7.80E-03	2.30E-02	1.60E-03	1.30E-02
Si 31	2.60E-02	8.30E-03	2.50E-02	4.70E-07	1.90E-02
P 32	2.40E-02	1.10E-02	2.10E-02	0.00E+00	1.90E-02
P 33	1.40E-02	2.50E-05	7.60E-03	0.00E+00	6.30E-03
S 35	7.90E-03	0.00E+00	3.10E-03	0.00E+00	9.50E-04
Cl 36	2.20E-02	4.60E-03	1.70E-02	9.60E-08	1.60E-03
Cl 38	6.70E-02	2.10E-02	6.30E-02	6.00E-04	6.30E-02
K 40	2.10E-02	8.30E-03	1.80E-02	7.00E-05	1.60E-02
K 42	6.30E-02	2.00E-02	5.90E-02	1.20E-04	2.20E-02
K 43	2.00E-02	5.40E-03	1.90E-02	4.90E-04	1.60E-02
Ca-41					
Ca 45	1.40E-02	3.20E-05	7.70E-03	1.80E-09	6.30E-03
Ca 47	4.10E-02	1.00E-02	3.80E-02	5.50E-04	3.50E-02
Sc 46	1.70E-02	5.50E-04	1.20E-02	1.10E-03	9.50E-03
Sc 47	1.40E-02	2.80E-03	1.30E-02	4.90E-05	1.30E-02
Sc 48	2.00E-02	4.00E-03	1.90E-02	1.50E-03	1.60E-02
V 48	3.50E-02	1.10E-02	3.30E-02	5.20E-04	9.50E-03
Cr 51	0.00E+00	0.00E+00	0.00E+00	1.30E-04	3.20E-05
Mn 51	4.10E-02	1.30E-02	3.90E-02	5.20E-04	3.90E-02
Mn 52	6.50E-03	1.30E-03	6.10E-03	1.70E-03	6.30E-03
Mn 52m	5.00E-02	1.60E-02	4.70E-02	1.10E-03	1.60E-02
Mn 53	0.00E+00	0.00E+00	0.00E+00	7.30E-07	3.20E-07
Mn 54	0.00E+00	0.00E+00	0.00E+00	5.30E-04	6.30E-04
Mn 56	3.60E-02	1.20E-02	3.40E-02	8.90E-04	1.30E-02
Fe 52	6.90E-02	2.00E-02	6.50E-02	1.50E-03	2.60E-02
Fe 55	0.00E+00	0.00E+00	0.00E+00	1.40E-04	3.20E-05
Fe 59	1.70E-02	9.40E-04	1.10E-02	5.40E-04	9.50E-03
Co 55	2.00E-02	7.50E-03	1.90E-02	1.00E-03	1.90E-02
Co 56	1.10E-02	2.20E-03	1.00E-02	1.50E-03	3.20E-03
Co 57	9.60E-04	0.00E+00	6.90E-04	3.50E-04	3.20E-04
Co 58	3.60E-03	4.40E-04	2.80E-03	6.10E-04	2.80E-03
Co 58m	2.00E-03	0.00E+00	1.80E-03	1.30E-04	6.30E-05
Co 60	1.60E-02	2.50E-04	9.90E-03	1.10E-03	9.50E-03
Co 60m	5.10E-03	1.10E-03	4.70E-03	6.10E-04	6.30E-05
Co 61	2.00E-02	8.10E-03	1.90E-02	4.80E-05	1.90E-02
Co 62m	4.60E-02	1.50E-02	4.30E-02	1.20E-03	4.30E-02
Ni 59	0.00E+00	0.00E+00	0.00E+00	1.30E-06	6.30E-05
Ni 63	1.60E-04	0.00E+00	0.00E+00	0.00E+00	1.30E-02
Ni 65	2.80E-02	8.90E-03	2.60E-02	2.90E-04	1.30E-02
Cu 64	1.10E-02	2.20E-03	1.00E-02	1.70E-04	9.50E-03
Zn 65	3.30E-04	1.00E-05	2.30E-04	4.40E-04	6.30E-04
Zn 69	2.00E-02	5.60E-03	1.90E-02	3.20E-09	1.60E-02
Zn 69m	2.30E-02	6.40E-03	2.20E-02	2.20E-04	1.80E-02
Ga 72	2.00E-02	8.70E-03	1.90E-02	1.20E-03	6.30E-03

Radio-nuclide	4 mg/cm^2 (KOC87 / RP65)	40 mg/cm^2 (KOC87 / RP65)	7 mg/cm^2 (KOC87 / interpoliert)	gamma (RP65)	TÜV90
Ge 71	0.00E+00	0.00E+00	0.00E+00	2.20E-06	6.30E-05
As 73	5.30E-03	1.10E-03	5.00E-03	8.50E-06	1.60E-04
As 74	2.00E-02	4.70E-03	1.90E-02	4.00E-04	1.30E-02
As 76	4.60E-02	1.50E-02	4.40E-02	6.10E-04	1.90E-02
As 77	2.00E-02	4.00E-03	1.90E-02	4.60E-06	1.60E-02
Se 75	1.50E-03	2.90E-05	8.40E-04	3.70E-04	1.30E-03
Se-79	1.00E-02				
Br 82	1.20E-02	2.40E-03	1.10E-02	1.30E-03	1.30E-02
Rb 86	2.30E-02	1.00E-02	2.00E-02	4.50E-05	1.30E-02
Rb-87					
Sr 85	1.50E-04	7.30E-05	1.30E-04	4.10E-04	1.30E-04
Sr 85m	1.10E-03	2.10E-04	1.00E-03	1.10E-04	2.50E-04
Sr 87m	5.90E-03	1.20E-03	5.50E-03	1.70E-04	3.20E-03
Sr 89	2.30E-02	9.80E-03	2.00E-02	4.10E-08	1.30E-02
Sr 90	4.50E-02	2.70E-02	3.70E-02	4.20E-08	2.90E-02
Sr 91	2.30E-02	9.50E-03	2.00E-02	3.60E-04	1.30E-02
Sr 92	1.70E-02	3.40E-03	1.60E-02	7.00E-04	1.30E-02
Y 90	2.40E-02	1.20E-02	2.10E-02	2.10E-08	1.30E-02
Y 91	2.30E-02	9.90E-03	2.00E-02	1.70E-06	1.30E-02
Y 91m	2.40E-03	0.00E+00	2.20E-03	2.80E-04	1.30E-03
Y 92	6.30E-02	2.00E-02	6.00E-02	1.30E-04	1.30E-02
Y 93	5.10E-02	1.60E-02	4.80E-02	4.70E-05	1.30E-02
Zr 93	2.10E-04	0.00E+00	0.00E+00	1.00E-06	3.20E-07
Zr 95	2.70E-02	7.80E-04	1.60E-02	4.20E-04	1.20E-02
Zr 97	4.65E-02	1.89E-02	3.94E-02	4.40E-04	1.30E-02
Nb 93m	0.00E+00	0.00E+00	0.00E+00	1.00E-06	1.30E-04
Nb 94	1.90E-02	1.60E-03	1.40E-02	8.30E-04	1.30E-02
Nb 95	6.40E-03	1.80E-05	2.30E-03	3.60E-05	1.90E-03
Nb 97	2.30E-02	8.60E-03	1.90E-02	3.40E-04	1.90E-02
Nb 98	3.90E-02	1.20E-02	3.70E-02	1.30E-03	3.70E-02
Mo 90	2.00E-02	3.60E-03	1.90E-02	4.30E-04	9.50E-03
Mo 93	0.00E+00	0.00E+00	0.00E+00	5.50E-06	9.50E-05
Mo 99	2.30E-02	7.10E-03	1.90E-02	8.00E-05	1.30E-02
Mo 101	2.60E-02	8.20E-03	2.40E-02	6.90E-04	2.40E-02
Tc 96	7.70E-04	0.00E+00	7.00E-04	1.30E-03	6.30E-05
Tc 96m	2.40E-03	0.00E+00	2.20E-03	2.70E-05	2.20E-03
Tc 97	4.90E-04	0.00E+00	4.40E-04	6.00E-06	9.50E-05
Tc 97m	7.60E-03	1.50E-03	7.10E-03	5.00E-06	3.20E-03
Tc 99	1.40E-02	1.20E-04	8.60E-03	0.00E+00	9.50E-03
Tc 99m	2.90E-03	0.00E+00	2.10E-03	6.70E-05	1.60E-03
Ru 97	1.20E-03	0.00E+00	1.10E-03	1.30E-04	6.30E-04
Ru 103	1.10E-02	2.10E-04	5.80E-03	2.50E-04	6.30E-03
Ru 105	2.30E-02	7.60E-03	1.90E-02	4.10E-04	1.30E-02
Ru 106	2.50E-02	1.40E-02	2.20E-02	1.10E-04	1.60E-02
Rh-102					
Rh 103m	0.00E+00	0.00E+00	0.00E+00	1.40E-05	6.30E-06
Rh 105	1.80E-02	2.10E-03	1.30E-02	4.10E-05	9.50E-03
Pd 103	0.00E+00	0.00E+00	0.00E+00	2.20E-05	6.90E-05
Pd-107	0.00E+00				
Pd 109	3.80E-02	7.70E-03	2.40E-02	6.20E-06	3.20E-02
Ag 105	1.70E-03	0.00E+00	1.50E-03	2.80E-04	3.20E-04
Ag-108m	3.70E-04				
Ag 110m	7.20E-03	8.90E-04	5.00E-03	1.30E-03	3.40E-03

Radio-nuclide	4 mg/cm^2 (KOC87 / RP65)	40 mg/cm^2 (KOC87 / RP65)	7 mg/cm^2 (KOC87 / interpoliert)	gamma (RP65)	TÜV90
Ag 111	2.00E-02	6.20E-03	1.90E-02	1.30E-05	1.30E-02
Cd 109	1.80E-02	0.00E+00	4.50E-03	1.50E-04	6.30E-03
Cd-113m	2.00E-02				
Cd 115	3.60E-02	8.60E-03	3.40E-02	2.10E-04	2.60E-02
Cd 115m	2.30E-02	9.90E-03	2.00E-02	1.10E-05	1.90E-02
In 111	4.20E-03	1.10E-04	3.30E-03	3.00E-04	2.20E-03
In 113m	8.40E-03	3.50E-03	8.00E-03	1.60E-04	6.30E-03
In 114m	1.20E-02	2.50E-03	1.20E-02	5.00E-05	2.80E-02
In 115m	1.50E-02	3.00E-03	1.40E-02	8.50E-05	9.50E-03
Sn 113	8.40E-03	3.50E-03	8.00E-03	2.70E-04	6.30E-03
Sn-121m					
Sn 125	3.60E-02	1.10E-02	3.30E-02	1.60E-04	1.90E-02
Sn-126	1.60E-02				
Sb 122	2.50E-02	7.90E-03	2.30E-02	2.30E-04	1.90E-02
Sb 124	2.10E-02	5.50E-03	1.60E-02	8.30E-04	1.30E-02
Sb 125	1.80E-02	7.40E-04	9.90E-03	3.10E-04	8.60E-03
Te 123m	2.00E-02	0.00E+00	7.80E-03	1.10E-04	6.30E-03
Te 125m	2.60E-02	0.00E+00	1.00E-02	1.60E-04	9.50E-03
Te 127	2.10E-02	4.00E-03	1.60E-02	2.50E-06	1.30E-02
Te 127m	3.70E-02	4.00E-03	2.00E-02	8.00E-06	1.90E-02
Te 129	2.30E-02	9.10E-03	2.00E-02	3.10E-05	1.30E-02
Te 129m	3.70E-02	9.20E-03	2.60E-02	4.00E-05	1.80E-02
Te 131	2.80E-02	1.00E-02	2.30E-02	2.10E-04	1.90E-02
Te 131m	2.80E-02	4.00E-03	2.00E-02	7.70E-04	1.70E-02
Te 132	3.70E-02	8.50E-03	2.70E-02	1.30E-03	6.50E-03
Te 133	3.60E-02	1.10E-02	3.40E-02	4.90E-04	3.40E-02
Te 133m	3.90E-02	1.20E-02	3.60E-02	1.30E-03	3.50E-02
Te 134	1.30E-02	5.20E-03	1.20E-02	4.60E-04	1.20E-02
I 123	4.30E-03	0.00E+00	3.20E-03	1.80E-04	3.20E-03
I 125	0.00E+00	0.00E+00	0.00E+00	1.80E-04	1.30E-04
I 126	1.40E-02	2.80E-03	1.30E-02	2.40E-04	1.30E-02
I 129	5.70E-03	0.00E+00	1.90E-03	8.50E-05	1.90E-03
I 130	1.30E-02	5.20E-03	1.20E-02	1.10E-03	1.60E-02
I 131	2.10E-02	3.00E-03	1.50E-02	1.90E-04	1.30E-02
I 132	2.30E-02	8.20E-03	1.90E-02	1.10E-03	3.20E-03
I 133	2.30E-02	7.60E-03	1.90E-02	3.20E-04	1.30E-02
I 134	2.40E-02	9.70E-03	2.00E-02	1.30E-03	2.00E-02
I 135	2.20E-02	6.50E-03	1.80E-02	8.20E-04	1.30E-02
Cs 129	1.60E-03	3.10E-04	1.40E-03	1.50E-04	1.60E-04
Cs 131	5.80E-04	1.20E-04	5.40E-04	8.70E-05	6.30E-05
Cs 132	1.20E-03	2.50E-04	1.20E-03	3.70E-04	1.30E-02
Cs 134	1.60E-02	2.70E-03	1.20E-02	7.70E-04	9.50E-03
Cs 134m	9.70E-03	1.90E-03	9.10E-03	9.60E-05	1.30E-02
Cs 135	9.60E-03	5.00E-07	4.50E-03	0.00E+00	6.30E-03
Cs 136	2.00E-02	5.90E-04	1.30E-02	1.10E-03	1.30E-02
Cs 137	2.20E-02	3.40E-03	1.60E-02	2.90E-04	1.50E-02
Cs 138	5.30E-02	2.10E-02	5.00E-02	1.20E-03	5.00E-02
Ba 131	4.70E-03	1.70E-04	4.40E-03	3.70E-04	3.30E-03
Ba-133					
Ba-139					
Ba 140	5.00E-02	1.60E-02	4.00E-02	2.50E-03	3.10E-02
La-137					
La 140	2.40E-02	9.20E-03	2.00E-02	1.10E-03	1.60E-02

Radio-nuclide	4 mg/cm^2 (KOC87 / RP65)	40 mg/cm^2 (KOC87 / RP65)	7 mg/cm^2 (KOC87 / interpoliert)	gamma (RP65)	TÜV90
Ce 139	3.10E-03	6.20E-04	2.60E-03	1.70E-04	2.50E-03
Ce 141	2.50E-02	1.60E-03	1.70E-02	5.20E-05	1.30E-02
Ce 143	2.40E-02	7.70E-03	1.90E-02	1.50E-04	1.60E-02
Ce 144	3.90E-02	1.30E-02	3.10E-02		2.80E-02
Pr 142	3.50E-02	1.10E-02	3.30E-02	3.10E-05	1.90E-02
Pr 143	2.20E-02	6.20E-03	1.80E-02	4.40E-12	1.30E-02
Nd 147	2.30E-02	4.20E-03	1.70E-02	7.40E-05	1.30E-02
Nd 149	2.00E-02	8.70E-03	1.90E-02	2.00E-04	1.90E-02
Pm-145					
Pm-146					
Pm 147	1.10E-02	3.60E-06	5.40E-03	4.30E-09	3.20E-03
Pm 149	2.00E-02	6.40E-03	1.90E-02	5.60E-06	1.30E-02
Sm 151	2.50E-04	0.00E+00	5.20E-06	7.00E-09	3.20E-07
Sm 153	2.00E-02	4.80E-03	1.90E-02	3.20E-05	2.20E-02
Eu 152	1.40E-02	1.50E-03	7.90E-03	6.00E-04	6.30E-03
Eu 152m	2.20E-02	7.10E-03	2.10E-02	1.50E-04	9.50E-03
Eu 154	3.00E-02	3.30E-03	1.80E-02	6.50E-04	1.60E-02
Eu 155	7.60E-03	2.80E-06	2.90E-03	3.00E-05	2.80E-03
Gd 153	3.50E-03	0.00E+00	1.10E-03	5.50E-05	6.30E-04
Gd 159	2.00E-02	5.30E-03	1.90E-02	2.60E-05	1.60E-02
Tb-157					
Tb 160	3.00E-02	3.70E-03	1.80E-02	5.90E-04	1.90E-02
Dy 165	2.00E-02	7.80E-03	1.90E-02	1.40E-05	1.90E-02
Dy 166	5.60E-02	1.60E-02	5.40E-02	4.30E-05	4.80E-02
Ho 166	3.00E-02	9.70E-03	2.90E-02	1.50E-05	2.50E-02
Ho-166m	2.20E-02				
Er 169	1.60E-02	3.10E-04	1.50E-02	4.60E-07	9.50E-03
Er 171	2.00E-02	7.40E-03	1.90E-02	2.00E-04	2.50E-02
Tm 170	2.00E-02	5.80E-03	1.70E-02	2.70E-06	1.60E-02
Tm 171	2.20E-03	0.00E+00	1.80E-03	3.40E-07	2.20E-05
Yb 175	1.10E-02	2.30E-03	1.10E-02	2.10E-04	9.50E-03
Lu 177	1.30E-02	2.60E-03	1.20E-02	1.70E-03	1.30E-02
Hf 181	2.00E-02	3.50E-03	1.90E-02	2.90E-04	1.60E-02
Ta 182	2.00E-02	3.70E-03	1.70E-02	6.80E-04	1.60E-02
W 181	9.60E-04	0.00E+00	8.70E-04	2.10E-05	1.60E-05
W 185	1.10E-02	2.20E-03	8.70E-03	2.90E-08	1.30E-02
W 187	2.00E-02	5.40E-03	1.90E-02	2.50E-04	1.60E-02
Re 186	2.00E-02	6.00E-03	1.90E-02	2.60E-05	1.90E-02
Re 188	3.40E-02	1.10E-02	3.20E-02	3.00E-05	1.90E-02
Os 185	5.30E-04	1.10E-04	3.20E-04	3.80E-04	6.30E-04
Os 191	1.00E-02	0.00E+00	4.30E-03	4.20E-05	3.20E-03
Os 191m	5.70E-03	1.10E-03	5.30E-03	4.80E-06	3.20E-03
Os 193	2.00E-02	6.50E-03	1.90E-02	3.80E-05	1.90E-02
Ir 190	1.10E-02	2.20E-03	1.00E-02	7.60E-04	1.30E-02
Ir 192	2.30E-02	3.40E-03	1.70E-02	4.30E-04	1.60E-02
Ir 194	3.50E-02	1.10E-02	3.30E-02	4.70E-05	1.90E-02
Pt 191	5.50E-03	1.10E-03	5.10E-03	1.60E-04	2.50E-03
Pt-193					
Pt 193m	1.20E-02	2.40E-03	1.10E-02	6.70E-06	9.50E-03
Pt 197	2.00E-02	4.40E-03	1.90E-02	1.30E-05	1.90E-02
Pt 197m	2.00E-02	5.60E-03	1.90E-02	4.40E-05	9.50E-03
Au 198	2.30E-02	6.40E-03	1.90E-02	2.10E-04	1.60E-02
Au 199	1.30E-02	2.50E-03	1.20E-02	4.70E-05	1.30E-02

Radio-nuclide	4 mg/cm^2 (KOC87 / RP65)	40 mg/cm^2 (KOC87 / RP65)	7 mg/cm^2 (KOC87 / interpoliert)	gamma (RP65)	TÜV90
Hg 197	5.80E-03	1.20E-03	5.40E-03	1.90E-04	3.20E-03
Hg 197m	2.00E-02	3.80E-03	1.90E-02	4.90E-05	1.90E-02
Hg 203	1.60E-02	3.70E-04	9.60E-03	1.30E-04	9.50E-03
Tl 200	3.40E-03	0.00E+00	3.10E-03	6.80E-04	1.30E-03
Tl 201	5.30E-03	0.00E+00	2.30E-03	1.80E-04	2.50E-03
Tl 202	2.00E-03	0.00E+00	1.80E-03	2.50E-04	6.30E-04
Tl 204	2.10E-02	5.00E-03	1.70E-02	2.80E-06	1.60E-02
Pb 203	4.60E-03	9.10E-04	4.30E-03	1.60E-04	2.80E-03
Bi 206	5.80E-03	2.30E-03	5.50E-03	1.40E-03	6.30E-03
Bi 207	1.00E-02	2.00E-03	8.70E-03	8.10E-04	2.20E-03
Po 203	1.40E-02	2.80E-03	1.30E-02	8.60E-04	1.30E-02
Po 205	5.00E-03	1.00E-03	4.70E-03	8.20E-04	2.80E-03
Po 207	4.40E-03	8.90E-04	4.10E-03	6.90E-04	1.90E-03
At 211	5.20E-04	0.00E+00	4.70E-04	2.10E-05	1.60E-04
Ra 225	8.60E-02	1.80E-02	6.50E-02		6.60E-02
Ra 227	2.00E-02	7.50E-03	1.90E-02	8.70E-05	1.90E-02
Th 226	1.90E-03	3.90E-04	1.80E-03	9.80E-06	3.20E-03
Th 229	7.50E-02	1.20E-02	5.20E-02		5.30E-02
Pa 230	5.80E-03	1.20E-03	5.40E-03	3.40E-04	2.50E-03
Pa 233	2.60E-02	8.70E-04	1.60E-02	1.10E-04	1.60E-02
U 230	5.70E-03	1.20E-03	5.40E-03	2.10E-05	4.50E-03
U 231	6.20E-03	1.20E-03	5.80E-03	4.30E-05	1.90E-03
U 232	2.80E-04	0.00E+00	3.00E-05	8.20E-04	6.30E-05
U 233	4.60E-05	0.00E+00	6.80E-06	1.50E-05	6.30E-05
U 236	4.00E-05	0.00E+00	1.90E-05	8.30E-07	1.60E-05
U 237	1.70E-02	3.40E-03	1.60E-02	7.50E-05	1.30E-02
U 239	2.00E-02	7.20E-03	1.90E-02	2.70E-05	1.90E-02
U 240	4.10E-02	1.00E-02	3.10E-02	4.70E-06	2.60E-02
Np 237	3.00E-02	8.70E-04	1.70E-02	5.90E-04	1.70E-02
Np 239	3.60E-02	1.20E-03	2.30E-02	9.00E-05	1.90E-02
Np 240	5.40E-02	5.00E-03	3.00E-02	6.90E-04	3.20E-02
Pu 234	9.40E-04	0.00E+00	8.60E-04	3.60E-05	1.30E-04
Pu 235	1.90E-03	0.00E+00	1.70E-03	5.00E-05	1.70E-03
Pu 236	0.00E+00	0.00E+00	0.00E+00	1.10E-06	3.20E-05
Pu 237	1.40E-03	0.00E+00	1.30E-03	2.80E-05	1.60E-04
Pu 238	9.30E-04	0.00E+00	0.00E+00	2.40E-05	3.20E-05
Pu 239	3.80E-06	0.00E+00	0.00E+00	8.80E-06	1.30E-05
Pu 240	0.00E+00	0.00E+00	0.00E+00	9.10E-07	3.20E-05
Pu 241	0.00E+00	0.00E+00	0.00E+00	1.40E-08	3.20E-07
Pu 242	0.00E+00	0.00E+00	0.00E+00	7.60E-07	3.20E-05
Pu 243	2.00E-02	2.20E-03	1.40E-02	1.30E-05	1.30E-02
Pu 244	4.10E-02	1.00E-02	3.10E-02	5.30E-06	2.60E-02
Am 241	4.80E-04	0.00E+00	2.20E-05	1.50E-04	1.60E-04
Am 242	1.70E-02	2.60E-03	1.30E-02	9.60E-06	9.50E-03
Am 242m	1.70E-02	2.60E-03	1.30E-02		9.50E-03
Am 243	3.70E-02	1.20E-03	2.30E-02	2.10E-04	2.00E-02
Cm 242	0.00E+00	0.00E+00	0.00E+00	2.10E-05	1.60E-05
Cm 243	1.70E-02	3.00E-04	1.10E-02	7.00E-05	9.50E-03
Cm 244	0.00E+00	0.00E+00	0.00E+00	1.90E-05	1.30E-05
Cm 245	8.60E-03	0.00E+00	5.80E-04	8.40E-04	3.20E-03
Cm 246	0.00E+00	0.00E+00	0.00E+00	1.30E-05	3.20E-05
Cm 247	2.10E-02	2.40E-03	1.50E-02	1.70E-04	1.40E-02
Cm 248	0.00E+00	0.00E+00	0.00E+00	6.10E-07	1.30E-02

Radio-nuclide	4 mg/cm^2 (KOC87 / RP65)	40 mg/cm^2 (KOC87 / RP65)	7 mg/cm^2 (KOC87 / interpoliert)	gamma (RP65)	TÜV90
Bk 249	3.50E-03	0.00E+00	8.20E-04	0.00E+00	3.20E-07
Cf 246	5.20E-04	0.00E+00	4.80E-04	6.90E-07	2.20E-05
Cf 248	5.20E-04	0.00E+00	4.40E-04	6.80E-07	3.20E-06
Cf 249	2.80E-03	1.40E-04	1.90E-03	1.80E-04	2.20E-03
Cf 250	4.20E-05	0.00E+00	4.70E-06	6.50E-07	9.50E-05
Cf 251	1.70E-02	3.40E-03	1.60E-02	6.90E-05	1.60E-02
Cf 252	3.40E-05	0.00E+00	4.80E-06	1.10E-05	3.20E-03
Cf 253	6.90E-03	1.40E-03	6.50E-03	1.20E-08	6.30E-03
Cf 254	4.40E-01	1.40E-01	4.00E-01	7.60E-03	1.60E-01
Es 253	3.00E-04	0.00E+00	2.80E-04	5.80E-07	2.50E-05
Es 254	6.10E-03	1.20E-03	6.00E-03	1.00E-05	1.60E-04
Es 254m	2.10E-02	4.50E-03	2.00E-02	2.50E-04	1.60E-02
Fm 254	5.10E-04	0.00E+00	4.70E-04	6.60E-07	6.30E-05
Fm 255	8.60E-03	1.70E-03	8.00E-03	7.10E-02	3.20E-03

TABLE I-VII: Calculations for Realistic Scenarios (except water pathway)

	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
H-3	1.08E-03	9.07E-04	0.00E+00	7.48E-02	3.39E-02	8.04E-07	0.00E+00	5.75E-04	7.48E-02	RL-C	1.34E+02	1.00E+02
Be-7	5.37E-01	1.25E-02	2.48E-02	3.11E-07	1.17E-07	1.55E-09	4.25E-01	2.36E-02	5.37E-01	WL	1.86E+01	1.00E+01
C-14	1.79E-02	1.38E-02	0.00E+00	7.61E-01	3.57E-01	2.03E-05	0.00E+00	8.02E-03	7.61E-01	RL-C	1.31E+01	1.00E+01
F-18	3.38E-120	7.89E-122	1.58E-121	1.25E-128	1.30E-128	4.38E-128	0.00E+00	0.00E+00	3.38E-120	WL	1.00E+10	1.00E+10
Na-22	1.50E+02	3.65E+00	7.19E+00	3.77E-01	1.04E-01	1.93E-05	2.55E+02	1.53E+01	2.55E+02	RH	3.92E-02	1.00E-01
Na-24	2.48E-15	5.75E-17	1.15E-16	1.08E-23	8.87E-24	3.80E-23	4.27E-49	2.90E-50	2.48E-15	WL	1.00E+10	1.00E+10
Si-31	1.13E-87	7.27E-89	5.24E-89	6.01E-93	5.51E-93	3.01E-94	6.68E-280	6.82E-281	1.13E-87	WL	1.00E+10	1.00E+10
P-32	6.68E-04	6.29E-04	0.00E+00	1.86E-07	2.15E-07	8.62E-08	0.00E+00	4.11E-05	6.68E-04	WL	1.50E+04	1.00E+04
P-33	2.78E-04	2.18E-04	0.00E+00	6.37E-06	1.39E-06	9.06E-08	0.00E+00	6.04E-05	2.78E-04	WL	3.60E+04	1.00E+05
S-35	4.28E-03	3.99E-03	0.00E+00	4.01E-02	7.40E-03	5.11E-07	0.00E+00	4.00E-03	4.01E-02	RL-C	2.49E+02	1.00E+02
Cl-36	2.41E-02	2.05E-02	0.00E+00	2.14E+01	4.09E+00	8.01E-05	0.00E+00	3.16E-02	2.14E+01	RL-C	4.67E-01	1.00E+00
Cl-38	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
K-40	1.33E+01	4.45E-01	6.40E-01	1.57E+01	3.00E+00	5.24E-05	2.20E+01	1.62E+00	2.20E+01	RH	4.55E-01	1.00E+00
K-42	1.01E-19	2.47E-21	4.87E-21	3.77E-27	2.47E-27	1.32E-26	9.64E-61	6.25E-62	1.01E-19	WL	1.00E+10	1.00E+10
K-43	8.17E-11	1.90E-12	3.79E-12	9.75E-19	7.68E-19	3.41E-18	9.75E-33	5.45E-34	8.17E-11	WL	1.00E+10	1.00E+10
Ca-41	6.01E-03	5.81E-03	0.00E+00	1.24E-01	5.85E-02	1.14E-07	0.00E+00	2.60E-03	1.24E-01	RL-C	8.08E+01	1.00E+02
Ca-45	7.95E-03	6.89E-03	0.00E+00	1.27E-01	2.39E-02	1.74E-06	0.00E+00	8.20E-03	1.27E-01	RL-C	7.84E+01	1.00E+02
Ca-47	1.37E-02	3.31E-04	6.51E-04	1.17E-09	1.59E-09	5.87E-10	3.62E-07	2.26E-08	1.37E-02	WL	7.32E+02	1.00E+03
Sc-46	4.04E+01	9.91E-01	1.97E+00	8.82E-05	2.85E-05	2.49E-06	4.02E+01	2.42E+00	4.04E+01	WL	2.48E-01	1.00E-01
Sc-47	1.59E-04	1.73E-06	2.87E-06	6.69E-11	9.51E-11	3.34E-11	1.68E-10	9.28E-12	1.59E-04	WL	6.28E+04	1.00E+05
Sc-48	2.24E-05	5.48E-07	1.09E-06	4.22E-13	4.29E-13	2.11E-13	1.11E-16	6.81E-18	2.24E-05	WL	4.46E+05	1.00E+06
V-48	4.12E+00	1.00E-01	1.99E-01	1.68E-07	2.00E-07	8.42E-08	3.54E-01	2.14E-02	4.12E+00	WL	2.43E+00	1.00E+00
Cr-51	1.10E-01	2.31E-03	4.53E-03	1.05E-08	8.36E-09	4.33E-09	3.76E-02	2.05E-03	1.10E-01	WL	9.08E+01	1.00E+02
Mn-51	6.48E-284	1.51E-285	3.03E-285	2.08E-292	1.72E-292	3.64E-293	0.00E+00	0.00E+00	6.48E-284	WL	1.00E+10	1.00E+10
Mn-52	1.37E-01	3.32E-03	6.61E-03	2.90E-09	3.26E-09	5.08E-10	3.40E-05	2.07E-06	1.37E-01	WL	7.32E+01	1.00E+02
Mn-52m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Mn-53	6.39E-04	6.01E-04	0.00E+00	4.49E-02	7.92E-03	5.24E-08	0.00E+00	1.10E-03	4.49E-02	RL-C	2.23E+02	1.00E+02
Mn-54	4.28E+01	1.05E+00	2.08E+00	1.94E-01	5.75E-02	6.14E-07	6.69E+01	3.92E+00	6.69E+01	RH	1.49E-01	1.00E-01
Mn-56	2.06E-84	4.94E-86	9.86E-86	9.97E-93	8.37E-93	1.75E-93	1.28E-276	7.98E-278	2.06E-84	WL	1.00E+10	1.00E+10
Fe-52	1.39E-27	3.25E-29	6.46E-29	2.43E-35	1.94E-35	1.21E-36	9.59E-89	5.69E-90	1.39E-27	WL	1.00E+10	1.00E+10
Fe-55	6.01E-03	5.70E-03	0.00E+00	1.11E-03	2.00E-04	5.32E-08	0.00E+00	9.87E-03	9.87E-03	RP	1.01E+03	1.00E+03
Fe-59	1.06E+01	2.61E-01	5.13E-01	5.96E-06	2.75E-06	6.14E-08	6.03E+00	3.75E-01	1.06E+01	WL	9.45E-01	1.00E+00
Co-55	1.89E-13	4.55E-15	9.04E-15	3.35E-21	2.95E-21	1.67E-22	4.70E-42	2.75E-43	1.89E-13	WL	1.00E+10	1.00E+10
Co-56	7.12E+01	1.70E+00	3.38E+00	1.06E-02	2.30E-03	2.17E-07	6.53E+01	4.16E+00	7.12E+01	WL	1.40E-01	1.00E-01
Co-57	3.45E+00	2.08E-02	3.66E-02	2.21E-02	3.76E-03	5.82E-08	5.73E+00	3.11E-01	5.73E+00	RH	1.75E+00	1.00E+00
Co-58	1.52E+01	3.69E-01	7.32E-01	1.67E-03	3.64E-04	5.66E-08	1.39E+01	8.06E-01	1.52E+01	WL	6.59E-01	1.00E+00

	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
Co-58m	1.04E-28	2.66E-30	5.03E-30	2.52E-35	2.67E-35	1.26E-36	3.56E-86	2.10E-87	1.04E-28	WL	1.00E+10	1.00E+10
Co-60	1.94E+02	4.78E+00	9.44E+00	1.21E+00	1.97E-01	1.39E-06	3.23E+02	2.03E+01	3.23E+02	RH	3.09E-02	1.00E-01
Co-60m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Co-61	6.66E-134	1.08E-135	2.12E-135	3.91E-141	3.71E-141	1.95E-142	0.00E+00	0.00E+00	6.66E-134	WL	1.00E+10	1.00E+10
Co-62m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Ni-59	1.36E-03	1.26E-03	0.00E+00	6.94E-02	1.66E-02	2.73E-08	0.00E+00	1.70E-03	6.94E-02	RL-C	1.44E+02	1.00E+02
Ni-63	3.32E-03	2.99E-03	0.00E+00	1.70E-01	3.92E-02	8.32E-08	0.00E+00	4.18E-03	1.70E-01	RL-C	5.90E+01	1.00E+02
Ni-65	9.23E-88	2.24E-89	4.47E-89	9.21E-96	8.21E-96	4.60E-97	1.32E-286	8.29E-288	9.23E-88	WL	1.00E+10	1.00E+10
Cu-64	6.07E-20	1.43E-21	2.84E-21	2.15E-27	2.47E-27	1.08E-28	6.70E-61	3.76E-62	6.07E-20	WL	1.00E+10	1.00E+10
Zn-65	2.74E+01	7.11E-01	1.33E+00	4.82E+00	1.52E+00	1.15E-05	3.93E+01	2.43E+00	3.93E+01	RH	2.55E-01	1.00E-01
Zn-69	2.07E-232	1.21E-232	3.74E-234	2.30E-236	2.33E-236	8.06E-236	0.00E+00	0.00E+00	2.07E-232	WL	1.00E+10	1.00E+10
Zn-69m	2.39E-17	5.50E-19	1.09E-18	1.13E-24	9.95E-25	3.95E-24	3.82E-53	2.11E-54	2.39E-17	WL	1.00E+10	1.00E+10
Ga-72	1.80E-16	4.30E-18	8.57E-18	2.30E-24	2.02E-24	8.06E-24	2.52E-52	1.59E-53	1.80E-16	WL	1.00E+10	1.00E+10
Ge-71	1.96E-06	1.87E-06	0.00E+00	5.90E-10	4.11E-10	2.94E-11	0.00E+00	4.77E-08	1.96E-06	WL	5.10E+06	1.00E+07
As-73	1.98E-02	1.22E-03	4.29E-10	1.35E-03	2.39E-04	4.13E-08	2.47E-02	2.30E-03	2.47E-02	RH	4.05E+02	1.00E+03
As-74	1.28E+00	3.08E-02	6.05E-02	1.86E-07	2.27E-07	8.17E-09	1.61E-01	9.08E-03	1.28E+00	WL	7.84E+00	1.00E+01
As-76	8.23E-10	2.04E-11	3.93E-11	9.91E-17	8.70E-17	4.96E-18	8.59E-29	5.08E-30	8.23E-10	WL	1.21E+10	1.00E+10
As-77	8.78E-09	2.89E-10	3.36E-10	2.26E-14	2.83E-14	1.13E-15	1.28E-21	8.65E-23	8.78E-09	WL	1.14E+09	1.00E+09
Se-75	8.32E+00	1.54E-01	2.72E-01	4.52E-02	1.17E-02	9.28E-07	1.10E+01	6.07E-01	1.10E+01	RH	9.12E-01	1.00E+00
Se-79	5.97E-02	5.81E-02	0.00E+00	1.90E+00	2.55E-01	5.72E-06	0.00E+00	1.40E-01	1.90E+00	RL-C	5.25E+00	1.00E+01
Br-82	7.93E-07	1.92E-08	3.83E-08	9.94E-15	1.14E-14	4.97E-16	5.29E-21	3.12E-22	7.93E-07	WL	1.26E+07	1.00E+07
Rb-86	1.88E-01	5.91E-03	9.12E-03	4.14E-07	1.53E-07	8.16E-09	2.43E-02	1.65E-03	1.88E-01	WL	5.31E+01	1.00E+02
Rb-87	3.08E-02	3.00E-02	0.00E+00	1.36E+00	2.64E-01	1.80E-07	0.00E+00	5.00E-02	1.36E+00	RL-C	7.35E+00	1.00E+01
Sr-85	7.04E+00	1.67E-01	3.29E-01	3.42E-03	8.00E-04	2.53E-07	6.44E+00	3.60E-01	7.04E+00	WL	1.42E+00	1.00E+00
Sr-85m	1.17E-193	1.86E-195	3.72E-195	2.10E-202	1.91E-202	1.05E-202	0.00E+00	0.00E+00	1.17E-193	WL	1.00E+10	1.00E+10
Sr-87m	4.98E-80	1.11E-81	2.21E-81	2.34E-88	2.12E-88	1.17E-88	3.75E-260	2.06E-261	4.98E-80	WL	1.00E+10	1.00E+10
Sr-89	9.22E-03	7.02E-03	7.15E-05	5.21E-03	9.78E-04	1.41E-06	1.03E-03	4.71E-03	9.22E-03	WL	1.08E+03	1.00E+03
Sr-90	6.89E-01	6.10E-01	0.00E+00	1.83E+01	7.82E+00	5.14E-05	0.00E+00	4.57E-01	1.83E+01	RL-C	5.47E-01	1.00E+00
Sr-91	2.81E-24	6.90E-26	1.36E-25	9.88E-32	9.06E-32	4.94E-32	1.67E-76	9.88E-78	2.81E-24	WL	1.00E+10	1.00E+10
Sr-92	8.17E-82	1.99E-83	3.96E-83	1.08E-89	8.83E-90	5.39E-90	8.11E-268	5.12E-269	8.17E-82	WL	1.00E+10	1.00E+10
Y-90	2.40E-07	2.32E-07	0.00E+00	3.18E-11	2.89E-11	1.59E-11	0.00E+00	5.31E-15	2.40E-07	WL	4.17E+07	1.00E+08
Y-91	5.72E-02	8.95E-03	2.35E-03	1.18E-04	2.65E-05	2.41E-06	3.64E-02	8.61E-03	5.72E-02	WL	1.75E+02	1.00E+02
Y-91m	3.30E-266	7.81E-268	1.56E-267	5.78E-275	6.49E-275	2.89E-275	0.00E+00	0.00E+00	3.30E-266	WL	1.00E+10	1.00E+10
Y-92	1.65E-64	4.07E-66	7.98E-66	8.50E-72	6.95E-72	4.25E-72	1.37E-208	8.29E-210	1.65E-64	WL	1.00E+10	1.00E+10
Y-93	3.00E-23	7.90E-25	1.38E-24	1.10E-29	8.40E-30	5.50E-30	4.01E-71	2.61E-72	3.00E-23	WL	1.00E+10	1.00E+10
Zr-93	1.54E-02	8.02E-03	0.00E+00	1.13E-03	1.12E-03	2.41E-07	1.01E-03	8.33E-03	1.54E-02	WL	6.49E+02	1.00E+03
Zr-95	1.50E+01	3.66E-01	7.24E-01	2.27E-05	9.01E-06	1.41E-07	1.26E+01	7.33E-01	1.50E+01	WL	6.68E-01	1.00E+00

Nuclide	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level [Bq/g]	excl. level rounded [Bq/g]
	WL	WF	WO	RL-C	RL-A	RF	RH	RP	Maximum	Pathway		
Zr-97	5.75E-14	1.40E-15	2.77E-15	1.26E-21	1.19E-21	6.31E-23	4.38E-44	2.53E-45	5.75E-14	WL	1.00E+10	1.00E+10
Nb-93m	2.64E-03	2.35E-03	0.00E+00	5.75E-03	9.83E-04	1.03E-06	9.79E-04	4.39E-03	5.75E-03	RL-C	1.74E+03	1.00E+03
Nb-94	1.25E+02	3.05E+00	6.04E+00	6.60E-02	1.50E-02	1.63E-05	2.29E+02	1.33E+01	2.29E+02	RH	4.37E-02	1.00E-01
Nb-95	4.61E+00	1.12E-01	2.23E-01	2.55E-06	1.07E-06	1.75E-07	2.13E+00	1.23E-01	4.61E+00	WL	2.17E+00	1.00E+00
Nb-97	1.93E-179	4.65E-181	9.29E-181	8.28E-188	7.76E-188	4.14E-188	0.00E+00	0.00E+00	1.93E-179	WL	1.00E+10	1.00E+10
Nb-98	9.63E-255	2.32E-256	4.65E-256	1.51E-263	1.28E-263	7.57E-264	0.00E+00	0.00E+00	9.63E-255	WL	1.00E+10	1.00E+10
Mo-90	5.03E-40	1.02E-41	2.02E-41	1.42E-47	1.32E-47	7.11E-48	1.44E-128	8.16E-130	5.03E-40	WL	1.00E+10	1.00E+10
Mo-93	5.59E-02	5.44E-02	0.00E+00	1.06E+00	5.66E-01	1.82E-06	6.69E-03	3.89E-02	1.06E+00	RL-C	9.44E+00	1.00E+01
Mo-99	8.77E-05	1.75E-06	3.24E-06	2.14E-11	2.36E-11	1.07E-11	3.33E-12	1.89E-13	8.77E-05	WL	1.14E+05	1.00E+05
Mo-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Tc-96	2.98E-02	7.27E-04	1.45E-03	5.15E-10	4.90E-10	2.58E-10	8.41E-07	4.92E-08	2.98E-02	WL	3.35E+02	1.00E+03
Tc-96m	2.33E-256	5.68E-258	1.13E-257	3.14E-264	2.93E-264	1.57E-264	0.00E+00	0.00E+00	2.33E-256	WL	1.00E+10	1.00E+10
Tc-97	1.84E-03	1.67E-03	0.00E+00	1.67E+00	2.99E-01	4.40E-07	8.63E-03	2.45E-03	1.67E+00	RL-C	6.00E+00	1.00E+01
Tc-97m	7.33E-03	3.44E-03	4.53E-06	2.54E-01	4.41E-02	1.13E-06	5.00E-03	3.24E-03	2.54E-01	RL-C	3.94E+01	1.00E+02
Tc-99	1.91E-02	1.58E-02	1.91E-08	1.63E+01	2.82E+00	5.72E-06	3.87E-05	2.40E-02	1.63E+01	RL-C	6.13E-01	1.00E+00
Tc-99m	8.79E-39	5.92E-41	1.17E-40	1.20E-46	1.26E-46	6.01E-47	3.74E-122	2.01E-123	8.79E-39	WL	1.00E+10	1.00E+10
Ru-97	1.32E-04	2.21E-06	4.36E-06	5.00E-12	4.47E-12	1.75E-11	1.59E-11	8.57E-13	1.32E-04	WL	7.58E+04	1.00E+05
Ru-103	3.39E+00	8.04E-02	1.58E-01	4.64E-05	1.05E-05	2.45E-06	1.94E+00	1.09E-01	3.39E+00	WL	2.95E+00	1.00E+00
Ru-105	1.36E-50	3.21E-52	6.40E-52	2.14E-58	2.19E-58	7.48E-58	1.61E-163	9.16E-165	1.36E-50	WL	1.00E+10	1.00E+10
Ru-106	6.98E+00	2.62E-01	3.24E-01	6.01E-01	1.11E-01	2.31E-04	1.13E+01	7.88E-01	1.13E+01	RH	8.85E-01	1.00E+00
Rh-102	1.44E+02	3.49E+00	6.88E+00	9.53E-01	3.21E-01	1.34E-04	2.53E+02	1.47E+01	2.53E+02	RH	3.95E-02	1.00E-01
Rh-103m	5.20E-233	1.44E-233	0.00E+00	2.14E-237	2.42E-237	7.48E-237	0.00E+00	0.00E+00	5.20E-233	WL	1.00E+10	1.00E+10
Rh-105	1.97E-08	4.31E-10	8.04E-10	5.63E-15	6.32E-15	1.97E-14	1.43E-22	7.93E-24	1.97E-08	WL	5.08E+08	1.00E+09
Pd-103	2.57E-04	8.16E-05	6.70E-06	3.48E-08	4.43E-08	1.61E-09	5.07E-05	9.60E-06	2.57E-04	WL	3.89E+04	1.00E+05
Pd-107	1.05E-03	7.42E-04	0.00E+00	1.90E-02	3.26E-03	8.80E-08	0.00E+00	1.41E-03	1.90E-02	RL-C	5.25E+02	1.00E+03
Pd-109	1.30E-20	8.49E-22	1.73E-22	1.16E-25	1.23E-25	5.79E-27	8.34E-59	8.86E-60	1.30E-20	WL	1.00E+10	1.00E+10
Ag-105	3.50E+00	7.70E-02	1.52E-01	5.23E-06	1.53E-06	1.02E-07	2.01E+00	1.12E-01	3.50E+00	WL	2.86E+00	1.00E+00
Ag-108m	1.22E+02	2.93E+00	5.77E+00	7.42E-02	2.01E-02	8.29E-06	2.29E+02	1.30E+01	2.29E+02	RH	4.37E-02	1.00E-01
Ag-110m	1.27E+02	3.12E+00	6.17E+00	2.20E-02	5.71E-03	5.01E-06	1.89E+02	1.12E+01	1.89E+02	RH	5.29E-02	1.00E-01
Ag-111	3.04E-03	1.06E-04	1.24E-04	9.71E-09	1.20E-08	3.40E-09	7.61E-06	5.15E-07	3.04E-03	WL	3.29E+03	1.00E+04
Cd-109	1.33E-01	3.24E-02	8.16E-05	1.47E+00	4.00E-01	8.45E-05	2.17E-01	4.11E-02	1.47E+00	RL-C	6.81E+00	1.00E+01
Cd-113m	1.80E+01	8.81E-01	7.73E-01	1.76E+01	9.38E+00	8.07E-04	3.35E+01	2.11E+00	3.35E+01	RH	2.98E-01	1.00E-01
Cd-115	1.83E-05	4.35E-07	8.23E-07	3.65E-12	4.26E-12	1.28E-11	1.22E-14	6.85E-16	1.83E-05	WL	5.45E+05	1.00E+06
Cd-115m	2.00E-01	1.20E-02	9.32E-03	3.46E-03	7.80E-04	1.06E-05	1.12E-01	1.01E-02	2.00E-01	WL	5.01E+01	1.00E+02
In-111	1.58E-04	2.39E-06	4.70E-06	7.18E-12	7.51E-12	2.51E-11	9.95E-12	5.36E-13	1.58E-04	WL	6.35E+04	1.00E+05
In-113m	2.95E-133	6.57E-135	1.31E-134	1.59E-141	1.58E-141	5.57E-141	0.00E+00	0.00E+00	2.95E-133	WL	1.00E+10	1.00E+10
In-114m	1.14E+00	3.60E-02	4.89E-02	9.88E-05	2.13E-05	3.17E-05	8.34E-01	5.47E-02	1.14E+00	WL	8.75E+00	1.00E+01

	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
In-115m	2.42E-51	5.14E-53	1.02E-52	6.54E-59	6.38E-59	2.29E-58	3.00E-164	1.64E-165	2.42E-51	WL	1.00E+10	1.00E+10
Sn-113	6.04E+00	1.39E-01	2.68E-01	4.51E-02	8.55E-03	1.03E-05	7.68E+00	4.25E-01	7.68E+00	RH	1.30E+00	1.00E+00
Sn-121m	1.84E-02	1.35E-02	0.00E+00	8.81E-01	1.58E-01	4.92E-05	9.98E-03	2.21E-02	8.81E-01	RL-C	1.14E+01	1.00E+01
Sn-125	1.06E-01	2.82E-03	5.10E-03	5.60E-08	6.34E-08	1.96E-07	1.11E-03	7.05E-05	1.06E-01	WL	9.45E+01	1.00E+02
Sn-126	1.51E+02	3.66E+00	7.11E+00	6.12E+00	1.24E+00	3.08E-04	2.83E+02	1.62E+01	2.83E+02	RH	3.53E-02	1.00E-01
Sb-122	1.63E-04	4.03E-06	7.73E-06	2.43E-11	2.32E-11	1.21E-12	4.86E-12	2.78E-13	1.63E-04	WL	6.15E+04	1.00E+05
Sb-124	2.64E+01	6.43E-01	1.27E+00	4.81E-05	1.43E-05	1.82E-07	2.09E+01	1.30E+00	2.64E+01	WL	3.78E-01	1.00E+00
Sb-125	2.68E+01	6.41E-01	1.24E+00	3.46E-03	7.95E-04	6.93E-07	4.89E+01	2.75E+00	4.89E+01	RH	2.04E-01	1.00E-01
Te-123m	2.55E+00	3.26E-02	4.54E-02	3.06E-01	6.30E-02	2.01E-06	3.39E+00	1.91E-01	3.39E+00	RH	2.95E+00	1.00E+00
Te-125m	9.40E-03	2.81E-03	1.21E-05	1.28E-02	2.29E-03	7.72E-07	1.93E-02	2.48E-03	1.93E-02	RH	5.18E+02	1.00E+03
Te-127	1.76E-26	5.58E-28	7.69E-28	3.28E-32	3.18E-32	1.64E-32	1.11E-78	7.11E-80	1.76E-26	WL	1.00E+10	1.00E+10
Te-127m	1.30E-01	1.84E-02	4.76E-03	5.04E-01	8.39E-02	3.79E-06	1.53E-01	2.75E-02	5.04E-01	RL-C	1.98E+01	1.00E+01
Te-129	3.49E-194	8.15E-196	1.61E-195	1.72E-201	1.58E-201	8.60E-202	0.00E+00	0.00E+00	3.49E-194	WL	1.00E+10	1.00E+10
Te-129m	3.57E-01	1.26E-02	1.66E-02	1.17E-03	1.92E-04	8.21E-07	1.57E-01	1.09E-02	3.57E-01	WL	2.80E+01	1.00E+01
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Te-131m	3.15E-08	7.64E-10	1.48E-09	3.14E-15	2.19E-15	1.57E-15	5.97E-25	3.56E-26	3.15E-08	WL	3.18E+08	1.00E+09
Te-132	3.74E-03	8.96E-05	1.76E-04	2.60E-10	2.13E-10	1.30E-10	2.24E-09	1.31E-10	3.74E-03	WL	2.67E+03	1.00E+03
Te-133	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Te-133m	1.05E-249	2.50E-251	4.99E-251	6.16E-258	3.83E-258	3.08E-258	0.00E+00	0.00E+00	1.05E-249	WL	1.00E+10	1.00E+10
Te-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
I-123	5.77E-19	6.61E-21	1.26E-20	4.81E-26	2.46E-26	1.69E-25	3.74E-57	2.02E-58	5.77E-19	WL	1.00E+10	1.00E+10
I-125	5.81E-02	5.22E-02	0.00E+00	3.17E-03	1.08E-03	1.22E-05	2.35E-02	2.27E-02	5.81E-02	WL	1.72E+02	1.00E+02
I-126	3.72E-01	1.49E-02	1.73E-02	7.80E-07	5.02E-07	2.73E-06	1.72E-02	1.25E-03	3.72E-01	WL	2.69E+01	1.00E+01
I-129	2.29E+00	2.22E+00	0.00E+00	2.99E+00	1.94E+00	2.65E-04	2.27E-01	1.10E+00	2.99E+00	RL-C	3.34E+00	1.00E+01
I-130	7.06E-19	1.71E-20	3.38E-20	2.79E-26	1.38E-26	9.77E-26	7.64E-60	4.39E-61	7.06E-19	WL	1.00E+10	1.00E+10
I-131	6.47E-02	2.46E-03	2.79E-03	1.51E-07	8.46E-08	5.28E-07	2.93E-04	2.12E-05	6.47E-02	WL	1.55E+02	1.00E+02
I-132	4.67E-97	1.13E-98	2.25E-98	2.18E-105	1.16E-105	7.63E-105	0.00E+00	0.00E+00	4.67E-97	WL	1.00E+10	1.00E+10
I-133	7.88E-12	2.00E-13	3.71E-13	2.69E-18	1.22E-18	9.42E-18	1.30E-35	7.72E-37	7.88E-12	WL	1.00E+10	1.00E+10
I-134	1.15E-249	2.79E-251	5.57E-251	1.78E-258	1.18E-258	6.22E-258	0.00E+00	0.00E+00	1.15E-249	WL	1.00E+10	1.00E+10
I-135	1.51E-34	3.63E-36	7.23E-36	3.61E-42	1.70E-42	1.26E-41	2.74E-111	1.71E-112	1.51E-34	WL	1.00E+10	1.00E+10
Cs-129	1.94E-08	4.32E-10	8.61E-10	2.70E-16	2.21E-16	9.46E-16	9.47E-24	5.17E-25	1.94E-08	WL	5.15E+08	1.00E+09
Cs-131	8.90E-05	4.94E-06	0.00E+00	6.27E-10	5.43E-10	2.20E-09	4.76E-06	9.05E-08	8.90E-05	WL	1.12E+05	1.00E+05
Cs-132	5.87E-02	1.42E-03	2.82E-03	1.16E-09	1.21E-09	4.05E-09	6.82E-05	3.89E-06	5.87E-02	WL	1.70E+02	1.00E+02
Cs-134	1.01E+02	2.73E+00	4.83E+00	2.66E-01	4.10E-01	1.86E-05	1.75E+02	1.01E+01	1.75E+02	RH	5.72E-02	1.00E-01
Cs-134m	4.18E-79	2.70E-81	4.91E-81	3.87E-86	3.70E-86	1.35E-85	9.81E-254	5.09E-255	4.18E-79	WL	1.00E+10	1.00E+10
Cs-135	4.11E-02	4.04E-02	0.00E+00	6.26E-02	7.04E-02	3.05E-06	0.00E+00	1.15E-02	7.04E-02	RL-A	1.42E+02	1.00E+02
Cs-136	1.82E+00	4.40E-02	8.67E-02	4.89E-08	6.15E-08	1.71E-07	8.20E-02	4.85E-03	1.82E+00	WL	5.49E+00	1.00E+01

	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
Cs-137	4.54E+01	1.35E+00	2.18E+00	3.15E-01	4.42E-01	1.64E-05	8.43E+01	4.86E+00	8.43E+01	RH	1.19E-01	1.00E-01
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Ba-131	2.41E-01	5.18E-03	1.02E-02	2.17E-08	2.88E-08	7.60E-08	7.32E-03	4.05E-04	2.41E-01	WL	4.15E+01	1.00E+02
Ba-133	2.23E+01	4.71E-01	9.02E-01	1.91E-01	5.99E-02	2.97E-05	4.32E+01	2.38E+00	4.32E+01	RH	2.31E-01	1.00E-01
Ba-139	3.11E-161	3.55E-163	6.14E-163	6.11E-168	5.33E-168	2.14E-167	0.00E+00	0.00E+00	3.11E-161	WL	1.00E+10	1.00E+10
Ba-140	1.54E+00	3.74E-02	7.31E-02	2.15E-07	2.81E-07	7.52E-07	5.92E-02	3.70E-03	1.54E+00	WL	6.50E+00	1.00E+01
La-137	1.24E-02	2.16E-03	0.00E+00	9.25E-04	2.31E-04	3.56E-06	0.00E+00	2.28E-03	1.24E-02	WL	8.05E+02	1.00E+03
La-140	5.34E-06	1.29E-07	2.55E-07	1.54E-13	1.46E-13	7.69E-14	2.55E-18	1.61E-19	5.34E-06	WL	1.87E+06	1.00E+06
Ce-139	2.93E+00	3.10E-02	5.79E-02	4.04E-03	8.52E-04	1.06E-06	4.15E+00	2.22E-01	4.15E+00	RH	2.41E+00	1.00E+00
Ce-141	2.49E-01	2.71E-03	3.47E-03	9.88E-06	2.70E-06	3.28E-07	1.11E-01	6.33E-03	2.49E-01	WL	4.02E+01	1.00E+02
Ce-143	2.95E-08	6.73E-10	1.26E-09	6.87E-15	7.60E-15	3.43E-15	3.66E-23	2.07E-24	2.95E-08	WL	3.39E+08	1.00E+09
Ce-144	2.12E+00	1.05E-01	7.96E-02	3.65E-01	6.30E-02	4.34E-05	3.03E+00	2.86E-01	3.03E+00	RH	3.31E+00	1.00E+01
Pr-142	9.02E-14	2.64E-15	4.33E-15	5.86E-20	4.75E-20	2.93E-20	8.47E-40	5.99E-41	9.02E-14	WL	1.00E+10	1.00E+10
Pr-143	3.02E-04	2.76E-04	0.00E+00	9.27E-08	1.32E-07	4.63E-08	0.00E+00	1.37E-05	3.02E-04	WL	3.31E+04	1.00E+05
Nd-147	5.31E-02	1.22E-03	2.14E-03	5.02E-08	7.63E-08	2.51E-08	1.22E-03	7.02E-05	5.31E-02	WL	1.88E+02	1.00E+02
Nd-149	1.39E-126	2.74E-128	5.44E-128	2.89E-134	2.97E-134	1.44E-134	0.00E+00	0.00E+00	1.39E-126	WL	1.00E+10	1.00E+10
Pm-145	1.67E-01	2.28E-03	3.25E-06	8.81E-04	1.99E-04	4.22E-06	5.28E-01	2.05E-02	5.28E-01	RH	1.89E+01	1.00E+01
Pm-146	5.19E+01	1.24E+00	2.45E+00	5.80E-03	1.41E-03	2.41E-05	9.52E+01	5.43E+00	9.52E+01	RH	1.05E-01	1.00E-01
Pm-147	7.85E-03	4.63E-03	1.32E-06	1.75E-03	3.28E-04	6.80E-06	2.68E-04	7.82E-03	7.85E-03	WL	1.27E+03	1.00E+03
Pm-149	5.27E-07	2.35E-08	2.11E-08	2.06E-12	2.28E-12	1.03E-12	2.39E-16	1.88E-17	5.27E-07	WL	1.90E+07	1.00E+07
Sm-151	4.75E-03	2.09E-03	0.00E+00	1.73E-03	3.60E-04	4.38E-06	1.59E-05	3.22E-03	4.75E-03	WL	2.11E+03	1.00E+03
Sm-153	2.65E-07	3.07E-09	1.26E-09	4.19E-13	4.96E-13	2.09E-13	7.11E-18	4.16E-19	2.65E-07	WL	3.77E+07	1.00E+08
Eu-152	8.66E+01	2.07E+00	4.08E+00	9.38E-03	2.47E-03	4.27E-05	1.52E+02	9.17E+00	1.52E+02	RH	6.57E-02	1.00E-01
Eu-152m	1.23E-24	2.99E-26	5.89E-26	5.84E-32	5.39E-32	2.92E-32	7.34E-77	4.35E-78	1.23E-24	WL	1.00E+10	1.00E+10
Eu-154	9.51E+01	2.29E+00	4.51E+00	1.46E-02	3.37E-03	6.31E-05	1.66E+02	1.00E+01	1.66E+02	RH	6.03E-02	1.00E-01
Eu-155	1.81E+00	8.20E-03	4.11E-03	2.45E-03	4.88E-04	9.34E-06	3.57E+00	1.97E-01	3.57E+00	RH	2.80E+00	1.00E+00
Gd-153	1.46E+00	4.51E-03	2.73E-03	1.07E-03	2.12E-04	3.00E-06	2.55E+00	1.31E-01	2.55E+00	RH	3.92E+00	1.00E+01
Gd-159	1.16E-14	2.92E-16	4.85E-16	6.61E-21	6.49E-21	3.30E-21	7.39E-42	4.28E-43	1.16E-14	WL	1.00E+10	1.00E+10
Tb-157	3.31E-02	7.21E-04	8.33E-14	5.97E-04	1.25E-04	1.32E-06	8.88E-02	4.47E-03	8.88E-02	RH	1.13E+02	1.00E+02
Tb-160	1.79E+01	4.33E-01	8.52E-01	2.42E-04	5.63E-05	2.31E-06	1.65E+01	9.89E-01	1.79E+01	WL	5.58E-01	1.00E+00
Dy-165	1.35E-95	2.98E-97	5.56E-97	2.68E-102	2.58E-102	1.34E-102	0.00E+00	0.00E+00	1.35E-95	WL	1.00E+10	1.00E+10
Dy-166	5.89E-05	2.27E-06	1.71E-06	2.74E-10	3.20E-10	1.37E-10	6.80E-11	5.41E-12	5.89E-05	WL	1.70E+05	1.00E+05
Ho-166	8.53E-11	3.10E-12	3.57E-12	1.64E-16	1.46E-16	8.22E-17	3.45E-29	2.69E-30	8.53E-11	WL	1.00E+10	1.00E+10
Ho-166m	1.19E+02	2.77E+00	5.45E+00	2.55E-02	7.61E-03	1.10E-04	2.22E+02	1.27E+01	2.22E+02	RH	4.51E-02	1.00E-01
Er-169	3.13E-05	2.75E-05	1.53E-09	1.14E-08	1.77E-08	5.69E-09	2.46E-09	2.54E-07	3.13E-05	WL	3.20E+05	1.00E+06
Er-171	4.84E-31	9.30E-33	1.83E-32	2.23E-38	2.23E-38	1.11E-38	7.06E-98	3.85E-99	4.84E-31	WL	1.00E+10	1.00E+10
Tm-170	5.86E-02	9.73E-03	1.91E-05	1.21E-03	2.19E-04	4.56E-06	6.79E-02	1.58E-02	6.79E-02	RH	1.47E+02	1.00E+02

	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
Tm-171	1.11E-02	1.83E-03	1.04E-07	9.30E-04	1.74E-04	2.04E-06	1.90E-02	3.82E-03	1.90E-02	RH	5.27E+02	1.00E+03
Yb-175	3.85E-04	9.17E-06	1.57E-05	3.57E-10	5.26E-10	1.78E-10	1.16E-08	6.70E-10	3.85E-04	WL	2.60E+04	1.00E+04
Lu-177	2.03E-03	3.66E-05	4.99E-05	3.96E-09	6.31E-09	1.98E-09	2.50E-06	1.46E-07	2.03E-03	WL	4.94E+03	1.00E+04
Hf-181	4.00E+00	8.75E-02	1.70E-01	2.14E-06	2.68E-06	8.03E-07	2.55E+00	1.42E-01	4.00E+00	WL	2.50E+00	1.00E+00
Ta-182	3.39E+01	8.08E-01	1.60E+00	6.92E-04	1.57E-04	4.97E-06	3.86E+01	2.37E+00	3.86E+01	RH	2.59E-01	1.00E-01
W-181	2.52E-01	6.06E-04	5.77E-05	1.64E-04	3.42E-05	2.94E-08	4.05E-01	1.85E-02	4.05E-01	RH	2.47E+01	1.00E+01
W-185	2.56E-03	2.23E-03	2.91E-06	2.42E-04	4.18E-05	9.79E-08	2.96E-04	1.97E-03	2.56E-03	WL	3.91E+03	1.00E+04
W-187	9.25E-11	2.17E-12	4.27E-12	3.53E-18	2.44E-18	1.76E-18	7.25E-32	4.11E-33	9.25E-11	WL	1.00E+10	1.00E+10
Re-186	4.27E-05	1.70E-06	4.96E-07	2.43E-10	2.56E-10	1.21E-10	1.42E-10	1.19E-11	4.27E-05	WL	2.34E+05	1.00E+05
Re-188	9.92E-16	2.55E-17	3.64E-17	1.01E-21	5.75E-22	5.04E-22	7.67E-46	4.92E-47	9.92E-16	WL	1.00E+10	1.00E+10
Os-185	1.45E+01	3.47E-01	6.87E-01	1.52E-04	3.96E-05	5.01E-06	1.64E+01	9.32E-01	1.64E+01	RH	6.11E-01	1.00E+00
Os-191	3.93E-02	3.31E-04	2.87E-04	8.93E-08	1.42E-07	3.12E-07	3.42E-03	1.89E-04	3.93E-02	WL	2.55E+02	1.00E+02
Os-191m	1.25E-20	1.82E-22	3.99E-23	4.89E-26	7.28E-26	1.71E-25	8.86E-59	5.24E-60	1.25E-20	WL	1.00E+10	1.00E+10
Os-193	1.07E-09	2.51E-11	4.17E-11	6.16E-16	6.47E-16	2.16E-15	2.19E-26	1.27E-27	1.07E-09	WL	9.32E+09	1.00E+10
Ir-190	1.81E+00	4.08E-02	8.12E-02	6.41E-08	8.54E-08	3.21E-09	6.17E-02	3.44E-03	1.81E+00	WL	5.53E+00	1.00E+01
Ir-192	1.20E+01	2.64E-01	5.17E-01	7.79E-04	1.68E-04	2.04E-07	1.20E+01	6.62E-01	1.20E+01	WL	8.35E-01	1.00E+00
Ir-194	1.20E-13	3.14E-15	5.34E-15	5.86E-20	4.84E-20	2.93E-21	1.29E-39	7.82E-41	1.20E-13	WL	1.00E+10	1.00E+10
Pt-191	1.09E-04	2.10E-06	4.12E-06	4.73E-12	3.59E-12	1.65E-12	6.83E-12	3.72E-13	1.09E-04	WL	9.18E+04	1.00E+05
Pt-193	6.44E-04	6.16E-04	0.00E+00	7.99E-02	1.34E-02	4.89E-08	0.00E+00	1.19E-03	7.99E-02	RL-C	1.25E+02	1.00E+02
Pt-193m	4.07E-05	1.36E-06	1.66E-08	1.32E-10	8.65E-11	4.62E-11	1.32E-09	1.04E-10	4.07E-05	WL	2.46E+05	1.00E+05
Pt-197	4.50E-15	6.98E-17	5.94E-17	3.22E-21	2.04E-21	1.13E-21	2.89E-42	1.78E-43	4.50E-15	WL	1.00E+10	1.00E+10
Pt-197m	3.67E-141	6.25E-143	1.21E-142	1.82E-148	1.29E-148	6.38E-149	0.00E+00	0.00E+00	3.67E-141	WL	1.00E+10	1.00E+10
Au-198	1.40E-04	3.24E-06	6.29E-06	1.87E-11	2.00E-11	6.56E-12	4.27E-12	2.38E-13	1.40E-04	WL	7.16E+04	1.00E+05
Au-199	7.45E-05	8.54E-07	1.42E-06	4.06E-11	6.25E-11	1.42E-11	2.87E-11	1.59E-12	7.45E-05	WL	1.34E+05	1.00E+05
Hg-197	7.81E-06	2.41E-08	7.81E-09	4.54E-12	6.19E-12	1.59E-11	2.02E-13	1.07E-14	7.81E-06	WL	1.28E+06	1.00E+06
Hg-197m	1.17E-11	1.13E-13	1.70E-13	6.42E-18	7.54E-18	2.25E-17	9.73E-33	5.34E-34	1.17E-11	WL	1.00E+10	1.00E+10
Hg-203	1.74E+00	3.71E-02	6.49E-02	2.03E-03	4.54E-04	2.93E-06	1.24E+00	6.91E-02	1.74E+00	WL	5.73E+00	1.00E+01
Tl-200	2.46E-09	5.74E-11	1.15E-10	1.87E-17	1.53E-17	9.37E-18	2.52E-28	1.50E-29	2.46E-09	WL	4.06E+09	1.00E+10
Tl-201	3.74E-05	1.59E-07	2.70E-07	3.63E-12	2.64E-12	1.82E-12	8.52E-12	4.46E-13	3.74E-05	WL	2.67E+05	1.00E+05
Tl-202	2.64E-01	5.79E-03	1.14E-02	9.05E-09	7.75E-09	4.47E-09	9.10E-03	5.02E-04	2.64E-01	WL	3.79E+01	1.00E+02
Tl-204	5.02E-02	2.34E-02	2.21E-06	8.81E+00	1.61E+00	1.31E-06	5.31E-02	3.97E-02	8.81E+00	RL-C	1.14E+00	1.00E+00
Pb-203	1.12E-05	1.97E-07	3.87E-07	5.73E-13	6.25E-13	2.01E-12	5.31E-15	2.87E-16	1.12E-05	WL	8.90E+05	1.00E+06
Bi-206	2.21E-01	5.27E-03	1.05E-02	6.05E-09	7.01E-09	3.03E-10	1.59E-04	9.50E-06	2.21E-01	WL	4.52E+01	1.00E+02
Bi-207	1.19E+02	2.84E+00	5.64E+00	4.70E-01	1.11E-01	8.71E-07	2.13E+02	1.26E+01	2.13E+02	RH	4.69E-02	1.00E-01
Po-203	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Po-205	5.71E-120	1.34E-121	2.68E-121	1.25E-128	1.43E-128	6.26E-129	0.00E+00	0.00E+00	5.71E-120	WL	1.00E+10	1.00E+10
Po-207	1.24E-38	2.94E-40	5.87E-40	5.11E-47	4.27E-47	2.56E-47	1.54E-124	9.02E-126	1.24E-38	WL	1.00E+10	1.00E+10

	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
At-211	1.44E-33	1.86E-34	1.35E-35	2.58E-37	4.19E-37	1.29E-37	9.02E-104	1.71E-104	1.44E-33	WL	1.00E+10	1.00E+10
Ra-225	2.15E-01	3.75E-02	4.29E-03	2.78E-04	4.74E-04	1.39E-04	7.45E-03	4.15E-03	2.15E-01	WL	4.65E+01	1.00E+02
Ra-227	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Th-226	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Th-229	8.90E+01	1.52E+01	6.95E-01	1.81E+00	9.15E-01	9.50E-02	3.61E+01	1.47E+01	8.90E+01	WL	1.12E-01	1.00E-01
Pa-230	1.07E+00	2.63E-02	4.81E-02	6.31E-05	1.19E-04	3.15E-05	1.20E-01	7.12E-03	1.07E+00	WL	9.38E+00	1.00E+01
Pa-233	6.50E-01	1.27E-02	2.36E-02	9.50E-07	9.95E-07	2.83E-07	2.12E-01	1.17E-02	6.50E-01	WL	1.54E+01	1.00E+01
U-230	3.99E-01	5.20E-02	1.13E-03	9.93E-04	1.90E-03	4.96E-04	6.53E-03	5.64E-03	3.99E-01	WL	2.51E+01	1.00E+01
U-231	3.93E-04	1.60E-06	1.52E-06	2.25E-10	2.74E-10	1.12E-10	1.22E-08	6.70E-10	3.93E-04	WL	2.54E+04	1.00E+04
U-232	1.62E+02	1.36E+01	5.17E+00	1.23E+01	4.21E+00	6.55E-02	1.88E+02	2.17E+01	1.88E+02	RH	5.31E-02	1.00E-01
U-233	4.22E+00	1.26E+00	6.58E-03	1.12E+00	5.20E-01	5.73E-03	3.57E-01	8.78E-01	4.22E+00	WL	2.37E+00	1.00E+00
U-236	2.97E+00	1.02E+00	1.09E-07	8.93E-01	4.29E-01	4.40E-03	4.13E-03	6.85E-01	2.97E+00	WL	3.36E+00	1.00E+01
U-237	8.38E-03	9.63E-05	1.50E-04	6.86E-09	1.12E-08	3.43E-09	1.55E-05	8.50E-07	8.38E-03	WL	1.19E+03	1.00E+03
U-239	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
U-240	1.46E-17	3.66E-19	6.97E-19	2.16E-24	2.02E-24	1.08E-24	2.25E-53	1.31E-54	1.46E-17	WL	1.00E+10	1.00E+10
Np-237	3.24E+01	3.27E+00	4.82E-01	5.93E+00	4.02E+00	1.76E-02	2.75E+01	2.71E+00	3.24E+01	WL	3.09E-01	1.00E+00
Np-239	1.29E-05	1.80E-07	3.13E-07	5.41E-12	6.54E-12	2.71E-12	3.35E-14	1.85E-15	1.29E-05	WL	7.77E+05	1.00E+06
Np-240	9.92E-209	2.31E-210	4.62E-210	4.38E-217	4.61E-217	2.19E-217	0.00E+00	0.00E+00	9.92E-209	WL	1.00E+10	1.00E+10
Pu-234	5.35E-30	1.06E-30	0.00E+00	1.36E-32	2.63E-32	6.78E-33	0.00E+00	2.76E-88	5.35E-30	WL	1.00E+10	1.00E+10
Pu-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	WL	1.00E+10	1.00E+10
Pu-236	1.90E+01	2.53E+00	1.71E-01	1.72E-01	1.54E-01	1.86E-02	5.94E+00	1.71E+00	1.90E+01	WL	5.26E-01	1.00E+00
Pu-237	2.01E-01	5.47E-04	6.61E-04	3.83E-07	2.27E-07	6.61E-08	1.33E-01	7.20E-03	2.01E-01	WL	4.97E+01	1.00E+02
Pu-238	3.68E+01	6.19E+00	4.28E-09	3.34E-01	4.20E-01	3.24E-02	1.01E-03	2.25E+00	3.68E+01	WL	2.72E-01	1.00E-01
Pu-239	3.96E+01	6.73E+00	1.66E-05	3.53E-01	4.60E-01	3.39E-02	4.78E-03	2.37E+00	3.96E+01	WL	2.53E-01	1.00E-01
Pu-240	3.96E+01	6.73E+00	1.18E-11	3.53E-01	4.60E-01	3.39E-02	1.05E-03	2.37E+00	3.96E+01	WL	2.53E-01	1.00E-01
Pu-241	1.67E+00	2.79E-01	6.21E-09	1.31E-02	1.88E-02	1.29E-03	2.86E-02	9.16E-02	1.67E+00	WL	6.00E+00	1.00E+01
Pu-242	3.83E+01	6.47E+00	1.50E-11	3.36E-01	4.42E-01	3.21E-02	1.03E-03	2.26E+00	3.83E+01	WL	2.61E-01	1.00E-01
Pu-243	4.62E-48	3.17E-50	4.53E-50	1.82E-54	2.11E-54	9.11E-55	7.39E-151	4.11E-152	4.62E-48	WL	1.00E+10	1.00E+10
Pu-244	5.68E+01	6.97E+00	9.17E-01	3.51E-01	4.43E-01	3.20E-02	3.58E+01	4.42E+00	5.68E+01	WL	1.76E-01	1.00E-01
Am-241	3.35E+01	5.45E+00	2.16E-07	5.63E-01	5.53E-01	3.03E-02	1.00E+00	2.13E+00	3.35E+01	WL	2.98E-01	1.00E-01
Am-242	2.72E-17	4.32E-19	1.08E-19	4.86E-21	7.65E-21	2.43E-21	4.33E-49	2.76E-50	2.72E-17	WL	1.00E+10	1.00E+10
Am-242m	4.68E+01	7.63E+00	1.22E-02	7.63E-01	7.65E-01	4.11E-02	1.47E+00	2.92E+00	4.68E+01	WL	2.14E-01	1.00E-01
Am-243	4.35E+01	5.60E+00	2.14E-01	5.73E-01	5.52E-01	3.00E-02	2.05E+01	3.22E+00	4.35E+01	WL	2.30E-01	1.00E-01
Cm-242	1.99E+00	2.12E-01	8.36E-12	1.31E-02	1.30E-02	3.63E-03	3.53E-04	1.52E-01	1.99E+00	WL	5.03E+00	1.00E+01
Cm-243	3.10E+01	4.12E+00	1.70E-01	2.70E-01	2.75E-01	2.65E-02	1.32E+01	2.54E+00	3.10E+01	WL	3.23E-01	1.00E+00
Cm-244	2.04E+01	3.26E+00	1.00E-11	2.36E-01	2.28E-01	2.46E-02	6.60E-04	1.61E+00	2.04E+01	WL	4.90E-01	1.00E+00
Cm-245	4.11E+01	6.44E+00	2.74E-02	3.54E-01	4.40E-01	3.44E-02	6.27E+00	2.71E+00	4.11E+01	WL	2.43E-01	1.00E-01

Nuclide	Effective Dose for Scenario [µSv/a/(Bq/g)]										excl. level [Bq/g]	excl. level rounded [Bq/g]
	WL	WF	WO	RL-C	RL-A	RF	RH	RP	Maximum	Pathway		
Cm-246	3.34E+01	5.66E+00	3.29E-15	3.12E-01	3.86E-01	3.04E-02	2.72E-04	2.09E+00	3.34E+01	WL	3.00E-01	1.00E-01
Cm-247	5.43E+01	5.70E+00	9.92E-01	2.97E-01	3.58E-01	2.80E-02	4.51E+01	4.47E+00	5.43E+01	WL	1.84E-01	1.00E-01
Cm-248	1.18E+02	2.05E+01	8.48E-12	1.16E+00	1.40E+00	1.06E-01	5.98E-04	7.84E+00	1.18E+02	WL	8.47E-02	1.00E-01
Bk-249	2.09E-01	3.22E-02	1.58E-03	3.66E-03	2.58E-03	2.01E-04	6.16E-02	1.89E-02	2.09E-01	WL	4.77E+01	1.00E+02
Cf-246	2.43E-09	4.64E-10	2.40E-14	6.25E-12	1.18E-11	3.12E-12	6.95E-26	5.65E-24	2.43E-09	WL	4.12E+09	1.00E+10
Cf-248	5.31E+00	6.82E-01	2.92E-13	4.08E-01	1.28E-01	1.00E-02	9.59E-05	5.62E-01	5.31E+00	WL	1.88E+00	1.00E+00
Cf-249	7.84E+01	9.95E+00	9.75E-01	6.05E+00	3.42E+00	6.62E-02	4.41E+01	7.30E+00	7.84E+01	WL	1.28E-01	1.00E-01
Cf-250	2.62E+01	4.27E+00	6.17E-08	3.54E+00	1.46E+00	4.19E-02	1.42E-03	2.98E+00	2.62E+01	WL	3.81E-01	1.00E+00
Cf-251	6.26E+01	9.73E+00	1.06E-01	6.11E+00	3.50E+00	6.60E-02	1.15E+01	5.54E+00	6.26E+01	WL	1.60E-01	1.00E-01
Cf-252	1.36E+01	2.15E+00	2.27E-08	2.40E+00	6.15E-01	3.29E-02	8.13E-04	2.33E+00	1.36E+01	WL	7.35E-01	1.00E+00
Cf-253	4.30E-02	3.64E-03	9.45E-06	1.35E-04	2.37E-04	6.77E-05	3.33E-05	2.32E-04	4.30E-02	WL	2.33E+02	1.00E+02
Cf-254	5.48E+00	1.58E+00	0.00E+00	1.01E-01	4.83E-02	1.44E-02	0.00E+00	1.08E+00	5.48E+00	WL	1.83E+00	1.00E+00
Es-253	7.10E-02	6.98E-03	1.99E-05	2.07E-04	3.82E-04	1.03E-04	1.18E-04	7.00E-04	7.10E-02	WL	1.41E+02	1.00E+02
Es-254	4.58E+01	1.66E+00	1.99E+00	1.20E-01	5.50E-02	9.58E-03	6.11E+01	4.19E+00	6.11E+01	RH	1.64E-01	1.00E-01
Es-254m	9.01E-07	2.37E-08	4.27E-08	2.74E-11	5.23E-11	1.37E-11	2.47E-19	1.46E-20	9.01E-07	WL	1.11E+07	1.00E+07
Fm-254	6.71E-72	9.31E-73	5.87E-77	1.45E-74	2.10E-74	7.27E-75	1.96E-229	1.13E-228	6.71E-72	WL	1.00E+10	1.00E+10
Fm-255	2.20E-14	3.72E-15	9.16E-18	3.73E-17	7.52E-17	1.86E-17	4.80E-40	4.73E-40	2.20E-14	WL	1.00E+10	1.00E+10

TABLE I-VIII: Calculations for Low Probability Scenarios (except water pathway)

	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**SKIN**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
H-3	6.45E-03	8.13E-03	0.00E+00	2.25E+00	1.02E+00	1.82E-04	0.00E+00	1.16E-02	0.00E+00	2.25E+00	RL-C	4.45E+02	1.00E+03
Be-7	1.45E+01	3.35E+00	3.34E+00	9.97E-05	1.17E-04	2.28E-06	4.14E+00	2.96E-01	2.96E-03	1.45E+01	WL	6.91E+01	1.00E+02
C-14	1.08E-01	1.46E-01	0.00E+00	2.28E+01	1.07E+01	4.45E-03	0.00E+00	1.63E-01	9.74E-01	2.28E+01	RL-C	4.38E+01	1.00E+02
F-18	3.48E-02	8.13E-03	8.13E-03	1.41E-08	1.47E-08	2.47E-08	0.00E+00	0.00E+00	2.90E+00	2.90E+00	SKIN	3.45E+02	1.00E+03
Na-22	7.00E+02	1.68E+02	1.67E+02	1.13E+01	3.13E+00	4.92E-03	2.48E+03	1.92E+02	2.72E+00	2.48E+03	RH	4.03E-01	1.00E+00
Na-24	4.74E+02	1.10E+02	1.10E+02	2.27E-04	1.86E-04	3.97E-04	4.15E-48	3.62E-49	3.16E+00	4.74E+02	WL	2.11E+00	1.00E+00
Si-31	5.58E-04	1.57E-04	1.28E-04	3.23E-07	2.96E-07	8.07E-09	6.50E-279	1.05E-279	3.21E+00	3.21E+00	SKIN	3.12E+02	1.00E+03
P-32	2.52E-01	2.35E-01	0.00E+00	5.51E-03	6.81E-03	1.38E-03	0.00E+00	8.24E-04	2.96E+00	2.96E+00	SKIN	3.38E+02	1.00E+03
P-33	3.43E-02	2.61E-02	0.00E+00	1.91E-03	3.10E-03	4.31E-04	0.00E+00	1.22E-03	1.73E+00	1.73E+00	SKIN	5.79E+02	1.00E+03
S-35	8.58E-02	7.88E-02	0.00E+00	1.21E+00	2.25E-01	4.30E-04	0.00E+00	8.03E-02	9.74E-01	1.21E+00	RL-C	8.30E+02	1.00E+03
Cl-36	1.37E-01	1.70E-01	0.00E+00	6.43E+02	1.23E+02	1.75E-02	0.00E+00	6.41E-01	2.71E+00	6.43E+02	RL-C	1.56E+00	1.00E+00
Cl-38	1.26E-09	2.98E-10	2.98E-10	2.80E-16	2.29E-16	4.90E-16	0.00E+00	0.00E+00	8.33E+00	8.33E+00	SKIN	1.20E+02	1.00E+02
K-40	5.35E+01	1.35E+01	1.28E+01	4.71E+02	9.00E+01	1.15E-02	2.14E+02	2.18E+01	2.60E+00	4.71E+02	RL-C	2.12E+00	1.00E+00
K-42	2.42E+01	5.86E+00	5.85E+00	9.93E-05	6.50E-05	1.74E-04	9.38E-60	7.85E-61	7.78E+00	2.42E+01	WL	4.14E+01	1.00E+02
K-43	1.38E+02	3.20E+01	3.20E+01	1.80E-04	1.42E-04	3.15E-04	9.49E-32	6.81E-33	2.53E+00	1.38E+02	WL	7.25E+00	1.00E+01
Ca-41	3.06E-02	2.94E-02	0.00E+00	3.71E+00	1.76E+00	2.51E-05	0.00E+00	5.21E-02	0.00E+00	3.71E+00	RL-C	2.69E+02	1.00E+02
Ca-45	9.55E-02	8.06E-02	0.00E+00	3.83E+00	7.23E-01	8.44E-04	0.00E+00	1.65E-01	1.73E+00	3.83E+00	RL-C	2.61E+02	1.00E+02
Ca-47	3.11E+02	7.42E+01	7.41E+01	2.92E-03	3.96E-03	7.30E-04	3.53E-06	2.84E-07	5.12E+00	3.11E+02	WL	3.22E+00	1.00E+01
Sc-46	6.51E+02	1.59E+02	1.58E+02	1.13E-02	1.48E-02	2.20E-03	3.91E+02	3.03E+01	2.23E+00	6.51E+02	WL	1.54E+00	1.00E+00
Sc-47	1.91E+01	1.76E+00	1.72E+00	8.78E-04	1.25E-03	2.19E-04	1.63E-09	1.18E-10	1.73E+00	1.91E+01	WL	5.23E+01	1.00E+02
Sc-48	7.55E+02	1.84E+02	1.84E+02	1.56E-03	1.58E-03	3.89E-04	1.08E-15	8.52E-17	2.65E+00	7.55E+02	WL	1.32E+00	1.00E+00
V-48	9.07E+02	2.19E+02	2.19E+02	4.06E-03	4.83E-03	1.02E-03	3.44E+00	2.68E-01	4.38E+00	9.07E+02	WL	1.10E+00	1.00E+00
Cr-51	8.29E+00	1.71E+00	1.71E+00	7.15E-05	6.56E-05	1.79E-05	3.66E-01	2.57E-02	1.60E-02	8.29E+00	WL	1.21E+02	1.00E+02
Mn-51	1.26E-07	2.93E-08	2.93E-08	4.42E-14	3.66E-14	3.87E-15	0.00E+00	0.00E+00	5.12E+00	5.12E+00	SKIN	1.95E+02	1.00E+02
Mn-52	9.92E+02	2.40E+02	2.40E+02	2.31E-03	2.59E-03	2.02E-04	3.31E-04	2.58E-05	1.01E+00	9.92E+02	WL	1.01E+00	1.00E+00
Mn-52m	1.86E-18	4.46E-19	4.46E-19	1.76E-25	1.47E-25	1.54E-26	0.00E+00	0.00E+00	6.30E+00	6.30E+00	SKIN	1.59E+02	1.00E+02
Mn-53	3.31E-03	3.03E-03	0.00E+00	1.35E+00	2.38E-01	1.15E-05	0.00E+00	2.21E-02	9.00E-05	1.35E+00	RL-C	7.43E+02	1.00E+03
Mn-54	2.66E+02	6.46E+01	6.45E+01	5.82E+00	1.73E+00	2.09E-04	6.51E+02	4.90E+01	6.53E-02	6.51E+02	RH	1.54E+00	1.00E+00
Mn-56	1.01E+00	2.42E-01	2.42E-01	5.36E-07	4.50E-07	4.69E-08	1.24E-275	9.98E-277	4.55E+00	4.55E+00	SKIN	2.20E+02	1.00E+02
Fe-52	1.14E+02	2.65E+01	2.65E+01	2.18E-04	1.74E-04	5.45E-06	9.33E-88	7.12E-89	8.69E+00	1.14E+02	WL	8.77E+00	1.00E+01
Fe-55	3.58E-02	3.30E-02	0.00E+00	3.39E-02	6.74E-03	1.35E-05	0.00E+00	1.98E-01	1.73E-02	1.98E-01	RP	5.06E+03	1.00E+04
Fe-59	3.88E+02	9.43E+01	9.42E+01	5.07E-03	7.68E-03	1.23E-04	5.87E+01	4.70E+00	2.16E+00	3.88E+02	WL	2.58E+00	1.00E+00
Co-55	2.38E+02	5.70E+01	5.70E+01	4.62E-04	4.07E-04	1.16E-05	4.57E-41	3.44E-42	2.59E+00	2.38E+02	WL	4.19E+00	1.00E+01
Co-56	1.20E+03	2.86E+02	2.85E+02	3.27E-01	7.87E-02	2.01E-04	6.35E+02	5.21E+01	1.54E+00	1.20E+03	WL	8.30E-01	1.00E+00
Co-57	2.29E+01	1.23E+00	1.21E+00	6.65E-01	1.14E-01	2.11E-05	5.57E+01	3.92E+00	1.62E-01	5.57E+01	RH	1.79E+01	1.00E+01
Co-58	3.04E+02	7.34E+01	7.33E+01	5.24E-02	1.42E-02	6.20E-05	1.35E+02	1.01E+01	5.19E-01	3.04E+02	WL	3.29E+00	1.00E+01
Co-58m	2.39E-01	5.80E-02	5.76E-02	6.34E-06	6.71E-06	1.58E-07	3.47E-85	2.66E-86	2.63E-01	2.63E-01	SKIN	3.81E+03	1.00E+04
Co-60	8.37E+02	2.04E+02	2.03E+02	3.63E+01	5.93E+00	3.28E-04	3.15E+03	2.55E+02	2.11E+00	3.15E+03	RH	3.18E-01	1.00E+00
Co-60m	6.88E-42	1.55E-42	1.55E-42	1.05E-47	1.46E-47	2.62E-49	0.00E+00	0.00E+00	7.04E-01	7.04E-01	SKIN	1.42E+03	1.00E+03

Nuclide	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
	WL	WF	WO	RL-C	RL-A	RF	RH	RP	SKIN	Maximum	Pathway	[Bq/g]	[Bq/g]
Co-61	7.40E-04	1.18E-04	1.18E-04	4.75E-09	4.51E-09	1.19E-10	0.00E+00	0.00E+00	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Co-62m	1.71E-29	4.14E-30	4.14E-30	9.53E-37	8.00E-37	2.38E-38	0.00E+00	0.00E+00	5.82E+00	5.82E+00	SKIN	1.72E+02	1.00E+02
Ni-59	7.11E-03	6.32E-03	0.00E+00	2.08E+00	4.99E-01	5.97E-06	0.00E+00	3.43E-02	1.60E-04	2.08E+00	RL-C	4.81E+02	1.00E+03
Ni-63	1.77E-02	1.51E-02	0.00E+00	5.09E+00	1.18E+00	1.83E-05	0.00E+00	8.44E-02	1.97E-02	5.09E+00	RL-C	1.97E+02	1.00E+02
Ni-65	2.63E-01	6.37E-02	6.36E-02	2.87E-07	2.56E-07	7.18E-09	1.28E-285	1.04E-286	3.49E+00	3.49E+00	SKIN	2.87E+02	1.00E+02
Cu-64	1.46E+01	3.41E+00	3.41E+00	5.66E-05	6.50E-05	1.41E-06	6.52E-60	4.71E-61	1.38E+00	1.46E+01	WL	6.86E+01	1.00E+02
Zn-65	1.91E+02	4.68E+01	4.64E+01	1.45E+02	4.56E+01	4.37E-03	3.82E+02	3.07E+01	9.49E-02	3.82E+02	RH	2.62E+00	1.00E+00
Zn-69	1.67E-10	1.32E-10	1.27E-11	1.72E-12	1.74E-12	3.00E-12	0.00E+00	0.00E+00	2.47E+00	2.47E+00	SKIN	4.06E+02	1.00E+03
Zn-69m	3.67E+01	8.39E+00	8.38E+00	1.90E-04	1.68E-04	3.32E-04	3.71E-52	2.65E-53	2.86E+00	3.67E+01	WL	2.72E+01	1.00E+01
Ga-72	2.78E+02	6.60E+01	6.59E+01	3.88E-04	3.40E-04	6.79E-04	2.45E-51	1.99E-52	2.61E+00	2.78E+02	WL	3.60E+00	1.00E+01
Ge-71	1.22E-03	1.13E-03	0.00E+00	3.12E-05	2.18E-05	7.81E-07	0.00E+00	9.58E-07	2.71E-04	1.22E-03	WL	8.19E+05	1.00E+06
As-73	3.44E-01	2.59E-02	3.62E-08	4.19E-02	9.23E-03	3.82E-05	2.41E-01	3.80E-02	6.54E-01	6.54E-01	SKIN	1.53E+03	1.00E+03
As-74	2.22E+02	5.28E+01	5.27E+01	3.12E-03	4.25E-03	7.79E-05	1.56E+00	1.14E-01	2.52E+00	2.22E+02	WL	4.50E+00	1.00E+01
As-76	7.14E+01	1.71E+01	1.70E+01	9.41E-04	8.26E-04	2.35E-05	8.36E-28	6.41E-29	5.75E+00	7.14E+01	WL	1.40E+01	1.00E+01
As-77	1.52E+00	3.15E-01	2.89E-01	4.26E-04	5.33E-04	1.06E-05	1.24E-20	1.21E-21	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Se-75	9.42E+01	1.56E+01	1.54E+01	1.36E+00	3.53E-01	5.75E-04	1.07E+02	7.71E+00	2.31E-01	1.07E+02	RH	9.37E+00	1.00E+01
Se-79	3.04E-01	2.93E-01	0.00E+00	5.71E+01	7.66E+00	1.25E-03	0.00E+00	2.81E+00	1.23E+00	5.71E+01	RL-C	1.75E+01	1.00E+01
Br-82	5.24E+02	1.26E+02	1.26E+02	7.19E-04	8.24E-04	1.80E-05	5.15E-20	3.90E-21	1.64E+00	5.24E+02	WL	1.91E+00	1.00E+00
Rb-86	3.02E+01	7.57E+00	7.30E+00	2.87E-03	1.89E-03	7.15E-05	2.36E-01	2.20E-02	2.84E+00	3.02E+01	WL	3.31E+01	1.00E+02
Rb-87	1.57E-01	1.50E-01	0.00E+00	4.08E+01	7.92E+00	3.95E-05	0.00E+00	1.00E+00	0.00E+00	4.08E+01	RL-C	2.45E+01	1.00E+01
Sr-85	1.51E+02	3.53E+01	3.52E+01	1.04E-01	2.53E-02	2.96E-04	6.27E+01	4.51E+00	6.90E-02	1.51E+02	WL	6.64E+00	1.00E+01
Sr-85m	2.39E-05	3.79E-06	3.79E-06	4.69E-12	4.27E-12	1.17E-12	0.00E+00	0.00E+00	1.49E-01	1.49E-01	SKIN	6.70E+03	1.00E+04
Sr-87m	2.38E-01	5.29E-02	5.29E-02	1.22E-07	1.11E-07	3.06E-08	3.65E-259	2.57E-260	7.48E-01	7.48E-01	SKIN	1.34E+03	1.00E+03
Sr-89	3.48E-01	2.79E-01	1.06E-02	1.65E-01	4.19E-02	2.28E-03	9.99E-03	9.43E-02	2.84E+00	2.84E+00	SKIN	3.53E+02	1.00E+03
Sr-90	3.75E+00	3.24E+00	0.00E+00	5.49E+02	2.35E+02	1.14E-02	0.00E+00	9.18E+00	5.55E+00	5.49E+02	RL-C	1.82E+00	1.00E+00
Sr-91	3.92E+01	9.53E+00	9.51E+00	1.51E-04	1.38E-04	3.77E-05	1.62E-75	1.24E-76	2.88E+00	3.92E+01	WL	2.55E+01	1.00E+01
Sr-92	1.04E+00	2.52E-01	2.52E-01	1.50E-06	1.23E-06	3.76E-07	7.89E-267	6.41E-268	2.18E+00	2.18E+00	SKIN	4.58E+02	1.00E+03
Y-90	2.19E-01	2.11E-01	0.00E+00	2.50E-03	2.27E-03	6.24E-04	0.00E+00	1.06E-13	2.96E+00	2.96E+00	SKIN	3.38E+02	1.00E+03
Y-91	1.48E+00	5.39E-01	2.89E-01	1.64E-02	1.91E-02	3.24E-03	3.55E-01	1.56E-01	2.84E+00	2.84E+00	SKIN	3.53E+02	1.00E+03
Y-91m	2.68E-07	6.36E-08	6.36E-08	5.15E-14	5.78E-14	1.29E-14	0.00E+00	0.00E+00	3.30E-01	3.30E-01	SKIN	3.03E+03	1.00E+04
Y-92	7.10E-01	1.72E-01	1.72E-01	4.01E-06	3.28E-06	1.00E-06	1.33E-207	1.04E-208	7.78E+00	7.78E+00	SKIN	1.28E+02	1.00E+02
Y-93	5.91E+00	1.39E+00	1.36E+00	2.38E-04	1.81E-04	5.94E-05	3.90E-70	3.37E-71	6.29E+00	6.29E+00	SKIN	1.59E+02	1.00E+02
Zr-93	9.94E-02	4.14E-02	0.00E+00	3.60E-02	5.43E-02	5.28E-05	9.81E-03	1.69E-01	2.60E-02	1.69E-01	RP	5.93E+03	1.00E+04
Zr-95	3.43E+02	8.31E+01	8.30E+01	7.66E-03	1.16E-02	1.77E-04	1.23E+02	9.18E+00	3.38E+00	3.43E+02	WL	2.91E+00	1.00E+00
Zr-97	3.25E+02	7.84E+01	7.83E+01	7.81E-04	7.39E-04	1.95E-05	4.26E-43	3.17E-44	5.78E+00	3.25E+02	WL	3.08E+00	1.00E+01
Nb-93m	1.45E-02	1.26E-02	0.00E+00	1.73E-01	3.05E-02	2.31E-04	9.52E-03	8.86E-02	1.23E-04	1.73E-01	RL-C	5.77E+03	1.00E+04
Nb-94	4.98E+02	1.21E+02	1.21E+02	1.99E+00	4.72E-01	3.57E-03	2.23E+03	1.67E+02	2.44E+00	2.23E+03	RH	4.49E-01	1.00E+00
Nb-95	2.36E+02	5.73E+01	5.72E+01	2.03E-03	3.11E-03	4.91E-04	2.07E+01	1.54E+00	7.93E-01	2.36E+02	WL	4.23E+00	1.00E+01
Nb-97	2.64E-04	6.35E-05	6.35E-05	1.24E-10	1.16E-10	3.10E-11	0.00E+00	0.00E+00	2.88E+00	2.88E+00	SKIN	3.48E+02	1.00E+03
Nb-98	3.10E-06	7.47E-07	7.47E-07	5.33E-13	4.52E-13	1.33E-13	0.00E+00	0.00E+00	4.97E+00	4.97E+00	SKIN	2.01E+02	1.00E+02

Nuclide	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
	WL	WF	WO	RL-C	RL-A	RF	RH	RP	SKIN	Maximum	Pathway	[Bq/g]	[Bq/g]
Mo-90	1.34E+01	2.70E+00	2.70E+00	4.15E-05	3.85E-05	1.04E-05	1.40E-127	1.02E-128	2.52E+00	1.34E+01	WL	7.45E+01	1.00E+02
Mo-93	2.85E-01	2.75E-01	0.00E+00	3.18E+01	1.70E+01	3.99E-04	6.51E-02	7.81E-01	6.78E-04	3.18E+01	RL-C	3.15E+01	1.00E+02
Mo-99	5.01E+01	9.36E+00	9.26E+00	1.34E-03	1.47E-03	3.34E-04	3.24E-11	2.38E-12	2.85E+00	5.01E+01	WL	2.00E+01	1.00E+01
Mo-101	1.82E-27	4.29E-28	4.29E-28	2.39E-34	2.17E-34	5.96E-35	0.00E+00	0.00E+00	3.29E+00	3.29E+00	SKIN	3.04E+02	1.00E+03
Tc-96	6.78E+02	1.65E+02	1.64E+02	1.28E-03	1.22E-03	3.21E-04	8.19E-06	6.16E-07	2.55E-01	6.78E+02	WL	1.47E+00	1.00E+00
Tc-96m	7.51E-08	1.82E-08	1.82E-08	1.11E-13	1.03E-13	2.77E-14	0.00E+00	0.00E+00	2.99E-01	2.99E-01	SKIN	3.34E+03	1.00E+04
Tc-97	9.69E-03	8.65E-03	0.00E+00	5.00E+01	8.98E+00	9.64E-05	8.40E-02	4.94E-02	6.12E-02	5.00E+01	RL-C	2.00E+01	1.00E+01
Tc-97m	1.37E-01	7.16E-02	3.48E-04	7.62E+00	1.33E+00	9.56E-04	4.87E-02	6.38E-02	9.38E-01	7.62E+00	RL-C	1.31E+02	1.00E+02
Tc-99	1.06E-01	8.49E-02	3.83E-07	4.90E+02	8.45E+01	1.25E-03	3.76E-04	4.86E-01	1.73E+00	4.90E+02	RL-C	2.04E+00	1.00E+00
Tc-99m	1.62E+00	1.08E-01	1.08E-01	2.43E-06	2.55E-06	6.08E-07	3.64E-121	2.51E-122	3.66E-01	1.62E+00	WL	6.16E+02	1.00E+03
Ru-97	4.47E+01	7.39E+00	7.38E+00	1.85E-04	1.66E-04	3.25E-04	1.54E-10	1.07E-11	1.64E-01	4.47E+01	WL	2.24E+01	1.00E+01
Ru-103	1.41E+02	3.30E+01	3.29E+01	4.56E-03	5.25E-03	5.58E-03	1.89E+01	1.36E+00	1.39E+00	1.41E+02	WL	7.08E+00	1.00E+01
Ru-105	5.82E+00	1.37E+00	1.37E+00	1.00E-05	1.03E-05	1.76E-05	1.56E-162	1.15E-163	2.89E+00	5.82E+00	WL	1.72E+02	1.00E+02
Ru-106	4.11E+01	1.05E+01	9.50E+00	1.81E+01	3.39E+00	7.41E-02	1.10E+02	1.10E+01	3.10E+00	1.10E+02	RH	9.10E+00	1.00E+01
Rh-102	6.59E+02	1.58E+02	1.58E+02	2.86E+01	9.65E+00	3.37E-02	2.46E+03	1.84E+02	0.00E+00	2.46E+03	RH	4.06E-01	1.00E+00
Rh-103m	3.81E-11	1.33E-11	0.00E+00	1.59E-13	1.80E-13	2.79E-13	0.00E+00	0.00E+00	1.73E-03	1.73E-03	SKIN	5.79E+05	1.00E+06
Rh-105	1.30E+01	2.69E+00	2.66E+00	4.08E-04	4.58E-04	7.13E-04	1.39E-21	1.00E-22	2.22E+00	1.30E+01	WL	7.68E+01	1.00E+02
Pd-103	5.39E-02	2.50E-02	6.37E-03	6.71E-04	9.14E-04	1.68E-05	4.93E-04	1.85E-04	2.71E-03	5.39E-02	WL	1.86E+04	1.00E+04
Pd-107	6.21E-03	3.76E-03	0.00E+00	5.72E-01	9.89E-02	1.93E-05	0.00E+00	2.89E-02	0.00E+00	5.72E-01	RL-C	1.75E+03	1.00E+03
Pd-109	2.16E-01	2.96E-02	1.41E-02	2.06E-04	2.19E-04	5.16E-06	8.12E-58	1.46E-58	4.69E+00	4.69E+00	SKIN	2.13E+02	1.00E+02
Ag-105	1.46E+02	3.18E+01	3.17E+01	1.47E-03	1.54E-03	2.32E-04	1.95E+01	1.40E+00	2.44E-01	1.46E+02	WL	6.86E+00	1.00E+01
Ag-108m	4.88E+02	1.16E+02	1.16E+02	2.24E+00	6.18E-01	1.82E-03	2.23E+03	1.63E+02	4.56E-02	2.23E+03	RH	4.49E-01	1.00E+00
Ag-110m	8.74E+02	2.12E+02	2.12E+02	6.71E-01	1.87E-01	1.88E-03	1.84E+03	1.41E+02	1.05E+00	1.84E+03	RH	5.44E-01	1.00E+00
Ag-111	6.64E+00	1.47E+00	1.35E+00	2.31E-03	2.87E-03	4.05E-04	7.41E-05	7.20E-06	2.47E+00	6.64E+00	WL	1.51E+02	1.00E+02
Cd-109	7.98E-01	3.47E-01	2.20E-03	4.41E+01	1.20E+01	2.49E-02	2.11E+00	7.62E-01	2.24E+00	4.41E+01	RL-C	2.27E+01	1.00E+01
Cd-113m	7.51E+01	2.02E+01	1.59E+01	5.29E+02	2.82E+02	1.82E-01	3.26E+02	2.85E+01	2.47E+00	5.29E+02	RL-C	1.89E+00	1.00E+00
Cd-115	6.95E+01	1.57E+01	1.56E+01	1.51E-03	1.77E-03	2.65E-03	1.18E-13	8.66E-15	4.46E+00	6.95E+01	WL	1.44E+01	1.00E+01
Cd-115m	7.41E+00	2.13E+00	1.71E+00	1.16E-01	3.43E-02	2.12E-02	1.09E+00	1.52E-01	2.84E+00	7.41E+00	WL	1.35E+02	1.00E+02
In-111	7.25E+01	1.08E+01	1.08E+01	3.61E-04	3.78E-04	6.33E-04	9.68E-11	6.72E-12	5.55E-01	7.25E+01	WL	1.38E+01	1.00E+01
In-113m	3.27E-03	7.28E-04	7.28E-04	1.93E-09	1.92E-09	3.39E-09	0.00E+00	0.00E+00	1.06E+00	1.06E+00	SKIN	9.48E+02	1.00E+03
In-114m	3.39E+01	7.80E+00	7.23E+00	3.20E-02	1.97E-02	5.12E-02	8.12E+00	7.45E-01	1.49E+00	3.39E+01	WL	2.95E+01	1.00E+01
In-115m	1.04E+00	2.19E-01	2.19E-01	3.07E-06	3.00E-06	5.37E-06	2.92E-163	2.05E-164	1.86E+00	1.86E+00	SKIN	5.38E+02	1.00E+03
Sn-113	7.23E+01	1.61E+01	1.60E+01	1.36E+00	2.62E-01	6.78E-03	7.48E+01	5.36E+00	1.07E+00	7.48E+01	RH	1.34E+01	1.00E+01
Sn-121m	1.02E-01	1.15E-01	0.00E+00	2.64E+01	4.75E+00	1.09E-02	9.72E-02	4.46E-01	0.00E+00	2.64E+01	RL-C	3.78E+01	1.00E+02
Sn-125	9.39E+01	2.29E+01	2.26E+01	5.43E-03	6.16E-03	9.51E-03	1.08E-02	9.03E-04	4.46E+00	9.39E+01	WL	1.07E+01	1.00E+01
Sn-126	6.04E+02	1.43E+02	1.42E+02	1.84E+02	3.73E+01	6.75E-02	2.76E+03	2.04E+02	1.97E+00	2.76E+03	RH	3.62E-01	1.00E+00
Sb-122	1.04E+02	2.48E+01	2.47E+01	1.70E-03	1.63E-03	4.25E-05	4.73E-11	3.51E-12	3.11E+00	1.04E+02	WL	9.61E+00	1.00E+01
Sb-124	6.06E+02	1.46E+02	1.45E+02	1.05E-02	1.36E-02	2.29E-04	2.04E+02	1.62E+01	2.69E+00	6.06E+02	WL	1.65E+00	1.00E+00
Sb-125	1.23E+02	2.86E+01	2.85E+01	1.10E-01	3.46E-02	1.75E-04	4.76E+02	3.47E+01	2.26E+00	4.76E+02	RH	2.10E+00	1.00E+00
Te-123m	2.89E+01	2.72E+00	2.57E+00	9.19E+00	1.90E+00	1.25E-03	3.30E+01	2.47E+00	2.48E+00	3.30E+01	RH	3.03E+01	1.00E+02

Nuclide	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
	WL	WF	WO	RL-C	RL-A	RF	RH	RP	SKIN	Maximum	Pathway	[Bq/g]	[Bq/g]
Te-125m	2.62E-01	9.37E-02	1.50E-03	3.89E-01	7.58E-02	1.05E-03	1.88E-01	4.77E-02	3.23E+00	3.23E+00	SKIN	3.10E+02	1.00E+03
Te-127	2.46E-01	5.67E-02	5.36E-02	5.01E-05	4.86E-05	1.25E-05	1.08E-77	9.64E-79	2.59E+00	2.59E+00	SKIN	3.86E+02	1.00E+03
Te-127m	1.68E+00	5.52E-01	2.94E-01	1.51E+01	2.53E+00	2.56E-03	1.48E+00	4.95E-01	4.56E+00	1.51E+01	RL-C	6.61E+01	1.00E+02
Te-129	7.11E-06	1.64E-06	1.64E-06	3.84E-11	3.52E-11	9.60E-12	0.00E+00	0.00E+00	2.84E+00	2.84E+00	SKIN	3.52E+02	1.00E+03
Te-129m	1.97E+01	4.86E+00	4.55E+00	4.50E-02	1.93E-02	2.47E-03	1.53E+00	1.52E-01	4.57E+00	1.97E+01	WL	5.09E+01	1.00E+02
Te-131	7.85E-16	1.64E-16	1.64E-16	8.14E-22	6.02E-22	2.04E-22	0.00E+00	0.00E+00	3.48E+00	3.48E+00	SKIN	2.88E+02	1.00E+02
Te-131m	2.78E+02	6.57E+01	6.54E+01	3.03E-03	2.12E-03	7.58E-04	5.81E-24	4.49E-25	3.55E+00	2.78E+02	WL	3.60E+00	1.00E+01
Te-132	5.67E+02	1.34E+02	1.33E+02	4.32E-03	3.54E-03	1.08E-03	2.18E-08	1.65E-09	4.72E+00	5.67E+02	WL	1.76E+00	1.00E+00
Te-133	1.26E-32	2.92E-33	2.91E-33	5.05E-39	3.13E-39	1.26E-39	0.00E+00	0.00E+00	4.50E+00	4.50E+00	SKIN	2.22E+02	1.00E+02
Te-133m	4.34E-06	1.03E-06	1.03E-06	2.80E-12	1.74E-12	6.99E-13	0.00E+00	0.00E+00	4.97E+00	4.97E+00	SKIN	2.01E+02	1.00E+02
Te-134	2.59E-08	6.05E-09	6.05E-09	9.66E-15	8.33E-15	2.42E-15	0.00E+00	0.00E+00	1.66E+00	1.66E+00	SKIN	6.03E+02	1.00E+03
I-123	9.40E+00	1.04E+00	1.03E+00	8.59E-05	4.39E-05	1.50E-04	3.64E-56	2.55E-57	5.52E-01	9.40E+00	WL	1.06E+02	1.00E+02
I-125	1.66E+00	1.59E+00	0.00E+00	1.04E-01	4.30E-02	1.53E-02	2.29E-01	4.54E-01	2.22E-02	1.66E+00	WL	6.03E+02	1.00E+03
I-126	1.33E+02	3.36E+01	3.07E+01	3.03E-02	1.95E-02	5.31E-02	1.67E-01	1.77E-02	1.76E+00	1.33E+02	WL	7.53E+00	1.00E+01
I-129	1.16E+01	1.18E+01	0.00E+00	8.98E+01	5.82E+01	5.80E-02	2.21E+00	2.21E+01	7.13E-01	8.98E+01	RL-C	1.11E+01	1.00E+01
I-130	1.70E+02	4.06E+01	4.06E+01	7.35E-04	3.63E-04	1.29E-03	7.44E-59	5.50E-60	1.74E+00	1.70E+02	WL	5.89E+00	1.00E+01
I-131	1.00E+02	2.37E+01	2.15E+01	2.55E-02	1.43E-02	4.45E-02	2.85E-03	3.03E-04	2.61E+00	1.00E+02	WL	9.99E+00	1.00E+01
I-132	4.87E-01	1.18E-01	1.18E-01	2.49E-07	1.33E-07	4.36E-07	0.00E+00	0.00E+00	2.97E+00	2.97E+00	SKIN	3.37E+02	1.00E+03
I-133	8.41E+01	2.00E+01	1.98E+01	3.14E-03	1.43E-03	5.50E-03	1.27E-34	9.90E-36	2.88E+00	8.41E+01	WL	1.19E+01	1.00E+01
I-134	4.78E-06	1.15E-06	1.15E-06	8.07E-13	5.35E-13	1.41E-12	0.00E+00	0.00E+00	3.12E+00	3.12E+00	SKIN	3.21E+02	1.00E+03
I-135	4.34E+01	1.04E+01	1.04E+01	1.13E-04	5.35E-05	1.98E-04	2.67E-110	2.14E-111	2.81E+00	4.34E+01	WL	2.31E+01	1.00E+01
Cs-129	4.24E+01	9.40E+00	9.39E+00	6.46E-05	5.29E-05	1.13E-04	9.22E-23	6.47E-24	2.16E-01	4.24E+01	WL	2.36E+01	1.00E+01
Cs-131	8.02E-02	6.02E-03	0.00E+00	6.09E-05	5.28E-05	1.07E-04	4.63E-05	1.41E-06	8.22E-02	8.22E-02	SKIN	1.22E+04	1.00E+04
Cs-132	1.93E+02	4.64E+01	4.64E+01	4.16E-04	4.35E-04	7.28E-04	6.63E-04	4.87E-05	1.94E-01	1.93E+02	WL	5.19E+00	1.00E+01
Cs-134	4.85E+02	1.19E+02	1.17E+02	8.00E+00	1.23E+01	4.92E-03	1.70E+03	1.27E+02	2.07E+00	1.70E+03	RH	5.88E-01	1.00E+00
Cs-134m	1.05E-02	6.27E-04	6.18E-04	1.07E-07	1.02E-07	1.87E-07	9.55E-253	6.39E-254	1.21E+00	1.21E+00	SKIN	8.28E+02	1.00E+03
Cs-135	2.09E-01	2.15E-01	0.00E+00	1.88E+00	2.11E+00	6.68E-04	0.00E+00	2.30E-01	1.18E+00	2.11E+00	RL-A	4.73E+02	1.00E+03
Cs-136	6.48E+02	1.54E+02	1.54E+02	1.90E-03	2.39E-03	3.33E-03	7.98E-01	6.08E-02	2.60E+00	6.48E+02	WL	1.54E+00	1.00E+00
Cs-137	1.85E+02	4.55E+01	4.41E+01	9.46E+00	1.33E+01	3.64E-03	8.20E+02	6.12E+01	2.75E+00	8.20E+02	RH	1.22E+00	1.00E+00
Cs-138	2.39E-11	5.71E-12	5.71E-12	2.09E-18	1.52E-18	3.66E-18	0.00E+00	0.00E+00	6.68E+00	6.68E+00	SKIN	1.50E+02	1.00E+02
Ba-131	1.17E+02	2.48E+01	2.47E+01	1.15E-03	1.53E-03	2.01E-03	7.12E-02	5.08E-03	6.25E-01	1.17E+02	WL	8.57E+00	1.00E+01
Ba-133	9.28E+01	1.88E+01	1.87E+01	5.74E+00	1.80E+00	6.74E-03	4.21E+02	3.00E+01	0.00E+00	4.21E+02	RH	2.38E+00	1.00E+00
Ba-139	3.65E-05	3.68E-06	3.60E-06	7.85E-10	6.85E-10	1.37E-09	0.00E+00	0.00E+00	0.00E+00	3.65E-05	WL	2.74E+07	1.00E+07
Ba-140	5.88E+02	1.40E+02	1.40E+02	8.99E-03	1.18E-02	1.57E-02	5.76E-01	4.65E-02	6.47E+00	5.88E+02	WL	1.70E+00	1.00E+00
La-137	9.45E-02	2.97E-02	0.00E+00	3.07E-02	1.40E-02	7.81E-04	0.00E+00	4.86E-02	0.00E+00	9.45E-02	WL	1.06E+04	1.00E+04
La-140	5.09E+02	1.22E+02	1.22E+02	1.61E-03	1.53E-03	4.02E-04	2.48E-17	2.01E-18	3.09E+00	5.09E+02	WL	1.96E+00	1.00E+00
Ce-139	2.94E+01	2.94E+00	2.91E+00	1.23E-01	2.90E-02	5.85E-04	4.04E+01	2.79E+00	4.03E-01	4.04E+01	RH	2.47E+01	1.00E+01
Ce-141	1.44E+01	1.08E+00	1.00E+00	4.43E-03	6.64E-03	1.04E-03	1.08E+00	8.20E-02	3.09E+00	1.44E+01	WL	6.93E+01	1.00E+02
Ce-143	4.24E+01	9.15E+00	9.08E+00	1.08E-03	1.20E-03	2.70E-04	3.56E-22	2.62E-23	2.98E+00	4.24E+01	WL	2.36E+01	1.00E+01
Ce-144	1.39E+01	3.15E+00	2.58E+00	1.10E+01	1.96E+00	1.54E-02	2.94E+01	4.37E+00	4.81E+00	2.94E+01	RH	3.40E+01	1.00E+02

	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**SKIN**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
Pr-142	8.47E+00	2.09E+00	2.03E+00	6.02E-04	4.88E-04	1.50E-04	8.24E-39	7.87E-40	4.32E+00	8.47E+00	WL	1.18E+02	1.00E+02
Pr-143	1.32E-01	1.19E-01	0.00E+00	3.37E-03	4.79E-03	8.42E-04	0.00E+00	2.75E-04	2.71E+00	2.71E+00	SKIN	3.69E+02	1.00E+03
Nd-147	3.08E+01	6.32E+00	6.21E+00	3.18E-03	4.84E-03	7.96E-04	1.19E-02	9.00E-04	2.84E+00	3.08E+01	WL	3.25E+01	1.00E+02
Nd-149	7.44E-03	1.46E-03	1.46E-03	1.69E-08	1.74E-08	4.24E-09	0.00E+00	0.00E+00	2.49E+00	2.49E+00	SKIN	4.02E+02	1.00E+03
Pm-145	6.96E-01	1.62E-02	6.64E-05	2.99E-02	1.30E-02	9.44E-04	5.14E+00	2.85E-01	0.00E+00	5.14E+00	RH	1.94E+02	1.00E+02
Pm-146	2.23E+02	5.28E+01	5.27E+01	1.95E-01	8.35E-02	5.68E-03	9.27E+02	6.81E+01	0.00E+00	9.27E+02	RH	1.08E+00	1.00E+00
Pm-147	5.69E-02	3.36E-02	3.08E-05	5.91E-02	1.97E-02	1.73E-03	2.61E-03	1.62E-01	1.36E+00	1.36E+00	SKIN	7.37E+02	1.00E+03
Pm-149	2.38E+00	5.47E-01	4.73E-01	1.01E-03	1.12E-03	2.53E-04	2.32E-15	2.79E-16	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Sm-151	3.23E-02	1.54E-02	0.00E+00	5.55E-02	1.86E-02	9.64E-04	1.54E-04	6.80E-02	3.08E-02	6.80E-02	RP	1.47E+04	1.00E+04
Sm-153	4.53E+00	1.60E-01	1.08E-01	7.81E-04	9.26E-04	1.95E-04	6.92E-17	5.62E-18	2.47E+00	4.53E+00	WL	2.21E+02	1.00E+02
Eu-152	3.57E+02	8.43E+01	8.41E+01	3.17E-01	1.57E-01	9.63E-03	1.48E+03	1.15E+02	1.80E+00	1.48E+03	RH	6.75E-01	1.00E+00
Eu-152m	1.72E+01	4.12E+00	4.11E+00	8.92E-05	8.23E-05	2.23E-05	7.15E-76	5.47E-77	2.73E+00	1.72E+01	WL	5.80E+01	1.00E+02
Eu-154	3.98E+02	9.46E+01	9.44E+01	4.93E-01	2.05E-01	1.45E-02	1.61E+03	1.26E+02	3.78E+00	1.61E+03	RH	6.20E-01	1.00E+00
Eu-155	7.87E+00	1.31E-01	8.91E-02	8.18E-02	2.82E-02	2.22E-03	3.47E+01	2.55E+00	9.41E-01	3.47E+01	RH	2.88E+01	1.00E+01
Gd-153	1.03E+01	1.28E-01	9.59E-02	3.64E-02	1.06E-02	1.15E-03	2.48E+01	1.67E+00	4.38E-01	2.48E+01	RH	4.03E+01	1.00E+02
Gd-159	3.77E+00	8.04E-01	7.84E-01	2.34E-04	2.30E-04	5.85E-05	7.19E-41	5.57E-42	2.47E+00	3.77E+00	WL	2.65E+02	1.00E+02
Tb-157	1.37E-01	5.11E-03	1.67E-12	1.90E-02	6.09E-03	2.89E-04	8.64E-01	6.53E-02	0.00E+00	8.64E-01	RH	1.16E+03	1.00E+03
Tb-160	3.38E+02	8.05E+01	8.03E+01	1.67E-02	1.61E-02	2.39E-03	1.61E+02	1.24E+01	3.77E+00	3.38E+02	WL	2.96E+00	1.00E+00
Dy-165	5.32E-03	1.10E-03	1.09E-03	1.16E-07	1.11E-07	2.89E-08	3.82E-308	0.00E+00	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Dy-166	6.60E+00	1.15E+00	9.50E-01	3.34E-03	3.90E-03	8.34E-04	6.62E-10	7.99E-11	6.91E+00	6.91E+00	SKIN	1.45E+02	1.00E+02
Ho-166	3.98E+00	9.07E-01	8.30E-01	8.36E-04	7.41E-04	2.09E-04	3.36E-28	3.78E-29	3.70E+00	3.98E+00	WL	2.51E+02	1.00E+02
Ho-166m	4.76E+02	1.09E+02	1.09E+02	8.55E-01	4.63E-01	2.41E-02	2.16E+03	1.59E+02	2.71E+00	2.16E+03	RH	4.63E-01	1.00E+00
Er-169	4.19E-02	3.61E-02	7.66E-06	1.25E-03	1.95E-03	3.13E-04	2.39E-08	5.10E-06	1.97E+00	1.97E+00	SKIN	5.07E+02	1.00E+03
Er-171	1.01E+01	1.91E+00	1.91E+00	5.09E-05	5.10E-05	1.27E-05	6.87E-97	4.82E-98	2.49E+00	1.01E+01	WL	9.90E+01	1.00E+02
Tm-170	6.79E-01	1.41E-01	1.03E-03	4.68E-02	2.08E-02	2.68E-03	6.61E-01	2.94E-01	2.47E+00	2.47E+00	SKIN	4.06E+02	1.00E+03
Tm-171	6.06E-02	1.30E-02	2.55E-06	3.00E-02	8.01E-03	5.49E-04	1.85E-01	7.16E-02	2.71E-01	2.71E-01	SKIN	3.69E+03	1.00E+04
Yb-175	8.77E+00	1.82E+00	1.78E+00	8.88E-04	1.31E-03	2.22E-04	1.13E-07	8.65E-09	1.38E+00	8.77E+00	WL	1.14E+02	1.00E+02
Lu-177	6.67E+00	8.69E-01	8.19E-01	1.42E-03	2.27E-03	3.56E-04	2.43E-05	1.93E-06	1.81E+00	6.67E+00	WL	1.50E+02	1.00E+02
Hf-181	1.47E+02	3.13E+01	3.12E+01	6.47E-03	1.04E-02	1.61E-03	2.49E+01	1.79E+00	2.50E+00	1.47E+02	WL	6.82E+00	1.00E+01
Ta-182	4.06E+02	9.57E+01	9.55E+01	3.35E-02	2.51E-02	3.26E-03	3.75E+02	2.97E+01	2.55E+00	4.06E+02	WL	2.46E+00	1.00E+00
W-181	2.85E+00	1.15E-02	3.27E-03	4.98E-03	1.08E-03	1.82E-05	3.95E+00	2.35E-01	1.21E-01	3.95E+00	RH	2.53E+02	1.00E+02
W-185	5.64E-02	5.03E-02	2.59E-04	7.62E-03	1.50E-03	9.55E-05	2.88E-03	3.92E-02	1.36E+00	1.36E+00	SKIN	7.37E+02	1.00E+03
W-187	6.85E+01	1.59E+01	1.58E+01	2.86E-04	1.98E-04	7.15E-05	7.06E-31	5.16E-32	2.50E+00	6.85E+01	WL	1.46E+01	1.00E+01
Re-186	2.95E+00	2.96E-01	1.70E-01	1.82E-03	1.91E-03	4.54E-04	1.38E-09	1.83E-10	2.47E+00	2.95E+00	WL	3.39E+02	1.00E+03
Re-188	5.62E+00	1.08E+00	1.03E+00	6.24E-04	3.56E-04	1.56E-04	7.47E-45	6.59E-46	4.20E+00	5.62E+00	WL	1.78E+02	1.00E+02
Os-185	2.06E+02	4.87E+01	4.87E+01	6.72E-03	3.44E-03	3.88E-03	1.59E+02	1.17E+01	1.12E-01	2.06E+02	WL	4.85E+00	1.00E+01
Os-191	9.64E+00	4.28E-01	3.52E-01	2.39E-03	3.82E-03	4.19E-03	3.33E-02	2.47E-03	1.24E+00	9.64E+00	WL	1.04E+02	1.00E+02
Os-191m	2.05E-01	7.25E-03	3.25E-03	8.72E-05	1.30E-04	1.53E-04	8.62E-58	7.26E-59	7.03E-01	7.03E-01	SKIN	1.42E+03	1.00E+03
Os-193	9.48E+00	1.89E+00	1.84E+00	5.96E-04	6.26E-04	1.04E-03	2.13E-25	1.65E-26	2.47E+00	9.48E+00	WL	1.05E+02	1.00E+02
Ir-190	8.07E+02	1.81E+02	1.81E+02	3.13E-03	4.17E-03	7.82E-05	6.01E-01	4.31E-02	1.45E+00	8.07E+02	WL	1.24E+00	1.00E+00

Nuclide	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
	WL	WF	WO	RL-C	RL-A	RF	RH	RP	SKIN	Maximum	Pathway	[Bq/g]	[Bq/g]
Ir-192	2.26E+02	4.89E+01	4.87E+01	3.17E-02	1.86E-02	2.10E-04	1.16E+02	8.31E+00	2.89E+00	2.26E+02	WL	4.43E+00	1.00E+01
Ir-194	1.13E+01	2.56E+00	2.51E+00	6.02E-04	4.97E-04	1.50E-05	1.25E-38	1.02E-39	4.32E+00	1.13E+01	WL	8.86E+01	1.00E+02
Pt-191	5.01E+01	9.49E+00	9.46E+00	2.38E-04	1.81E-04	4.16E-05	6.64E-11	4.66E-12	6.98E-01	5.01E+01	WL	2.00E+01	1.00E+01
Pt-193	3.33E-03	3.14E-03	0.00E+00	2.40E+00	4.01E-01	1.08E-05	0.00E+00	2.38E-02	0.00E+00	2.40E+00	RL-C	4.17E+02	1.00E+03
Pt-193m	9.34E-01	4.06E-02	1.89E-03	3.29E-04	2.15E-04	5.76E-05	1.29E-08	1.60E-09	1.48E+00	1.48E+00	SKIN	6.76E+02	1.00E+03
Pt-197	1.46E+00	1.12E-01	9.61E-02	1.14E-04	7.23E-05	1.99E-05	2.82E-41	2.40E-42	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Pt-197m	4.23E-04	7.01E-05	6.98E-05	2.30E-09	1.63E-09	4.03E-10	0.00E+00	0.00E+00	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Au-198	8.93E+01	2.02E+01	2.01E+01	1.31E-03	1.40E-03	2.30E-04	4.16E-11	2.99E-12	2.86E+00	8.93E+01	WL	1.12E+01	1.00E+01
Au-199	1.45E+01	1.42E+00	1.38E+00	8.65E-04	1.33E-03	1.51E-04	2.80E-10	2.02E-11	1.61E+00	1.45E+01	WL	6.89E+01	1.00E+02
Hg-197	5.61E+00	4.90E-02	2.80E-02	3.57E-04	4.86E-04	6.24E-04	1.97E-12	1.37E-13	7.38E-01	5.61E+00	WL	1.78E+02	1.00E+02
Hg-197m	8.65E+00	6.59E-01	6.29E-01	5.21E-04	6.12E-04	9.12E-04	9.47E-32	6.83E-33	2.47E+00	8.65E+00	WL	1.16E+02	1.00E+02
Hg-203	5.72E+01	1.08E+01	1.06E+01	6.38E-02	1.86E-02	5.25E-03	1.20E+01	8.82E-01	1.99E+00	5.72E+01	WL	1.75E+01	1.00E+01
Tl-200	2.14E+02	4.97E+01	4.97E+01	1.78E-04	1.45E-04	4.45E-05	2.46E-27	1.87E-28	5.03E-01	2.14E+02	WL	4.68E+00	1.00E+01
Tl-201	9.52E+00	3.51E-01	3.43E-01	1.01E-04	7.36E-05	2.53E-05	8.30E-11	5.60E-12	6.76E-01	9.52E+00	WL	1.05E+02	1.00E+02
Tl-202	1.18E+02	2.55E+01	2.55E+01	4.37E-04	3.77E-04	1.09E-04	8.86E-02	6.29E-03	2.77E-01	1.18E+02	WL	8.51E+00	1.00E+01
Tl-204	2.52E-01	1.31E-01	4.91E-05	2.64E+02	4.83E+01	3.18E-04	5.16E-01	7.74E-01	2.59E+00	2.64E+02	RL-C	3.79E+00	1.00E+01
Pb-203	5.03E+01	8.69E+00	8.67E+00	2.81E-04	3.06E-04	4.92E-04	5.17E-14	3.60E-15	5.87E-01	5.03E+01	WL	1.99E+01	1.00E+01
Bi-206	9.21E+02	2.18E+02	2.18E+02	2.76E-03	3.20E-03	6.89E-05	1.55E-03	1.19E-04	8.88E-01	9.21E+02	WL	1.09E+00	1.00E+00
Bi-207	4.79E+02	1.14E+02	1.14E+02	1.41E+01	3.35E+00	1.93E-04	2.07E+03	1.58E+02	1.33E+00	2.07E+03	RH	4.82E-01	1.00E+00
Po-203	9.34E-10	2.17E-10	2.17E-10	1.34E-16	1.22E-16	3.34E-17	0.00E+00	0.00E+00	1.83E+00	1.83E+00	SKIN	5.46E+02	1.00E+03
Po-205	5.88E-02	1.38E-02	1.38E-02	1.41E-08	1.62E-08	3.53E-09	0.00E+00	0.00E+00	7.18E-01	7.18E-01	SKIN	1.39E+03	1.00E+03
Po-207	2.56E+01	6.06E+00	6.06E+00	1.15E-05	9.64E-06	2.89E-06	1.49E-123	1.13E-124	6.28E-01	2.56E+01	WL	3.91E+01	1.00E+02
At-211	7.83E-01	1.66E-01	3.37E-02	1.41E-02	2.28E-02	3.52E-03	8.78E-103	3.10E-103	6.67E-02	7.83E-01	WL	1.28E+03	1.00E+03
Ra-225	7.95E+01	2.65E+01	5.55E+00	7.90E+00	1.35E+01	1.97E+00	7.25E-02	8.44E-02	1.06E+01	7.95E+01	WL	1.26E+01	1.00E+01
Ra-227	2.42E-09	5.12E-10	5.12E-10	1.27E-14	2.89E-14	3.17E-15	0.00E+00	0.00E+00	2.48E+00	2.48E+00	SKIN	4.04E+02	1.00E+03
Th-226	2.55E-14	4.10E-15	1.95E-15	8.91E-16	1.35E-15	2.23E-16	0.00E+00	0.00E+00	2.35E-01	2.35E-01	SKIN	4.25E+03	1.00E+04
Th-229	6.01E+02	1.90E+02	1.39E+01	1.32E+02	1.81E+02	2.08E+01	3.52E+02	3.58E+02	9.25E+00	6.01E+02	WL	1.66E+00	1.00E+00
Pa-230	1.98E+02	4.59E+01	4.38E+01	1.26E+00	2.38E+00	3.14E-01	1.17E+00	9.17E-02	7.57E-01	1.98E+02	WL	5.06E+00	1.00E+01
Pa-233	5.13E+01	9.40E+00	9.31E+00	4.90E-03	7.99E-03	1.22E-03	2.06E+00	1.49E-01	3.22E+00	5.13E+01	WL	1.95E+01	1.00E+01
U-230	9.42E+01	2.74E+01	7.20E-01	1.39E+01	2.66E+01	3.47E+00	6.36E-02	1.51E-01	7.05E-01	9.42E+01	WL	1.06E+01	1.00E+01
U-231	8.95E+00	1.97E-01	1.73E-01	5.59E-04	6.82E-04	1.40E-04	1.18E-07	8.55E-09	7.70E-01	8.95E+00	WL	1.12E+02	1.00E+02
U-232	8.17E+02	2.28E+02	1.04E+02	4.22E+02	2.18E+02	1.44E+01	1.83E+03	3.97E+02	1.36E-01	1.83E+03	RH	5.46E-01	1.00E+00
U-233	2.97E+01	1.15E+01	1.32E-01	3.81E+01	2.41E+01	1.26E+00	3.48E+00	2.22E+01	7.52E-03	3.81E+01	RL-C	2.62E+01	1.00E+01
U-236	2.10E+01	8.70E+00	2.19E-06	3.04E+01	1.91E+01	9.64E-01	4.02E-02	1.74E+01	5.03E-03	3.04E+01	RL-C	3.29E+01	1.00E+02
U-237	2.22E+01	2.06E+00	1.99E+00	1.99E-03	3.23E-03	4.97E-04	1.51E-04	1.09E-05	2.11E+00	2.22E+01	WL	4.50E+01	1.00E+02
U-239	3.55E-18	3.69E-19	3.67E-19	2.69E-23	2.79E-23	6.71E-24	0.00E+00	0.00E+00	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
U-240	2.25E+01	5.40E+00	5.36E+00	3.65E-04	3.40E-04	9.12E-05	2.19E-52	1.66E-53	5.06E+00	2.25E+01	WL	4.45E+01	1.00E+02
Np-237	1.97E+02	5.32E+01	9.64E+00	1.92E+02	1.66E+02	3.86E+00	2.68E+02	5.79E+01	3.77E+00	2.68E+02	RH	3.73E+00	1.00E+01
Np-239	2.63E+01	3.26E+00	3.19E+00	1.21E-03	1.46E-03	3.02E-04	3.26E-13	2.36E-14	4.45E+00	2.63E+01	WL	3.81E+01	1.00E+02
Np-240	4.70E-05	1.09E-05	1.09E-05	2.27E-11	2.39E-11	5.68E-12	0.00E+00	0.00E+00	6.74E+00	6.74E+00	SKIN	1.48E+02	1.00E+02

	Effective Dose for Scenario [µSv/a/(Bq/g)]								Equiv. skin dose / 50 (see footnote)			excl. level	excl. level rounded
Nuclide	**WL**	**WF**	**WO**	**RL-C**	**RL-A**	**RF**	**RH**	**RP**	**SKIN**	**Maximum**	**Pathway**	**[Bq/g]**	**[Bq/g]**
Pu-234	2.31E-02	7.57E-03	0.00E+00	3.40E-03	6.61E-03	8.51E-04	0.00E+00	6.59E-87	1.20E-01	1.20E-01	SKIN	8.31E+03	1.00E+04
Pu-235	1.59E-16	5.77E-18	5.77E-18	2.53E-23	1.94E-23	6.34E-24	0.00E+00	0.00E+00	2.40E-01	2.40E-01	SKIN	4.16E+03	1.00E+04
Pu-236	1.51E+02	4.51E+01	3.93E+00	2.27E+01	4.76E+01	4.68E+00	5.78E+01	4.62E+01	1.36E-04	1.51E+02	WL	6.60E+00	1.00E+01
Pu-237	7.38E+00	1.32E-01	1.21E-01	5.39E-04	7.26E-04	1.33E-04	1.30E+00	9.09E-02	1.76E-01	7.38E+00	WL	1.36E+02	1.00E+02
Pu-238	2.82E+02	8.78E+01	8.59E-08	3.66E+01	1.03E+02	7.13E+00	9.86E-03	7.21E+01	1.18E-01	2.82E+02	WL	3.54E+00	1.00E+01
Pu-239	3.01E+02	9.41E+01	3.31E-04	3.82E+01	1.12E+02	7.42E+00	4.65E-02	7.59E+01	1.55E-03	3.01E+02	WL	3.32E+00	1.00E+01
Pu-240	3.01E+02	9.41E+01	2.36E-10	3.82E+01	1.12E+02	7.42E+00	1.02E-02	7.59E+01	1.12E-04	3.01E+02	WL	3.32E+00	1.00E+01
Pu-241	1.30E+01	4.04E+00	1.28E-07	1.48E+00	4.77E+00	2.90E-01	2.78E-01	2.89E+00	1.73E-06	1.30E+01	WL	7.68E+01	1.00E+02
Pu-242	2.92E+02	9.10E+01	3.01E-10	3.63E+01	1.07E+02	7.03E+00	1.00E-02	7.21E+01	9.37E-05	2.92E+02	WL	3.43E+00	1.00E+01
Pu-243	1.17E-01	6.04E-03	5.75E-03	5.06E-06	5.88E-06	1.27E-06	7.20E-150	5.23E-151	2.47E+00	2.47E+00	SKIN	4.05E+02	1.00E+03
Pu-244	3.63E+02	1.08E+02	1.83E+01	3.67E+01	1.06E+02	7.02E+00	3.49E+02	9.99E+01	5.06E+00	3.63E+02	WL	2.75E+00	1.00E+00
Am-241	2.55E+02	7.83E+01	4.32E-06	4.17E+01	9.88E+01	6.65E+00	9.76E+00	6.78E+01	7.77E-02	2.55E+02	WL	3.92E+00	1.00E+01
Am-242	8.51E-01	4.62E-02	1.62E-02	1.59E-02	2.50E-02	3.97E-03	4.22E-48	3.96E-49	2.10E+00	2.10E+00	SKIN	4.77E+02	1.00E+03
Am-242m	3.55E+02	1.09E+02	2.45E-01	5.65E+01	1.35E+02	9.02E+00	1.43E+01	9.23E+01	2.10E+00	3.55E+02	WL	2.81E+00	1.00E+00
Am-243	2.95E+02	8.30E+01	4.29E+00	4.17E+01	9.71E+01	6.57E+00	1.99E+02	8.14E+01	4.59E+00	2.95E+02	WL	3.39E+00	1.00E+01
Cm-242	3.44E+01	9.59E+00	3.70E-10	7.22E+00	1.14E+01	1.76E+00	3.44E-03	5.31E+00	2.59E-03	3.44E+01	WL	2.90E+01	1.00E+01
Cm-243	2.15E+02	6.18E+01	3.45E+00	3.00E+01	6.91E+01	5.89E+00	1.29E+02	6.77E+01	2.10E+00	2.15E+02	WL	4.65E+00	1.00E+01
Cm-244	1.60E+02	4.90E+01	2.05E-10	2.77E+01	6.00E+01	5.51E+00	6.43E-03	5.27E+01	2.34E-03	1.60E+02	WL	6.26E+00	1.00E+01
Cm-245	3.02E+02	9.09E+01	5.48E-01	3.87E+01	1.07E+02	7.53E+00	6.10E+01	8.05E+01	1.16E+00	3.02E+02	WL	3.31E+00	1.00E+01
Cm-246	2.54E+02	7.93E+01	6.57E-14	3.41E+01	9.39E+01	6.65E+00	2.65E-03	6.74E+01	1.60E-03	2.54E+02	WL	3.93E+00	1.00E+01
Cm-247	3.30E+02	9.36E+01	1.98E+01	3.18E+01	8.79E+01	6.13E+00	4.39E+02	9.43E+01	2.61E+00	4.39E+02	RH	2.28E+00	1.00E+00
Cm-248	8.98E+02	2.82E+02	1.70E-10	1.21E+02	3.36E+02	2.31E+01	5.82E-03	2.46E+02	7.52E-05	8.98E+02	WL	1.11E+00	1.00E+00
Bk-249	2.24E+00	6.91E-01	4.87E-02	3.69E-01	7.49E-01	6.78E-02	5.99E-01	4.98E-01	4.32E-01	2.24E+00	WL	4.46E+02	1.00E+03
Cf-246	2.11E+00	6.83E-01	5.52E-05	3.15E-01	5.95E-01	7.88E-02	6.77E-25	1.35E-22	6.42E-02	2.11E+00	WL	4.73E+02	1.00E+03
Cf-248	6.23E+01	1.80E+01	8.83E-12	2.49E+01	2.38E+01	3.31E+00	9.34E-04	1.85E+01	6.42E-02	6.23E+01	WL	1.61E+01	1.00E+01
Cf-249	5.16E+02	1.52E+02	1.95E+01	2.36E+02	2.40E+02	1.45E+01	4.30E+02	1.83E+02	3.67E-01	5.16E+02	WL	1.94E+00	1.00E+00
Cf-250	2.07E+02	6.37E+01	1.27E-06	1.42E+02	1.11E+02	9.46E+00	1.38E-02	9.43E+01	5.26E-03	2.07E+02	WL	4.84E+00	1.00E+01
Cf-251	4.57E+02	1.37E+02	2.12E+00	2.37E+02	2.44E+02	1.45E+01	1.12E+02	1.62E+02	2.10E+00	4.57E+02	WL	2.19E+00	1.00E+00
Cf-252	1.21E+02	3.71E+01	5.28E-07	1.03E+02	5.80E+01	8.38E+00	7.92E-03	7.29E+01	5.55E-03	1.21E+02	WL	8.25E+00	1.00E+01
Cf-253	1.47E+01	3.93E+00	8.22E-03	2.58E+00	4.52E+00	6.45E-01	3.24E-04	8.41E-03	8.51E-01	1.47E+01	WL	6.79E+01	1.00E+02
Cf-254	2.28E+02	8.65E+01	0.00E+00	7.46E+01	8.57E+01	1.81E+01	0.00E+00	2.71E+01	5.52E+01	2.28E+02	WL	4.40E+00	1.00E+01
Es-253	1.83E+01	5.03E+00	1.32E-02	3.00E+00	5.53E+00	7.50E-01	1.15E-03	2.20E-02	3.71E-02	1.83E+01	WL	5.45E+01	1.00E+02
Es-254	3.32E+02	8.40E+01	6.51E+01	1.68E+01	2.23E+01	3.44E+00	5.95E+02	6.32E+01	7.53E-01	5.95E+02	RH	1.68E+00	1.00E+00
Es-254m	1.16E+02	2.81E+01	2.72E+01	3.82E-01	7.29E-01	9.56E-02	2.40E-18	1.88E-19	2.62E+00	1.16E+02	WL	8.62E+00	1.00E+01
Fm-254	4.22E-03	1.24E-03	9.63E-08	5.23E-04	7.57E-04	1.31E-04	1.91E-228	2.83E-227	6.30E-02	6.30E-02	SKIN	1.59E+04	1.00E+04
Fm-255	1.18E+00	3.57E-01	1.38E-03	1.23E-01	2.49E-01	3.08E-02	4.67E-39	1.05E-38	9.81E+00	9.81E+00	SKIN	1.02E+02	1.00E+02

Footnote on skin dose:

The calculated equivalent dose is devided by 50 in this table. This results in applying the 50 mSv/a skin dose limit by comparing the result with 1 mSv/a as for the other exposure scenarios (this is just for computational purposes)

TABLE I-IX: Parameters used for Water Pathway Calculations

Parameter	Unit	realistic Value	low probability Value	Comment
Contaminated Material				
activity concentration	Bq/g	1	1	
total activity	Bq	4.50E+10	1.80E+11	calculated from other parameters
area of contaminated zone	m2	5000	20000	
thickness of contaminated zone	m	5.00	5.00	
density of contaminated area	g/cm3	1.80	1.80	
decay time before scenario	a	1.00	1.00	
Water Balance				
infiltration rate	m/a	0.20	0.20	
seepage through contaminated zone	m3/a	1000	4000	calculated from other parameters
irrigation rate	m/a	0.20	0.20	
Kd-Values used (Index)				
index of Kd-Values to be used from sheet KdValues		4	5	column index: 1 corresponds to column D in sheet 'MParam'
Hydrological parameter of contaminated area				
total porosity of contaminated area		0.40	0.40	
saturated hydraulic conductivity	m/a	5000	5000	
soil-specific exponential parameter b		4.05	4.05	
saturation ratio		0.40	0.40	calculated from other parameters
volumetric water content		0.16	0.16	calculated from other parameters
Hydrological parameter of unsaturated zone				
cut-off time for break-through	a	0	0	(zero for no cut-off)
thickness of unsaturated zone	m	2.00	0.00	(zero for no unsaturated zone)
density of unsaturated zone	g/cm3	1.80	1.80	
total porosity of unsaturated zone		0.40	0.40	
effective porosity of unsaturated zone		0.20	0.20	
saturated hydraulic conductivity	m/a	5550	5550	
soil-specific exponential parameter b		4.05	4.05	
saturation ratio		0.40	0.40	calculated from other parameters
volumetric water content		0.16	0.16	calculated from other parameters
Hydrological parameter of aquifer				
thickness of aquifer	m	5.00	5.00	
length of contaminated zone parallel to aquifer flow	m	50	200	
groundwater velocity	m/a	1000	500	pore water velocity
effective porosity of aquifer		0.25	0.25	
flow rate of aquifer	m3/a	1.25E+05	6.25E+04	calculated from other parameters
dilution factor between seepage and groundwater		7.94E-03	6.02E-02	calculated from other parameters
Hydrological parameter of river				
flow rate of river	m3/s	5.00	5.00	
watershed area of river	m2	7.884E+08	7.884E+08	calculated only for comparison purpose
relationship between cont. area and watershed		6.342E-06	2.537E-05	
dilution factor between seepage and river		6.342E-06	2.537E-05	calculated from other parameters
Parameters for plant uptake				
length of growing season for non-leafy vegetables	a	0.17	0.17	
length of growing season for leafy vegetables	a	0.25	0.25	
weathering removal constant for vegetation	1/a	20	20	
fraction of radionuclides retained on vegetation		0.25	0.25	refers to overhead irrigation
foliage-to-food transfer coefficient for non-leafy vegetables		0.1	0.1	
foliage-to-food transfer coefficient for leafy vegetables		1	1	
effective surface density of soil	kg/m2	225	225	
wet-weight crop yield for non-leafy vegetables	kg/m2	0.7	0.7	
wet-weight crop yield for leafy vegetables	kg/m2	1.5	1.5	
Dietary parameters				
consumption drinking water (1-2a)	kg/a	100	200	
consumption drinking water (> 17a)	kg/a	350	700	
consumption non-leafy vegetables and fruits (1-2a)	kg/a	17	51	
consumption non-leafy vegetables and fruits (> 17a)	kg/a	40	120	
consumption leafy vegetables (1-2a)	kg/a	6	18	
consumption leafy vegetables (> 17a)	kg/a	13	39	
consumption fish (1-2a)	kg/a	0.6	3	
consumption fish (> 17a)	kg/a	1.5	7.5	
fraction of contaminated drinking water		0.25	1	
fraction of contaminated vegetables		0.25	1	
fraction of contaminated fish		0.25	1	

TABLE I-X: K_d value used for Water Pathway Calculations

Nuclide	root transfer factor	fish transfer factor	K_d sand (Table E.3)	K_d IAEA 94 loamy soil (Table E.4)	K_d NUREG sandy soil (Table E.4)	K_d RESRAD defaults (Table E.4)	K_d min
			[cm^3/g]	[cm^3/g]	[cm^3/g]	[cm^3/g]	[cm^3/g]
Param. b for calc. from root transfer			**2.11**	**3.36**	**2.11**	**2.11**	**2.11**
Ag	0.0100	5	90.0	120.0	90.0	0.0	0.0
Am	0.0020	30	1900.0	990.0	1900.0	20.0	20.0
Ba	0.0500	4	44.2	154.1	52.0	50.0	44.2
Bi	0.1000	15	100.0	104.5	120.0	0.0	0.0
Bk	0.0030	30	213.4	744.8	213.4	213.4	213.4
C	0.7000	50000	5.0	35.2	6.7	0.0	0.0
Ca	0.3500	1000	5.0	30.0	8.9	50.0	5.0
Cd	0.5000	200	80.0	40.0	40.0	0.0	0.0
Ce	0.0500	30	500.0	8100.0	500.0	1000.0	500.0
Cf	0.0100	25	108.7	379.5	510.0	108.7	108.7
Cl	5.0000	1000	3.3	11.7	3.3	3.3	3.3
Cm	0.0010	30	4000.0	18000.0	4000.0	394.8	394.8
Co	0.0800	300	60.0	1300.0	60.0	1000.0	60.0
Cs	0.0400	2000	280.0	4400.0	270.0	1000.0	270.0
Es	0.0030	30	213.4	744.8	213.4	213.4	213.4
Eu	0.0020	50	267.8	934.7	240.0	267.8	240.0
Fe	0.0010	200	220.0	810.0	160.0	1000.0	160.0
Gd	0.0040	0	181.6	634.0	240.0	181.6	181.6
H	1.0000	1	0.0	0.0	0.0	0.0	0.0
Ho	0.0040	25	250.0	634.0	181.6	181.6	181.6
I	0.0200	40	1.0	4.5	1.0	0.1	0.1
La	0.0030	30	213.4	744.8	213.4	213.4	213.4
Mn	0.3000	400	50.0	720.0	50.0	200.0	50.0
Mo	0.2000	10	10.0	70.9	20.3	20.3	10.0
Na	0.0550	20	41.9	146.1	76.0	10.0	10.0
Nb	0.0100	300	160.0	540.0	160.0	0.0	0.0
Ni	0.3000	100	400.0	300.0	400.0	1000.0	300.0
Np	0.0400	30	5.0	25.0	5.0	50.0	5.0
Pd	0.1000	10	55.0	104.5	29.9	29.9	29.9
Pm	0.0020	30	267.8	934.7	240.0	267.8	240.0
Pt	0.5000	10	12.2	42.4	12.2	12.2	12.2
Pu	0.0010	30	550.0	1200.0	550.0	2000.0	550.0
Rb	0.2000	2000	55.0	70.9	20.3	20.3	20.3
Rh	0.0500	10	44.2	154.1	44.2	44.2	44.2
Ru	0.0500	10	55.0	900.0	55.0	0.0	0.0
Sb	0.0010	100	45.0	1377.9	45.0	0.0	0.0
Se	0.1000	200	150.0	810.0	29.9	0.0	0.0
Sm	0.0040	25	181.6	450.0	240.0	181.6	181.6
Sn	0.3000	3000	130.0	20.0	130.0	0.0	0.0
Sr	0.3000	60	15.0	810.0	15.0	30.0	15.0
Tb	0.0040	25	181.6	634.0	181.6	181.6	181.6
Tc	5.0000	20	0.1	11.7	0.1	0.0	0.0
Te	1.0000	400	125.0	3300.0	140.0	0.0	0.0
Th	0.0010	100	3200.0	1377.9	3200.0	60000.0	1377.9
Tl	2.0000	10000	5.6	12.0	390.0	0.0	0.0
Tm	0.0030	25	213.4	744.8	213.4	213.4	213.4
U	0.0100	10	35.0	379.5	15.0	50.0	15.0
Zn	2.0000	1000	200.0	1300.0	200.0	0.0	0.0
Zr	0.0010	300	600.0	2200.0	280.0	394.8	280.0

TABLE I-XI: Water Pathway Calculations for Realistic Scenario

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
H-3		1.20E+01	1.00E+00	1.20E-10	4.20E-11	1.00E+00	1.00E+00	0.00E+00	2.49E-01	1.80E+00	9.01E-01	1.01E+04
C-14		5.70E+03	1.00E+00	1.60E-09	5.80E-10	7.00E-01	5.00E+04	0.00E+00	2.49E-01	1.80E+00	1.00E+00	1.12E+04
Na-22		2.60E+00	1.00E+00	1.50E-08	3.20E-09	5.50E-02	2.00E+01	1.00E+01	2.20E-03	9.18E+01	2.35E-11	2.33E-09
Cl-36		3.00E+05	1.00E+00	6.30E-09	9.30E-10	5.00E+00	1.00E+03	3.35E+00	6.46E-03	3.19E+01	1.00E+00	2.91E+02
Ca-41		1.40E+05	1.00E+00	5.20E-10	1.90E-10	3.50E-01	1.00E+03	5.00E+01	4.44E-04	4.52E+02	9.98E-01	1.99E+01
Mn-53		3.70E+06	1.00E+00	2.20E-10	3.00E-11	3.00E-01	4.00E+02	2.00E+02	1.11E-04	1.80E+03	1.00E+00	5.00E+00
Mn-54		8.60E-01	1.00E+00	5.40E-09	7.10E-10	3.00E-01	4.00E+02	2.00E+02	1.11E-04	1.80E+03	0.00E+00	0.00E+00
Fe-55		2.70E+00	1.00E+00	2.40E-09	3.30E-10	1.00E-03	2.00E+02	1.00E+03	2.22E-05	9.00E+03	0.00E+00	0.00E+00
Co-57		7.40E-01	1.00E+00	1.60E-09	2.10E-10	8.00E-02	3.00E+02	1.00E+03	2.22E-05	9.00E+03	0.00E+00	0.00E+00
Co-60		5.30E+00	1.00E+00	2.70E-08	3.40E-09	8.00E-02	3.00E+02	1.00E+03	2.22E-05	9.00E+03	0.00E+00	0.00E+00
Ni-59		7.50E+04	1.00E+00	3.40E-10	6.30E-11	3.00E-01	1.00E+02	1.00E+03	2.22E-05	9.00E+03	9.20E-01	9.20E-01
Ni-63		9.60E+01	1.00E+00	8.40E-10	1.50E-10	3.00E-01	1.00E+02	1.00E+03	2.22E-05	9.00E+03	5.93E-29	5.93E-29
Zn-65		6.70E-01	1.00E+00	1.60E-08	3.90E-09	2.00E+00	1.00E+03	0.00E+00	2.49E-01	1.80E+00	1.56E-01	1.75E+03
Se-79		6.50E+04	1.00E+00	2.80E-08	2.90E-09	1.00E-01	2.00E+02	0.00E+00	2.49E-01	1.80E+00	1.00E+00	1.12E+04
Rb-87		4.70E+10	1.00E+00	1.00E-08	1.50E-09	2.00E-01	2.00E+03	2.03E+01	1.09E-03	1.85E+02	1.00E+00	4.90E+01
Sr-90		2.90E+01	1.00E+00	7.30E-08	2.80E-08	3.00E-01	6.00E+01	3.00E+01	7.39E-04	2.72E+02	1.51E-03	5.01E-02
	Y-90	7.30E-03	9.98E-01	2.00E-08	2.70E-09							5.01E-02
Zr-93		1.50E+06	1.00E+00	7.60E-10	1.10E-09	1.00E-03	3.00E+02	3.95E+02	5.63E-05	3.55E+03	9.98E-01	2.53E+00
	Nb-93m	1.40E+01	9.91E-01	9.10E-10	1.20E-10	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.80E+00	9.98E-01	1.11E+04
Nb-93m		1.40E+01	1.00E+00	9.10E-10	1.20E-10	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.80E+00	9.15E-01	1.03E+04
Nb-94		2.00E+04	1.00E+00	9.70E-09	1.70E-09	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.80E+00	1.00E+00	1.12E+04
Mo-93		3.50E+03	1.00E+00	6.90E-09	3.10E-09	2.00E-01	1.00E+01	2.03E+01	1.09E-03	1.85E+02	9.64E-01	4.73E+01
	Nb-93m	1.40E+01	9.76E-01	9.10E-10	1.20E-10	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.80E+00	9.64E-01	1.05E+04
Tc-97		2.60E+06	1.00E+00	4.90E-10	6.80E-11	5.00E+00	2.00E+01	0.00E+00	2.49E-01	1.80E+00	1.00E+00	1.12E+04
Tc-99		2.10E+05	1.00E+00	4.80E-09	6.40E-10	5.00E+00	2.00E+01	0.00E+00	2.49E-01	1.80E+00	1.00E+00	1.12E+04
Ru-106		1.00E+00	1.00E+00	4.90E-08	7.00E-09	5.00E-02	1.00E+01	0.00E+00	2.49E-01	1.80E+00	1.44E-01	1.61E+03
Rh-102		2.90E+00	1.00E+00	1.00E-08	2.60E-09	5.00E-02	1.00E+01	4.42E+01	5.02E-04	3.99E+02	2.90E-42	6.56E-41
Pd-107		6.50E+06	1.00E+00	2.80E-10	3.70E-11	1.00E-01	1.00E+01	2.99E+01	7.40E-04	2.71E+02	1.00E+00	3.33E+01
Ag-108m		1.27E+02	1.00E+00	1.10E-08	2.30E-09	1.00E-02	5.00E+00	0.00E+00	2.49E-01	1.80E+00	9.90E-01	1.11E+04
Ag-110m		6.90E-01	1.00E+00	1.40E-08	2.80E-09	1.00E-02	5.00E+00	0.00E+00	2.49E-01	1.80E+00	1.65E-01	1.85E+03
Cd-109		1.30E+00	1.00E+00	9.50E-09	2.00E-09	5.00E-01	2.00E+02	0.00E+00	2.49E-01	1.80E+00	2.25E-01	2.52E+03
Cd-113m		1.36E+01	1.00E+00	5.60E-08	2.30E-08	5.00E-01	2.00E+02	0.00E+00	2.49E-01	1.80E+00	9.13E-01	1.02E+04

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Cd-113	9.30E+15	0.00E+00	4.80E-08	2.50E-08	5.00E-01	2.00E+02	0.00E+00	2.49E-01	1.80E+00	1.00E+00	0.00E+00
	In-113m	1.89E-04	1.00E+00	1.80E-10	2.80E-11							0.00E+00
Sn-121m		5.50E+01	1.00E+00	2.70E-09	3.80E-10	3.00E-01	3.00E+03	0.00E+00	2.49E-01	1.80E+00	9.78E-01	1.10E+04
	Sn-121	3.10E-03	9.99E-01	1.70E-09	2.30E-10							1.10E+04
Sb-125		2.80E+00	1.00E+00	6.10E-09	1.10E-09	1.00E-03	1.00E+02	0.00E+00	2.49E-01	1.80E+00	6.41E-01	7.18E+03
	Te-125m	1.60E-01	1.94E-01	6.30E-09	8.70E-10	1.00E+00	4.00E+02	0.00E+00	2.49E-01	1.80E+00	6.41E-01	1.39E+03
I-129		1.60E+07	1.00E+00	2.20E-07	1.10E-07	2.00E-02	4.00E+01	1.00E-01	1.17E-01	2.70E+00	1.00E+00	5.28E+03
Cs-134		2.10E+00	1.00E+00	1.60E-08	1.90E-08	4.00E-02	2.00E+03	1.00E+03	2.22E-05	9.00E+03	0.00E+00	0.00E+00
Cs-135		2.30E+06	1.00E+00	2.30E-09	2.00E-09	4.00E-02	2.00E+03	1.00E+03	2.22E-05	9.00E+03	9.97E-01	9.97E-01
Cs-137		3.00E+01	1.00E+00	1.20E-08	1.30E-08	4.00E-02	2.00E+03	1.00E+03	2.22E-05	9.00E+03	4.71E-91	4.71E-91
Ba-133		1.07E+01	1.00E+00	6.20E-09	1.50E-09	5.00E-02	4.00E+00	5.00E+01	4.44E-04	4.52E+02	1.95E-13	3.89E-12
La-137		6.00E+04	1.00E+00	4.50E-10	8.10E-11	3.00E-03	3.00E+01	2.13E+02	1.04E-04	1.92E+03	9.78E-01	4.58E+00
Ce-144		7.80E-01	1.00E+00	3.90E-08	5.20E-09	5.00E-02	3.00E+01	1.00E+03	2.22E-05	9.00E+03	0.00E+00	0.00E+00
	Pr-144	3.29E-05	1.00E+00	3.50E-10	5.00E-11							0.00E+00
Pm-145		1.77E+01	1.00E+00	6.80E-10	1.10E-10	2.00E-03	3.00E+01	2.68E+02	8.30E-05	2.41E+03	9.57E-42	3.57E-41
Pm-146		5.53E+00	1.00E+00	5.10E-09	9.00E-10	2.00E-03	3.00E+01	2.68E+02	8.30E-05	2.41E+03	5.12E-132	1.91E-131
	Sm-146	1.03E+08	5.50E-08	1.50E-07	5.40E-08	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.64E+03	1.00E+00	3.03E-07
Pm-147		2.60E+00	1.00E+00	1.90E-09	2.60E-10	2.00E-03	3.00E+01	2.68E+02	8.30E-05	2.41E+03	5.68E-280	2.12E-279
	Sm-147	1.06E+11	2.60E-11	1.40E-07	4.90E-08	4.00E-03		1.82E+02	1.22E-04	1.64E+03	1.00E+00	1.43E-10
Sm-151		9.00E+01	1.00E+00	6.40E-10	9.80E-11	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.64E+03	3.36E-06	1.85E-05
Eu-152		1.30E+01	1.00E+00	7.40E-09	1.40E-09	2.00E-03	5.00E+01	2.68E+02	8.30E-05	2.41E+03	1.42E-56	5.28E-56
	Gd-152	1.08E+14	1.30E-13	1.20E-07	4.10E-08	4.00E-03		1.82E+02	1.22E-04	1.64E+03	1.00E+00	7.15E-13
Eu-154		8.80E+00	1.00E+00	1.20E-08	2.00E-09	2.00E-03	5.00E+01	2.68E+02	8.30E-05	2.41E+03	3.13E-83	1.17E-82
Eu-155		5.00E+00	1.00E+00	2.20E-09	3.20E-10	2.00E-03	5.00E+01	2.68E+02	8.30E-05	2.41E+03	6.20E-146	2.31E-145
Gd-153		6.60E-01	1.00E+00	1.80E-09	2.70E-10	4.00E-03	0.00E+00	1.82E+02	1.22E-04	1.64E+03	0.00E+00	0.00E+00
Tb-157		1.50E+02	1.00E+00	2.20E-10	3.40E-11	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.64E+03	5.20E-04	2.86E-03
Ho-166m		1.20E+03	1.00E+00	9.30E-09	2.00E-09	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.64E+03	3.89E-01	2.14E+00
Tm-171		1.90E+00	1.00E+00	7.80E-10	1.10E-10	3.00E-03	2.50E+01	2.13E+02	1.04E-04	1.92E+03	2.73E-305	1.28E-304
Pt-193		5.00E+01	1.00E+00	2.40E-10	3.10E-11	5.00E-01	1.00E+01	1.22E+01	1.81E-03	1.11E+02	2.14E-01	1.75E+01
Tl-204		3.80E+00	1.00E+00	8.50E-09	1.20E-09	2.00E+00	1.00E+04	0.00E+00	2.49E-01	1.80E+00	7.21E-01	8.08E+03
Bi-207		3.80E+01	1.00E+00	7.10E-09	1.30E-09	1.00E-01	1.50E+01	0.00E+00	2.49E-01	1.80E+00	9.68E-01	1.08E+04
Th-229		7.30E+03	1.00E+00	1.00E-06	4.90E-07	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	5.39E-23	8.99E-25
	Ra-225	4.05E-02	1.00E+00	1.20E-06	9.90E-08							8.99E-25
	Ac-225	2.74E-02	1.00E+00	1.80E-07	2.40E-08							8.99E-25

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Fr-221	9.32E-06	1.00E+00									
	At-217	1.01E-09	1.00E+00									
	Bi-213	8.69E-05	1.00E+00	1.40E-09	2.00E-10							8.99E-25
	Po-213	1.33E-12	9.78E-01									
	Tl-209	4.19E-06	2.16E-02									
	Pb-209	3.71E-04	1.00E+00	3.80E-10	5.70E-11							8.99E-25
U-232		7.20E+01	1.00E+00	8.20E-07	3.30E-07	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.29E-02	2.58E-01
	Th-228	1.91E+00	9.06E-01	3.70E-07	7.20E-08	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	1.29E-02	1.95E-04
	Ra-224	1.00E-02	9.06E-01	6.60E-07	6.50E-08						1.00E+00	1.95E-04
	Rn-220	1.76E-06	9.06E-01									
	Po-216	4.60E-09	9.06E-01									
	Pb-212	1.21E-03	9.06E-01	6.30E-08	6.00E-09							1.95E-04
	Bi-212	1.15E-04	9.06E-01	1.80E-09	2.60E-10							1.95E-04
	Po-212	9.48E-15	5.81E-01									
	Tl-208	5.80E-06	3.25E-01									
U-233		160000	1.00E+00	1.40E-07	5.10E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	9.98E-01	1.99E+01
	Th-229	7.30E+03	9.40E-03	1.00E-06	4.90E-07	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	9.98E-01	1.56E-04
	Ra-225	4.05E-02	9.40E-03	1.20E-06	9.90E-08							1.56E-04
	Ac-225	2.74E-02	9.40E-03	1.80E-07	2.40E-08							1.56E-04
	Fr-221	9.32E-06	9.40E-03									
	At-217	1.01E-09	9.40E-03									
	Bi-213	8.69E-05	9.40E-03	1.40E-09	2.00E-10							1.56E-04
	Po-213	1.33E-12	9.20E-03									
	Tl-209	4.19E-06	2.00E-04									
	Pb-209	3.71E-04	9.40E-03	3.80E-10	5.70E-11							1.56E-04
U-236		23000000	1.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	2.00E+01
	Th-232	1.4E+10	0.00E+00	4.50E-07	2.30E-07	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	1.00E+00	0.00E+00
Np-237		2100000	1.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	1.00E+00	2.00E+01
	Pa-233	0.0739726	1.00E+00	6.20E-09	8.70E-10							2.00E+01
	U-233	160000	4.00E-04	1.40E-07	5.10E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	9.98E-01	7.97E-03
	Th-229	7340	0.00E+00	1.00E-06	4.90E-07	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	7.13E-23	0.00E+00
Pu-236		2.8	1.00E+00	2.20E-07	8.70E-08	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	0.00E+00	0.00E+00
	U-232	72	3.47E-02	8.20E-07	3.30E-07	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.29E-02	8.95E-03
	Th-228	1.91	3.42E-02	3.70E-07	7.20E-08	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	1.29E-02	7.36E-06

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Ra-224	1.00E-02	3.42E-02	6.60E-07	6.50E-08						1.00E+00	7.36E-06
	Rn-220	1.76E-06	3.42E-02									
	Po-216	4.60E-09	3.42E-02									
	Pb-212	1.21E-03	3.42E-02	6.30E-08	6.00E-09							7.36E-06
	Bi-212	1.15E-04	3.42E-02	1.80E-09	2.60E-10							7.36E-06
	Po-212	9.48E-15	2.19E-02									
	Tl-208	5.80E-06	1.23E-02									
Pu-238		88	1.00E+00	4.00E-07	2.30E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	2.63E-62	1.31E-62
	U-234	240000	2.00E-04	1.30E-07	4.90E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	9.99E-01	3.99E-03
	Th-230	7.70E+04	0.00E+00	4.10E-07	2.10E-07	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	7.74E-03	0.00E+00
Pu-239		24000	1.00E+00	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	5.95E-01	2.97E-01
	U-235	700000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Pu-240		6500	1.00E+00	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	1.47E-01	7.33E-02
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Pu-241		14	1.00E+00	5.70E-09	4.80E-09	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	0.00E+00	0.00E+00
	Am-241	430	2.96E-02	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	7.46E-01	1.10E+00
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	1.00E+00	0.00E+00
Pu-242		380000	1.00E+00	4.00E-07	2.40E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	9.68E-01	4.84E-01
	U-238	4.5E+09	0.00E+00	1.20E-07	4.50E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Pu-244		83000000	1.00E+00	4.10E-07	2.40E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	1.00E+00	5.00E-01
	U-240	0.0016096	1.00E+00	8.10E-09	1.10E-09							5.00E-01
	Np-240m	1.37E-05	1.00E+00									
	Np-240	0.0001233	1.10E-03	5.20E-10	8.20E-11	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	0.00E+00	0.00E+00
	Pu-240	6500	1.05E-02	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	1.47E-01	7.70E-04
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Am-241		430	1.00E+00	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	7.46E-01	3.71E+01
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	1.00E+00	0.00E+00
Am-242m		150	1.00E+00	3.00E-07	1.90E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	4.32E-01	2.15E+01
	Am-242	0.0018265	9.95E-01	2.20E-09	3.00E-10							2.14E+01
	Cm-242	0.4465753	8.09E-01	7.60E-08	1.20E-08	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	0.00E+00	0.00E+00
	Np-238	0.0058082	5.00E-03	6.20E-09	9.10E-10	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	0.00E+00	0.00E+00
	Pu-238	88	3.51E-01	4.00E-07	2.30E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	2.63E-62	4.61E-63
	U-234	240000	1.00E-04	1.30E-07	4.90E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	9.99E-01	1.99E-03
	Th-230	7.70E+04	0.00E+00	4.10E-07	2.10E-07	1.00E-03	1.00E+02	6.00E+04	3.70E-07	5.40E+05	7.74E-03	0.00E+00

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
Am-243		7400	1.00E+00	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	9.83E-01	4.89E+01
	Np-239	0.0064658	1.00E+00	5.70E-09	8.00E-10							4.89E+01
	Pu-239	24000	2.90E-03	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	5.95E-01	8.62E-04
	U-235	700000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Cm-243		29	1.00E+00	3.30E-07	1.50E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	1.26E-37	3.18E-37
	Pu-239	24000	1.10E-03	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	5.95E-01	3.27E-04
	U-235	700000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Cm-244		18	1.00E+00	2.90E-07	1.20E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	3.54E-60	8.96E-60
	Pu-240	6500	2.70E-03	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	1.47E-01	1.98E-04
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Cm-245		8500	1.00E+00	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	7.48E-01	1.90E+00
	Pu-241	14	9.85E-01	5.70E-09	4.80E-09	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	7.48E-01	3.69E-01
	Am-241	430	1.19E-01	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	7.48E-01	4.43E+00
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	1.00E+00	0.00E+00
Cm-246		4700	1.00E+00	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	5.92E-01	1.50E+00
	Pu-242	380000	2.00E-04	4.00E-07	2.40E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	9.68E-01	9.68E-05
	U-238	4.5E+09	0.00E+00	1.20E-07	4.50E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Cm-247		16000000	1.00E+00	3.50E-07	1.90E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	1.00E+00	2.53E+00
	Pu-243	0.00056	1.00E+00	6.20E-10	8.50E-11							2.53E+00
	Am-243	7400	9.40E-03	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	9.83E-01	4.60E-01
	Np-239	0.0065	9.40E-03	5.70E-09	8.00E-10	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	9.83E-01	1.84E-01
	Pu-239	24000	0.00E+00	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	5.95E-01	0.00E+00
Cm-248		340000	1.00E+00	1.40E-06	7.70E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	9.93E-01	2.51E+00
	Pu-244	83000000	0.00E+00	4.10E-07	2.40E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	1.00E+00	0.00E+00
Bk-249		0.88	1.00E+00	2.90E-09	9.70E-10	3.00E-03	3.00E+01	2.13E+02	1.04E-04	1.92E+03	0.00E+00	0.00E+00
	Cf-249	350	2.50E-03	8.70E-07	3.50E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	1.43E-01	3.30E-03
	Cm-245	8500	0.00E+00	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	7.48E-01	0.00E+00
Cf-248		0.92	1.00E+00	1.60E-07	2.80E-08	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	0.00E+00	0.00E+00
	Cm-244	18	4.31E-02	2.90E-07	1.20E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	3.54E-60	3.86E-61
	Pu-240	6500	1.00E-04	4.20E-07	2.50E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	1.47E-01	7.33E-06
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00
Cf-249		350	1.00E+00	8.70E-07	3.50E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	1.43E-01	1.32E+00
	Cm-245	8500	7.40E-03	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	7.48E-01	1.40E-02
	Pu-241	14	5.90E-03	5.70E-09	4.80E-09	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	7.48E-01	2.21E-03

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Am-241	430	4.00E-04	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.82E+02	7.48E-01	1.49E-02
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+01	4.43E-04	4.52E+02	1.00E+00	0.00E+00
Cf-250		13	1.00E+00	5.50E-07	1.60E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	1.99E-23	1.82E-22
	Cm-246	4700	2.70E-03	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	5.92E-01	4.05E-03
	Pu-242	380000	0.00E+00	4.00E-07	2.40E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	9.68E-01	0.00E+00
Cf-251		900	1.00E+00	8.90E-07	3.60E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	4.70E-01	4.32E+00
	Cm-247	16000000	0.00E+00	3.50E-07	1.90E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	1.00E+00	0.00E+00
Cf-252		2.6	1.00E+00	5.10E-07	9.00E-08	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	3.09E-114	2.84E-113
	Cm-248	340000	0.00E+00	1.40E-06	7.70E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	9.93E-01	0.00E+00
Es-254		0.76	1.00E+00	1.60E-07	2.80E-08	3.00E-03	3.00E+01	2.13E+02	1.04E-04	1.92E+03	0.00E+00	0.00E+00
	Bk-250	0.0003676	1.00E+00	8.50E-10	1.40E-10		3.00E+01					0.00E+00
	Cf-250	13	4.84E-02	5.50E-07	1.60E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	9.80E+02	1.99E-23	8.83E-24
	Cm-246	4700	2.00E-03	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	3.55E+03	5.92E-01	3.00E-03
	Pu-242	380000	2.00E-04	4.00E-07	2.40E-07	1.00E-03	3.00E+01	2.00E+03	1.11E-05	1.80E+04	9.68E-01	9.68E-05
	U-238	4.5E+09	0.00E+00	1.20E-07	4.50E-08	1.00E-02	1.00E+01	5.00E+01	4.44E-04	4.52E+02	1.00E+00	0.00E+00

TABLE I-XI: Water Pathway Calculations for Realistic Scenario

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
H-3		8.02E+01	6.41E-02	3.66E+01	1.46E+02	6.41E-02	2.85E-01	3.30E-01	2.85E-01	3.30E-01
C-14		8.89E+01	7.10E-02	3.76E+01	1.57E+02	3.55E+03	5.04E+00	5.80E+00	5.04E+00	5.80E+00
Na-22		1.85E-11	1.48E-14	6.51E-12	3.08E-11	2.96E-13	8.05E-12	5.71E-12	8.05E-12	5.71E-12
Cl-36		2.31E+00	1.84E-03	2.10E+00	5.74E+00	1.84E+00	4.76E-01	2.25E-01	4.76E-01	2.25E-01
Ca-41		1.58E-01	1.26E-04	6.08E-02	2.71E-01	1.26E-01	2.41E-03	2.92E-03	2.41E-03	2.92E-03
Mn-53		3.97E-02	3.17E-05	1.50E-02	6.76E-02	1.27E-02	2.55E-04	1.15E-04	2.55E-04	1.15E-04
Mn-54		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-57		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-59		7.30E-03	5.84E-06	2.77E-03	1.25E-02	5.84E-04	7.25E-05	4.46E-05	7.25E-05	4.46E-05
Ni-63		4.70E-31	3.76E-34	1.78E-31	8.02E-31	3.76E-32	1.15E-32	6.83E-33	1.15E-32	6.83E-33
Zn-65		1.39E+01	1.11E-02	7.87E+00	2.75E+01	1.11E+01	6.77E+00	5.41E+00	6.77E+00	5.41E+00
Se-79		8.89E+01	7.11E-02	3.17E+01	1.49E+02	1.42E+01	7.23E+01	2.49E+01	7.23E+01	2.49E+01
Rb-87		3.89E-01	3.11E-04	1.43E-01	6.57E-01	6.22E-01	1.14E-01	5.68E-02	1.14E-01	5.68E-02
Sr-90		3.98E-04	3.18E-07	1.51E-04	6.79E-04	1.91E-05	8.48E-04	1.08E-03	1.08E-03	1.18E-03
	Y-90	3.98E-04	3.18E-07	1.51E-04	6.79E-04	1.91E-05	2.32E-04	1.04E-04		
Zr-93		2.01E-02	1.60E-05	6.93E-03	3.32E-02	4.81E-03	4.42E-04	2.13E-03	2.32E+00	1.02E+00
	Nb-93m	8.80E+01	7.03E-02	3.05E+01	1.46E+02	2.11E+01	2.32E+00	1.02E+00		
Nb-93m		8.14E+01	6.50E-02	2.82E+01	1.35E+02	1.95E+01	2.15E+00	9.42E-01	2.15E+00	9.42E-01
Nb-94		8.89E+01	7.11E-02	3.08E+01	1.47E+02	2.13E+01	2.50E+01	1.46E+01	2.50E+01	1.46E+01
Mo-93		3.75E-01	3.00E-04	1.38E-01	6.33E-01	3.00E-03	7.53E-02	1.12E-01	2.28E+00	1.08E+00
	Nb-93m	8.37E+01	6.69E-02	2.90E+01	1.39E+02	2.01E+01	2.21E+00	9.68E-01		
Tc-97		8.89E+01	7.11E-02	8.00E+01	2.19E+02	1.42E+00	1.42E+00	6.32E-01	1.42E+00	6.32E-01
Tc-99		8.89E+01	7.11E-02	8.00E+01	2.19E+02	1.42E+00	1.39E+01	5.95E+00	1.39E+01	5.95E+00
Ru-106		1.28E+01	1.02E-02	4.49E+00	2.13E+01	1.02E-01	1.82E+01	8.64E+00	1.82E+01	8.64E+00
Rh-102		5.21E-43	4.16E-46	1.83E-43	8.66E-43	4.16E-45	1.51E-43	1.31E-43	1.51E-43	1.31E-43
Pd-107		2.64E-01	2.11E-04	9.42E-02	4.42E-01	2.11E-03	2.15E-03	9.43E-04	2.15E-03	9.43E-04
Ag-108m		8.81E+01	7.04E-02	3.05E+01	1.46E+02	3.52E-01	2.81E+01	1.95E+01	2.81E+01	1.95E+01
Ag-110m		1.46E+01	1.17E-02	5.07E+00	2.43E+01	5.85E-02	5.94E+00	3.95E+00	5.94E+00	3.95E+00
Cd-109		2.00E+01	1.60E-02	8.03E+00	3.48E+01	3.20E+00	5.58E+00	3.89E+00	5.58E+00	3.89E+00
Cd-113m		8.12E+01	6.48E-02	3.25E+01	1.41E+02	1.30E+01	1.33E+02	1.81E+02	1.33E+02	1.81E+02

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Cd-113	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	In-113m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Sn-121m		8.69E+01	6.95E-02	3.29E+01	1.48E+02	2.08E+02	6.93E+00	3.23E+00	1.13E+01	5.18E+00
	Sn-121	8.69E+01	6.95E-02	3.29E+01	1.48E+02	2.08E+02	4.36E+00	1.95E+00		
Sb-125		5.70E+01	4.56E-02	1.97E+01	9.44E+01	4.56E+00	1.01E+01	6.04E+00	1.21E+01	6.99E+00
	Te-125m	1.11E+01	8.84E-03	5.05E+00	2.01E+01	3.54E+00	2.07E+00	9.44E-01		
I-129		4.19E+01	3.35E-02	1.46E+01	6.96E+01	1.34E+00	2.67E+02	4.45E+02	2.67E+02	4.45E+02
Cs-134		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-135		7.91E-03	6.32E-06	2.77E-03	1.32E-02	1.26E-02	5.32E-04	1.54E-03	5.32E-04	1.54E-03
Cs-137		3.74E-93	2.99E-96	1.31E-93	6.21E-93	5.97E-93	1.31E-93	4.71E-93	1.31E-93	4.71E-93
Ba-133		3.08E-14	2.47E-17	1.08E-14	5.13E-14	9.86E-17	5.54E-15	4.46E-15	5.54E-15	4.46E-15
La-137		3.64E-02	2.91E-05	1.26E-02	6.02E-02	8.72E-04	4.74E-04	2.84E-04	4.74E-04	2.84E-04
Ce-144		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pm-145		2.83E-43	2.27E-46	9.79E-44	4.69E-43	6.80E-45	5.58E-45	3.00E-45	5.58E-45	3.00E-45
Pm-146		1.52E-133	1.21E-136	5.24E-134	2.51E-133	3.63E-135	2.24E-134	1.31E-134	2.24E-134	1.31E-134
	Sm-146	2.40E-09	1.92E-12	8.30E-10	3.98E-09	4.80E-11	1.04E-08	1.25E-08		
Pm-147		1.68E-281	1.34E-284	5.81E-282	2.78E-281	4.03E-283	9.25E-283	4.21E-283	4.60E-12	5.36E-12
	Sm-147	1.14E-12	9.07E-16	3.93E-13	1.88E-12	0.00E+00	4.60E-12	5.36E-12		
Sm-151		1.47E-07	1.17E-10	5.07E-08	2.43E-07	2.93E-09	2.72E-09	1.38E-09	2.72E-09	1.38E-09
Eu-152		4.19E-58	3.35E-61	1.45E-58	6.94E-58	1.68E-59	8.98E-59	5.66E-59	1.97E-14	2.24E-14
	Gd-152	5.68E-15	4.54E-18	1.96E-15	9.40E-15	0.00E+00	1.97E-14	2.24E-14		
Eu-154		9.27E-85	7.41E-88	3.20E-85	1.54E-84	3.70E-86	3.22E-85	1.79E-85	3.22E-85	1.79E-85
Eu-155		1.84E-147	1.47E-150	6.34E-148	3.04E-147	7.33E-149	1.17E-148	5.66E-149	1.17E-148	5.66E-149
Gd-153		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tb-157		2.27E-05	1.81E-08	7.84E-06	3.76E-05	4.53E-07	1.45E-07	7.43E-08	1.45E-07	7.43E-08
Ho-166m		1.70E-02	1.36E-05	5.87E-03	2.81E-02	3.39E-04	4.57E-03	3.27E-03	4.57E-03	3.27E-03
Tm-171		1.02E-306	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pt-193		1.39E-01	1.11E-04	5.57E-02	2.41E-01	1.11E-03	9.75E-04	4.18E-04	9.75E-04	4.18E-04
Tl-204		6.41E+01	5.12E-02	3.64E+01	1.27E+02	5.12E+02	1.72E+01	7.89E+00	1.72E+01	7.89E+00
Bi-207		8.61E+01	6.88E-02	3.07E+01	1.44E+02	1.03E+00	1.77E+01	1.08E+01	1.77E+01	1.08E+01
Th-229		7.14E-27	5.70E-30	2.46E-27	1.18E-26	5.70E-28	2.07E-25	3.37E-25	4.92E-25	4.22E-25
	Ra-225	7.14E-27	5.70E-30	2.46E-27	1.18E-26	5.70E-28	2.48E-25	6.81E-26		
	Ac-225	7.14E-27	5.70E-30	2.46E-27	1.18E-26	5.70E-28	3.72E-26	1.65E-26		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Fr-221									
	At-217									
	Bi-213	7.14E-27	5.70E-30	2.46E-27	1.18E-26	5.70E-28	2.89E-28	1.38E-28		
	Po-213									
	Tl-209									
	Pb-209	7.14E-27	5.70E-30	2.46E-27	1.18E-26	5.70E-28	7.85E-29	3.92E-29		
U-232		2.05E-03	1.64E-06	7.09E-04	3.39E-03	1.64E-05	4.86E-02	6.51E-02	4.86E-02	6.51E-02
	Th-228	1.55E-06	1.24E-09	5.34E-07	2.56E-06	1.24E-07	1.66E-05	1.07E-05		
	Ra-224	1.55E-06	1.24E-09	5.34E-07	2.56E-06	1.24E-07	2.96E-05	9.69E-06		
	Rn-220									
	Po-216									
	Pb-212	1.55E-06	1.24E-09	5.34E-07	2.56E-06	1.24E-07	2.82E-06	8.95E-07		
	Bi-212	1.55E-06	1.24E-09	5.34E-07	2.56E-06	1.24E-07	8.07E-08	3.88E-08		
	Po-212									
	Tl-208									
U-233		1.58E-01	1.26E-04	5.48E-02	2.62E-01	1.26E-03	6.41E-01	7.77E-01	6.41E-01	7.77E-01
	Th-229	1.24E-06	9.92E-10	4.29E-07	2.05E-06	9.92E-08	3.59E-05	5.86E-05		
	Ra-225	1.24E-06	9.92E-10	4.29E-07	2.05E-06	9.92E-08	4.31E-05	1.18E-05		
	Ac-225	1.24E-06	9.92E-10	4.29E-07	2.05E-06	9.92E-08	6.47E-06	2.87E-06		
	Fr-221									
	At-217									
	Bi-213	1.24E-06	9.92E-10	4.29E-07	2.05E-06	9.92E-08	5.03E-08	2.39E-08		
	Po-213									
	Tl-209									
	Pb-209	1.24E-06	9.92E-10	4.29E-07	2.05E-06	9.92E-08	1.37E-08	6.82E-09		
U-236		1.58E-01	1.27E-04	5.49E-02	2.63E-01	1.27E-03	5.96E-01	7.18E-01	5.96E-01	7.18E-01
	Th-232	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Np-237		1.58E-01	1.27E-04	5.54E-02	2.63E-01	3.80E-03	9.64E-01	1.68E+00	9.92E-01	1.69E+00
	Pa-233	1.58E-01	1.27E-04	5.54E-02	2.63E-01	3.80E-03	2.85E-02	1.33E-02		
	U-233	6.33E-05	5.05E-08	2.19E-05	1.05E-04	5.05E-07	2.56E-04	3.11E-04		
	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-236		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-03	2.26E-03
	U-232	7.10E-05	5.67E-08	2.46E-05	1.18E-04	5.67E-07	1.69E-03	2.26E-03		
	Th-228	5.84E-08	4.67E-11	2.02E-08	9.67E-08	4.67E-09	6.26E-07	4.05E-07		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Ra-224	5.84E-08	4.67E-11	2.02E-08	9.67E-08	4.67E-09	1.12E-06	3.66E-07		
	Rn-220									
	Po-216									
	Pb-212	5.84E-08	4.67E-11	2.02E-08	9.67E-08	4.67E-09	1.07E-07	3.38E-08		
	Bi-212	5.84E-08	4.67E-11	2.02E-08	9.67E-08	4.67E-09	3.05E-09	1.46E-09		
	Po-212									
	Tl-208									
Pu-238		1.04E-64	8.33E-68	3.60E-65	1.73E-64	2.50E-66	1.21E-63	2.31E-63	1.19E-04	1.49E-04
	U-234	3.16E-05	2.53E-08	1.10E-05	5.24E-05	2.53E-07	1.19E-04	1.49E-04		
	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-239		2.36E-03	1.89E-06	8.15E-04	3.91E-03	5.66E-05	2.87E-02	5.68E-02	2.87E-02	5.68E-02
	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-240		5.82E-04	4.65E-07	2.01E-04	9.63E-04	1.40E-05	7.08E-03	1.40E-02	7.08E-03	1.40E-02
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-241		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.35E-02	1.68E-01
	Am-241	8.72E-03	6.97E-06	3.01E-03	1.44E-02	2.09E-04	9.35E-02	1.68E-01		
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-242		3.84E-03	3.07E-06	1.33E-03	6.36E-03	9.21E-05	4.45E-02	8.88E-02	4.45E-02	8.88E-02
	U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-244		3.97E-03	3.17E-06	1.37E-03	6.57E-03	9.51E-05	4.71E-02	9.17E-02	4.81E-02	9.23E-02
	U-240	3.97E-03	3.17E-06	1.37E-03	6.57E-03	9.51E-05	9.31E-04	4.20E-04		
	Np-240m									
	Np-240	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Pu-240	6.11E-06	4.88E-09	2.11E-06	1.01E-05	1.46E-07	7.43E-05	1.47E-04		
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Am-241		2.95E-01	2.35E-04	1.02E-01	4.88E-01	7.06E-03	3.16E+00	5.68E+00	3.16E+00	5.68E+00
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Am-242m		1.71E-01	1.36E-04	5.89E-02	2.82E-01	4.09E-03	1.48E+00	3.12E+00	1.49E+00	3.13E+00
	Am-242	1.70E-01	1.36E-04	5.86E-02	2.81E-01	4.07E-03	1.08E-02	4.90E-03		
	Cm-242	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Np-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Pu-238	3.66E-65	2.92E-68	1.26E-65	6.06E-65	8.77E-67	4.24E-64	8.11E-64		
	U-234	1.58E-05	1.26E-08	5.48E-06	2.62E-05	1.26E-07	5.96E-05	7.47E-05		
	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
Am-243		3.88E-01	3.10E-04	1.34E-01	6.43E-01	9.31E-03	4.16E+00	7.48E+00	4.23E+00	7.51E+00
	Np-239	3.88E-01	3.10E-04	1.34E-01	6.43E-01	9.31E-03	6.41E-02	2.99E-02		
	Pu-239	6.84E-06	5.47E-09	2.36E-06	1.13E-05	1.64E-07	8.32E-05	1.65E-04		
	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-243		2.53E-39	2.02E-42	8.72E-40	4.18E-39	6.06E-41	2.41E-38	3.65E-38	3.16E-05	6.25E-05
	Pu-239	2.60E-06	2.07E-09	8.96E-07	4.30E-06	6.22E-08	3.16E-05	6.25E-05		
	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-244		7.11E-62	5.68E-65	2.46E-62	1.18E-61	1.70E-63	5.97E-61	8.22E-61	1.91E-05	3.78E-05
	Pu-240	1.57E-06	1.26E-09	5.43E-07	2.60E-06	3.77E-08	1.91E-05	3.78E-05		
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-245		1.50E-02	1.20E-05	5.19E-03	2.49E-02	3.61E-04	1.61E-01	3.04E-01	5.39E-01	9.84E-01
	Pu-241	2.92E-03	2.34E-06	1.01E-03	4.84E-03	7.01E-05	4.83E-04	1.35E-03		
	Am-241	3.52E-02	2.81E-05	1.22E-02	5.83E-02	8.43E-04	3.77E-01	6.78E-01		
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-246		1.19E-02	9.51E-06	4.11E-03	1.97E-02	2.85E-04	1.27E-01	2.41E-01	1.27E-01	2.41E-01
	Pu-242	7.68E-07	6.14E-10	2.65E-07	1.27E-06	1.84E-08	8.89E-06	1.78E-05		
	U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-247		2.01E-02	1.61E-05	6.94E-03	3.33E-02	4.82E-04	2.04E-01	3.68E-01	2.43E-01	4.38E-01
	Pu-243	2.01E-02	1.61E-05	6.94E-03	3.33E-02	4.82E-04	3.61E-04	1.65E-04		
	Am-243	3.65E-03	2.92E-06	1.26E-03	6.05E-03	8.75E-05	3.91E-02	7.03E-02		
	Np-239	1.46E-03	1.17E-06	5.12E-04	2.43E-03	3.51E-05	2.42E-04	1.13E-04		
	Pu-239	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-248		2.00E-02	1.59E-05	6.89E-03	3.30E-02	4.78E-04	8.09E-01	1.48E+00	8.09E-01	1.48E+00
	Pu-244	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Bk-249		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-04	8.82E-04
	Cf-249	2.62E-05	2.09E-08	9.06E-06	4.33E-05	5.23E-07	6.59E-04	8.82E-04		
	Cm-245	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-248		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.08E-07	1.40E-06
	Cm-244	3.07E-63	2.45E-66	1.06E-63	5.07E-63	7.35E-65	2.57E-62	3.54E-62		
	Pu-240	5.82E-08	4.65E-11	2.01E-08	9.63E-08	1.40E-09	7.08E-07	1.40E-06		
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-249		1.05E-02	8.36E-06	3.62E-03	1.73E-02	2.09E-04	2.64E-01	3.53E-01	2.66E-01	3.57E-01
	Cm-245	1.11E-04	8.89E-08	3.84E-05	1.84E-04	2.67E-06	1.19E-03	2.25E-03		
	Pu-241	1.75E-05	1.40E-08	6.05E-06	2.90E-05	4.20E-07	2.89E-06	8.10E-06		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Am-241	1.18E-04	9.45E-08	4.09E-05	1.96E-04	2.83E-06	1.27E-03	2.28E-03		
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-250		1.45E-24	1.16E-27	5.02E-25	2.40E-24	2.89E-26	2.31E-23	2.23E-23	3.44E-04	6.50E-04
	Cm-246	3.21E-05	2.57E-08	1.11E-05	5.32E-05	7.70E-07	3.44E-04	6.50E-04		
	Pu-242	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-251		3.43E-02	2.74E-05	1.19E-02	5.68E-02	6.85E-04	8.83E-01	1.19E+00	8.83E-01	1.19E+00
	Cm-247	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-252		2.25E-115	1.80E-118	7.80E-116	3.73E-115	4.50E-117	3.32E-114	1.95E-114	3.32E-114	1.95E-114
	Cm-248	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Es-254		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-04	4.99E-04
	Bk-250	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Cf-250	7.01E-26	5.60E-29	2.43E-26	1.16E-25	1.40E-27	1.12E-24	1.08E-24		
	Cm-246	2.38E-05	1.90E-08	8.22E-06	3.94E-05	5.70E-07	2.55E-04	4.81E-04		
	Pu-242	7.68E-07	6.14E-10	2.65E-07	1.27E-06	1.84E-08	8.89E-06	1.78E-05		
	U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		

TABLE I-XII: Water Pathway Calculations for Low Probability Scenario

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
H-3		1.20E+01	1.00E+00	1.20E-10	4.20E-11	1.00E+00	1.00E+00	0.00E+00	2.49E-01	1.00E+00	9.44E-01	1.06E+04
C-14		5.70E+03	1.00E+00	1.60E-09	5.80E-10	7.00E-01	5.00E+04	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.12E+04
Na-22		2.60E+00	1.00E+00	1.50E-08	3.20E-09	5.50E-02	2.00E+01	1.00E+01	2.20E-03	1.00E+00	7.66E-01	7.59E+01
Cl-36		3.00E+05	1.00E+00	6.30E-09	9.30E-10	5.00E+00	1.00E+03	3.35E+00	6.46E-03	1.00E+00	1.00E+00	2.91E+02
Ca-41		1.40E+05	1.00E+00	5.20E-10	1.90E-10	3.50E-01	1.00E+03	5.00E+00	4.37E-03	1.00E+00	1.00E+00	1.96E+02
Mn-53		3.70E+06	1.00E+00	2.20E-10	3.00E-11	3.00E-01	4.00E+02	5.00E+01	4.44E-04	1.00E+00	1.00E+00	2.00E+01
Mn-54		8.60E-01	1.00E+00	5.40E-09	7.10E-10	3.00E-01	4.00E+02	5.00E+01	4.44E-04	1.00E+00	4.47E-01	8.92E+00
Fe-55		2.70E+00	1.00E+00	2.40E-09	3.30E-10	1.00E-03	2.00E+02	1.60E+02	1.39E-04	1.00E+00	7.74E-01	4.83E+00
Co-57		7.40E-01	1.00E+00	1.60E-09	2.10E-10	8.00E-02	3.00E+02	6.00E+01	3.70E-04	1.00E+00	3.92E-01	6.52E+00
Co-60		5.30E+00	1.00E+00	2.70E-08	3.40E-09	8.00E-02	3.00E+02	6.00E+01	3.70E-04	1.00E+00	8.77E-01	1.46E+01
Ni-59		7.50E+04	1.00E+00	3.40E-10	6.30E-11	3.00E-01	1.00E+02	3.00E+02	7.41E-05	1.00E+00	1.00E+00	3.33E+00
Ni-63		9.60E+01	1.00E+00	8.40E-10	1.50E-10	3.00E-01	1.00E+02	3.00E+02	7.41E-05	1.00E+00	9.93E-01	3.31E+00
Zn-65		6.70E-01	1.00E+00	1.60E-08	3.90E-09	2.00E+00	1.00E+03	0.00E+00	2.49E-01	1.00E+00	3.55E-01	3.98E+03
Se-79		6.50E+04	1.00E+00	2.80E-08	2.90E-09	1.00E-01	2.00E+02	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.12E+04
Rb-87		4.70E+10	1.00E+00	1.00E-08	1.50E-09	2.00E-01	2.00E+03	2.03E+01	1.09E-03	1.00E+00	1.00E+00	4.90E+01
Sr-90		2.90E+01	1.00E+00	7.30E-08	2.80E-08	3.00E-01	6.00E+01	1.50E+01	1.47E-03	1.00E+00	9.76E-01	6.47E+01
	Y-90	7.30E-03	9.98E-01	2.00E-08	2.70E-09							6.47E+01
Zr-93		1.50E+06	1.00E+00	7.60E-10	1.10E-09	1.00E-03	3.00E+02	2.80E+02	7.93E-05	1.00E+00	1.00E+00	3.57E+00
	Nb-93m	1.40E+01	9.91E-01	9.10E-10	1.20E-10	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.11E+04
Nb-93m		1.40E+01	1.00E+00	9.10E-10	1.20E-10	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.00E+00	9.52E-01	1.07E+04
Nb-94		2.00E+04	1.00E+00	9.70E-09	1.70E-09	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.12E+04
Mo-93		3.50E+03	1.00E+00	6.90E-09	3.10E-09	2.00E-01	1.00E+01	1.00E+01	2.20E-03	1.00E+00	1.00E+00	9.91E+01
	Nb-93m	1.40E+01	9.76E-01	9.10E-10	1.20E-10	1.00E-02	3.00E+02	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.09E+04
Tc-97		2.60E+06	1.00E+00	4.90E-10	6.80E-11	5.00E+00	2.00E+01	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.12E+04
Tc-99		2.10E+05	1.00E+00	4.80E-09	6.40E-10	5.00E+00	2.00E+01	0.00E+00	2.49E-01	1.00E+00	1.00E+00	1.12E+04
Ru-106		1.00E+00	1.00E+00	4.90E-08	7.00E-09	5.00E-02	1.00E+01	0.00E+00	2.49E-01	1.00E+00	5.00E-01	5.60E+03
Rh-102		2.90E+00	1.00E+00	1.00E-08	2.60E-09	5.00E-02	1.00E+01	4.42E+01	5.02E-04	1.00E+00	7.87E-01	1.78E+01
Pd-107		6.50E+06	1.00E+00	2.80E-10	3.70E-11	1.00E-01	1.00E+01	2.99E+01	7.40E-04	1.00E+00	1.00E+00	3.33E+01
Ag-108m		1.27E+02	1.00E+00	1.10E-08	2.30E-09	1.00E-02	5.00E+00	0.00E+00	2.49E-01	1.00E+00	9.95E-01	1.11E+04
Ag-110m		6.90E-01	1.00E+00	1.40E-08	2.80E-09	1.00E-02	5.00E+00	0.00E+00	2.49E-01	1.00E+00	3.66E-01	4.10E+03
Cd-109		1.30E+00	1.00E+00	9.50E-09	2.00E-09	5.00E-01	2.00E+02	0.00E+00	2.49E-01	1.00E+00	5.87E-01	6.57E+03
Cd-113m		1.36E+01	1.00E+00	5.60E-08	2.30E-08	5.00E-01	2.00E+02	0.00E+00	2.49E-01	1.00E+00	9.50E-01	1.06E+04

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Cd-113	9.30E+15	0.00E+00	4.80E-08	2.50E-08	5.00E-01	2.00E+02	0.00E+00	2.49E-01	1.00E+00	1.00E+00	0.00E+00
	In-113m	1.89E-04	9.99E-01	1.80E-10	2.80E-11							0.00E+00
Sn-121m		5.50E+01	1.00E+00	2.70E-09	3.80E-10	3.00E-01	3.00E+03	0.00E+00	2.49E-01	1.00E+00	9.87E-01	1.11E+04
	Sn-121	3.10E-03	9.99E-01	1.70E-09	2.30E-10							1.11E+04
Sb-125		2.80E+00	1.00E+00	6.10E-09	1.10E-09	1.00E-03	1.00E+02	0.00E+00	2.49E-01	1.00E+00	7.81E-01	8.75E+03
	Te-125m	1.60E-01	1.94E-01	6.30E-09	8.70E-10	1.00E+00	4.00E+02	0.00E+00	2.49E-01	1.00E+00	7.81E-01	1.70E+03
I-129		1.60E+07	1.00E+00	2.20E-07	1.10E-07	2.00E-02	4.00E+01	1.00E-01	1.17E-01	1.00E+00	1.00E+00	5.28E+03
Cs-134		2.10E+00	1.00E+00	1.60E-08	1.90E-08	4.00E-02	2.00E+03	2.70E+02	8.23E-05	1.00E+00	7.19E-01	2.66E+00
Cs-135		2.30E+06	1.00E+00	2.30E-09	2.00E-09	4.00E-02	2.00E+03	2.70E+02	8.23E-05	1.00E+00	1.00E+00	3.70E+00
Cs-137		3.00E+01	1.00E+00	1.20E-08	1.30E-08	4.00E-02	2.00E+03	2.70E+02	8.23E-05	1.00E+00	9.77E-01	3.62E+00
Ba-133		1.07E+01	1.00E+00	6.20E-09	1.50E-09	5.00E-02	4.00E+00	4.42E+01	5.02E-04	1.00E+00	9.37E-01	2.12E+01
La-137		6.00E+04	1.00E+00	4.50E-10	8.10E-11	3.00E-03	3.00E+01	2.13E+02	1.04E-04	1.00E+00	1.00E+00	4.68E+00
Ce-144		7.80E-01	1.00E+00	3.90E-08	5.20E-09	5.00E-02	3.00E+01	5.00E+02	4.44E-05	1.00E+00	4.11E-01	8.22E-01
	Pr-144	3.29E-05	1.00E+00	3.50E-10	5.00E-11							8.22E-01
Pm-145		1.77E+01	1.00E+00	6.80E-10	1.10E-10	2.00E-03	3.00E+01	2.40E+02	9.26E-05	1.00E+00	9.62E-01	4.01E+00
Pm-146		5.53E+00	1.00E+00	5.10E-09	9.00E-10	2.00E-03	3.00E+01	2.40E+02	9.26E-05	1.00E+00	8.82E-01	3.67E+00
	Sm-146	1.03E+08	5.50E-08	1.50E-07	5.40E-08	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.00E+00	1.00E+00	3.03E-07
Pm-147		2.60E+00	1.00E+00	1.90E-09	2.60E-10	2.00E-03	3.00E+01	2.40E+02	9.26E-05	1.00E+00	7.66E-01	3.19E+00
	Sm-147	1.06E+11	2.60E-11	1.40E-07	4.90E-08	4.00E-03		1.82E+02	1.22E-04	1.00E+00	1.00E+00	1.43E-10
Sm-151		9.00E+01	1.00E+00	6.40E-10	9.80E-11	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.00E+00	9.92E-01	5.46E+00
Eu-152		1.30E+01	1.00E+00	7.40E-09	1.40E-09	2.00E-03	5.00E+01	2.40E+02	9.26E-05	1.00E+00	9.48E-01	3.95E+00
	Gd-152	1.08E+14	1.30E-13	1.20E-07	4.10E-08	4.00E-03		1.82E+02	1.22E-04	1.00E+00	1.00E+00	7.15E-13
Eu-154		8.80E+00	1.00E+00	1.20E-08	2.00E-09	2.00E-03	5.00E+01	2.40E+02	9.26E-05	1.00E+00	9.24E-01	3.85E+00
Eu-155		5.00E+00	1.00E+00	2.20E-09	3.20E-10	2.00E-03	5.00E+01	2.40E+02	9.26E-05	1.00E+00	8.71E-01	3.63E+00
Gd-153		6.60E-01	1.00E+00	1.80E-09	2.70E-10	4.00E-03	0.00E+00	1.82E+02	1.22E-04	1.00E+00	3.50E-01	1.93E+00
Tb-157		1.50E+02	1.00E+00	2.20E-10	3.40E-11	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.00E+00	9.95E-01	5.48E+00
Ho-166m		1.20E+03	1.00E+00	9.30E-09	2.00E-09	4.00E-03	2.50E+01	1.82E+02	1.22E-04	1.00E+00	9.99E-01	5.50E+00
Tm-171		1.90E+00	1.00E+00	7.80E-10	1.10E-10	3.00E-03	2.50E+01	2.13E+02	1.04E-04	1.00E+00	6.94E-01	3.25E+00
Pt-193		5.00E+01	1.00E+00	2.40E-10	3.10E-11	5.00E-01	1.00E+01	1.22E+01	1.81E-03	1.00E+00	9.86E-01	8.05E+01
Tl-204		3.80E+00	1.00E+00	8.50E-09	1.20E-09	2.00E+00	1.00E+04	0.00E+00	2.49E-01	1.00E+00	8.33E-01	9.34E+03
Bi-207		3.80E+01	1.00E+00	7.10E-09	1.30E-09	1.00E-01	1.50E+01	0.00E+00	2.49E-01	1.00E+00	9.82E-01	1.10E+04
Th-229		7.30E+03	1.00E+00	1.00E-06	4.90E-07	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	1.00E+00	7.26E-01
	Ra-225	4.05E-02	1.00E+00	1.20E-06	9.90E-08							7.26E-01
	Ac-225	2.74E-02	1.00E+00	1.80E-07	2.40E-08							7.26E-01

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Fr-221	9.32E-06	1.00E+00									
	At-217	1.01E-09	1.00E+00									
	Bi-213	8.69E-05	1.00E+00	1.40E-09	2.00E-10							7.26E-01
	Po-213	1.33E-12	9.78E-01									
	Tl-209	4.19E-06	2.16E-02									
	Pb-209	3.71E-04	1.00E+00	3.80E-10	5.70E-11							7.26E-01
U-232		7.20E+01	1.00E+00	8.20E-07	3.30E-07	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	9.90E-01	6.56E+01
	Th-228	1.91E+00	9.06E-01	3.70E-07	7.20E-08	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	9.90E-01	6.51E-01
	Ra-224	1.00E-02	9.06E-01	6.60E-07	6.50E-08						1.00E+00	6.51E-01
	Rn-220	1.76E-06	9.06E-01									
	Po-216	4.60E-09	9.06E-01									
	Pb-212	1.21E-03	9.06E-01	6.30E-08	6.00E-09							6.51E-01
	Bi-212	1.15E-04	9.06E-01	1.80E-09	2.60E-10							6.51E-01
	Po-212	9.48E-15	5.81E-01									
	Tl-208	5.80E-06	3.25E-01									
U-233		160000	1.00E+00	1.40E-07	5.10E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	6.63E+01
	Th-229	7.30E+03	9.40E-03	1.00E-06	4.90E-07	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	1.00E+00	6.82E-03
	Ra-225	4.05E-02	9.40E-03	1.20E-06	9.90E-08							6.82E-03
	Ac-225	2.74E-02	9.40E-03	1.80E-07	2.40E-08							6.82E-03
	Fr-221	9.32E-06	9.40E-03									
	At-217	1.01E-09	9.40E-03									
	Bi-213	8.69E-05	9.40E-03	1.40E-09	2.00E-10							6.82E-03
	Po-213	1.33E-12	9.20E-03									
	Tl-209	4.19E-06	2.00E-04									
	Pb-209	3.71E-04	9.40E-03	3.80E-10	5.70E-11							6.82E-03
U-236		23000000	1.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	6.63E+01
	Th-232	1.4E+10	0.00E+00	4.50E-07	2.30E-07	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	1.00E+00	0.00E+00
Np-237		2100000	1.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	1.00E+00	1.96E+02
	Pa-233	0.0739726	1.00E+00	6.20E-09	8.70E-10							1.96E+02
	U-233	160000	4.00E-04	1.40E-07	5.10E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	2.65E-02
	Th-229	7340	0.00E+00	1.00E-06	4.90E-07	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	1.00E+00	0.00E+00
Pu-236		2.8	1.00E+00	2.20E-07	8.70E-08	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	7.81E-01	1.42E+00
	U-232	72	3.47E-02	8.20E-07	3.30E-07	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	9.90E-01	2.28E+00
	Th-228	1.91	3.42E-02	3.70E-07	7.20E-08	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	9.90E-01	2.46E-02

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Ra-224	1.00E-02	3.42E-02	6.60E-07	6.50E-08						1.00E+00	2.46E-02
	Rn-220	1.76E-06	3.42E-02									
	Po-216	4.60E-09	3.42E-02									
	Pb-212	1.21E-03	3.42E-02	6.30E-08	6.00E-09							2.46E-02
	Bi-212	1.15E-04	3.42E-02	1.80E-09	2.60E-10							2.46E-02
	Po-212	9.48E-15	2.19E-02									
	Tl-208	5.80E-06	1.23E-02									
Pu-238		88	1.00E+00	4.00E-07	2.30E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	9.92E-01	1.80E+00
	U-234	240000	2.00E-04	1.30E-07	4.90E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	1.33E-02
	Th-230	7.70E+04	0.00E+00	4.10E-07	2.10E-07	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	1.00E+00	0.00E+00
Pu-239		24000	1.00E+00	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.82E+00
	U-235	700000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Pu-240		6500	1.00E+00	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.82E+00
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Pu-241		14	1.00E+00	5.70E-09	4.80E-09	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	9.52E-01	1.73E+00
	Am-241	430	2.96E-02	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	9.98E-01	1.47E+00
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	1.00E+00	0.00E+00
Pu-242		380000	1.00E+00	4.00E-07	2.40E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.82E+00
	U-238	4.5E+09	0.00E+00	1.20E-07	4.50E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Pu-244		83000000	1.00E+00	4.10E-07	2.40E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.82E+00
	U-240	0.0016096	1.00E+00	8.10E-09	1.10E-09							1.82E+00
	Np-240m	1.37E-05	1.00E+00									
	Np-240	0.0001233	1.10E-03	5.20E-10	8.20E-11	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	0.00E+00	0.00E+00
	Pu-240	6500	1.05E-02	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.91E-02
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Am-241		430	1.00E+00	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	9.98E-01	4.97E+01
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	1.00E+00	0.00E+00
Am-242m		150	1.00E+00	3.00E-07	1.90E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	9.95E-01	4.95E+01
	Am-242	0.0018265	9.95E-01	2.20E-09	3.00E-10							4.93E+01
	Cm-242	0.4465753	8.09E-01	7.60E-08	1.20E-08	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	2.12E-01	4.34E-01
	Np-238	0.0058082	5.00E-03	6.20E-09	9.10E-10	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	2.12E-01	2.08E-01
	Pu-238	88	3.51E-01	4.00E-07	2.30E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	9.92E-01	6.33E-01
	U-234	240000	1.00E-04	1.30E-07	4.90E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	6.63E-03
	Th-230	7.70E+04	0.00E+00	4.10E-07	2.10E-07	1.00E-03	1.00E+02	1.38E+03	1.61E-05	1.00E+00	1.00E+00	0.00E+00

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
Am-243		7400	1.00E+00	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	1.00E+00	4.98E+01
	Np-239	0.0064658	1.00E+00	5.70E-09	8.00E-10							4.98E+01
	Pu-239	24000	2.90E-03	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	5.27E-03
	U-235	700000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Cm-243		29	1.00E+00	3.30E-07	1.50E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	9.76E-01	2.47E+00
	Pu-239	24000	1.10E-03	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	2.00E-03
	U-235	700000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Cm-244		18	1.00E+00	2.90E-07	1.20E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	9.62E-01	2.44E+00
	Pu-240	6500	2.70E-03	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	4.91E-03
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Cm-245		8500	1.00E+00	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	2.53E+00
	Pu-241	14	9.85E-01	5.70E-09	4.80E-09	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.79E+00
	Am-241	430	1.19E-01	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	1.00E+00	5.92E+00
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	1.00E+00	0.00E+00
Cm-246		4700	1.00E+00	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	2.53E+00
	Pu-242	380000	2.00E-04	4.00E-07	2.40E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	3.64E-04
	U-238	4.5E+09	0.00E+00	1.20E-07	4.50E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Cm-247		16000000	1.00E+00	3.50E-07	1.90E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	2.53E+00
	Pu-243	0.00056	1.00E+00	6.20E-10	8.50E-11							2.53E+00
	Am-243	7400	9.40E-03	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	1.00E+00	4.68E-01
	Np-239	0.0065	9.40E-03	5.70E-09	8.00E-10	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	1.00E+00	1.85E+00
	Pu-239	24000	0.00E+00	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	0.00E+00
Cm-248		340000	1.00E+00	1.40E-06	7.70E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	2.53E+00
	Pu-244	83000000	0.00E+00	4.10E-07	2.40E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	0.00E+00
Bk-249		0.88	1.00E+00	2.90E-09	9.70E-10	3.00E-03	3.00E+01	2.13E+02	1.04E-04	1.00E+00	4.55E-01	2.13E+00
	Cf-249	350	2.50E-03	8.70E-07	3.50E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	9.98E-01	2.29E-02
	Cm-245	8500	0.00E+00	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	0.00E+00
Cf-248		0.92	1.00E+00	1.60E-07	2.80E-08	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	4.71E-01	4.33E+00
	Cm-244	18	4.31E-02	2.90E-07	1.20E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	9.62E-01	1.05E-01
	Pu-240	6500	1.00E-04	4.20E-07	2.50E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.82E-04
	U-236	23000000	0.00E+00	1.30E-07	4.70E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00
Cf-249		350	1.00E+00	8.70E-07	3.50E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	9.98E-01	9.17E+00
	Cm-245	8500	7.40E-03	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	1.87E-02
	Pu-241	14	5.90E-03	5.70E-09	4.80E-09	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	1.07E-02

Nuclide	Daugh-ter	Half-Life	Ratio daughter /parent	dose coeff. 1-2 a	dose coeff. adults	root transfer factor	fish transfer factor	Kd	Leach rate	decay time	decay factor unsaturated zone	seepage concentr.
		[a]		[Sv/Bq]	[Sv/Bq]		[l/kg]	[cm^3/g]	[1/a]	[a]		[Bq/l]
	Am-241	430	4.00E-04	3.70E-07	2.00E-07	2.00E-03	3.00E+01	2.00E+01	1.11E-03	1.00E+00	1.00E+00	1.99E-02
	Np-237	2100000	0.00E+00	2.10E-07	1.10E-07	4.00E-02	3.00E+01	5.00E+00	4.37E-03	1.00E+00	1.00E+00	0.00E+00
Cf-250		13	1.00E+00	5.50E-07	1.60E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	9.48E-01	8.71E+00
	Cm-246	4700	2.70E-03	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	6.84E-03
	Pu-242	380000	0.00E+00	4.00E-07	2.40E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	0.00E+00
Cf-251		900	1.00E+00	8.90E-07	3.60E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	9.99E-01	9.18E+00
	Cm-247	16000000	0.00E+00	3.50E-07	1.90E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	0.00E+00
Cf-252		2.6	1.00E+00	5.10E-07	9.00E-08	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	7.66E-01	7.04E+00
	Cm-248	340000	0.00E+00	1.40E-06	7.70E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	0.00E+00
Es-254		0.76	1.00E+00	1.60E-07	2.80E-08	3.00E-03	3.00E+01	2.13E+02	1.04E-04	1.00E+00	4.02E-01	1.88E+00
	Bk-250	0.0003676	1.00E+00	8.50E-10	1.40E-10		3.00E+01					1.88E+00
	Cf-250	13	4.84E-02	5.50E-07	1.60E-07	1.00E-02	2.50E+01	1.09E+02	2.04E-04	1.00E+00	9.48E-01	4.22E-01
	Cm-246	4700	2.00E-03	3.70E-07	2.10E-07	1.00E-03	3.00E+01	3.95E+02	5.63E-05	1.00E+00	1.00E+00	5.06E-03
	Pu-242	380000	2.00E-04	4.00E-07	2.40E-07	1.00E-03	3.00E+01	5.50E+02	4.04E-05	1.00E+00	1.00E+00	3.64E-04
	U-238	4.5E+09	0.00E+00	1.20E-07	4.50E-08	1.00E-02	1.00E+01	1.50E+01	1.47E-03	1.00E+00	1.00E+00	0.00E+00

TABLE I-XII: Water Pathway Calculations for Low Probability Scenario

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
H-3		6.36E+02	2.68E-01	2.90E+02	1.16E+03	2.68E-01	1.95E+01	2.21E+01	1.95E+01	2.21E+01
C-14		6.74E+02	2.84E-01	2.85E+02	1.19E+03	1.42E+04	3.41E+02	3.82E+02	3.41E+02	3.82E+02
Na-22		4.57E+00	1.93E-03	1.60E+00	7.60E+00	3.85E-02	1.70E+01	1.18E+01	1.70E+01	1.18E+01
Cl-36		1.75E+01	7.38E-03	1.59E+01	4.35E+01	7.38E+00	3.22E+01	1.48E+01	3.22E+01	1.48E+01
Ca-41		1.18E+01	4.98E-03	4.55E+00	2.03E+01	4.98E+00	1.55E+00	1.83E+00	1.55E+00	1.83E+00
Mn-53		1.20E+00	5.06E-04	4.55E-01	2.05E+00	2.03E-01	6.62E-02	2.93E-02	6.62E-02	2.93E-02
Mn-54		5.36E-01	2.26E-04	2.03E-01	9.15E-01	9.05E-02	7.26E-01	3.10E-01	7.26E-01	3.10E-01
Fe-55		2.91E-01	1.23E-04	1.00E-01	4.81E-01	2.45E-02	1.73E-01	7.74E-02	1.73E-01	7.74E-02
Co-57		3.92E-01	1.65E-04	1.39E-01	6.55E-01	4.96E-02	1.56E-01	6.66E-02	1.56E-01	6.66E-02
Co-60		8.78E-01	3.70E-04	3.11E-01	1.47E+00	1.11E-01	5.89E+00	2.41E+00	5.89E+00	2.41E+00
Ni-59		2.00E-01	8.45E-05	7.60E-02	3.42E-01	8.45E-03	1.70E-02	1.03E-02	1.70E-02	1.03E-02
Ni-63		1.99E-01	8.39E-05	7.55E-02	3.39E-01	8.39E-03	4.18E-02	2.42E-02	4.18E-02	2.42E-02
Zn-65		2.40E+02	1.01E-01	1.36E+02	4.74E+02	1.01E+02	1.02E+03	7.93E+02	1.02E+03	7.93E+02
Se-79		6.74E+02	2.84E-01	2.40E+02	1.13E+03	5.68E+01	4.69E+03	1.58E+03	4.69E+03	1.58E+03
Rb-87		2.95E+00	1.24E-03	1.08E+00	4.98E+00	2.49E+00	7.42E+00	3.61E+00	7.42E+00	3.61E+00
Sr-90		3.89E+00	1.64E-03	1.48E+00	6.64E+00	9.85E-02	7.11E+01	8.85E+01	9.05E+01	9.71E+01
	Y-90	3.89E+00	1.64E-03	1.48E+00	6.64E+00	9.85E-02	1.95E+01	8.54E+00		
Zr-93		2.15E-01	9.06E-05	7.42E-02	3.56E-01	2.72E-02	4.04E-02	1.91E-01	1.51E+02	6.49E+01
	Nb-93m	6.68E+02	2.82E-01	2.31E+02	1.11E+03	8.45E+01	1.51E+02	6.47E+01		
Nb-93m		6.41E+02	2.71E-01	2.22E+02	1.06E+03	8.12E+01	1.45E+02	6.21E+01	1.45E+02	6.21E+01
Nb-94		6.74E+02	2.84E-01	2.33E+02	1.12E+03	8.53E+01	1.62E+03	9.25E+02	1.62E+03	9.25E+02
Mo-93		5.96E+00	2.51E-03	2.19E+00	1.01E+01	2.51E-02	1.02E+01	1.50E+01	1.59E+02	7.87E+01
	Nb-93m	6.58E+02	2.77E-01	2.28E+02	1.09E+03	8.32E+01	1.48E+02	6.37E+01		
Tc-97		6.74E+02	2.84E-01	6.07E+02	1.66E+03	5.68E+00	9.59E+01	4.14E+01	9.59E+01	4.14E+01
Tc-99		6.74E+02	2.84E-01	6.07E+02	1.66E+03	5.68E+00	9.39E+02	3.90E+02	9.39E+02	3.90E+02
Ru-106		3.37E+02	1.42E-01	1.18E+02	5.61E+02	1.42E+00	4.09E+03	1.90E+03	4.09E+03	1.90E+03
Rh-102		1.07E+00	4.51E-04	3.76E-01	1.78E+00	4.51E-03	2.65E+00	2.25E+00	2.65E+00	2.25E+00
Pd-107		2.00E+00	8.45E-04	7.14E-01	3.35E+00	8.45E-03	1.39E-01	5.99E-02	1.39E-01	5.99E-02
Ag-108m		6.70E+02	2.83E-01	2.32E+02	1.11E+03	1.41E+00	1.82E+03	1.24E+03	1.82E+03	1.24E+03
Ag-110m		2.47E+02	1.04E-01	8.55E+01	4.09E+02	5.20E-01	8.55E+02	5.57E+02	8.55E+02	5.57E+02
Cd-109		3.95E+02	1.67E-01	1.58E+02	6.87E+02	3.34E+01	9.47E+02	6.46E+02	9.47E+02	6.46E+02
Cd-113m		6.41E+02	2.70E-01	2.57E+02	1.11E+03	5.40E+01	9.04E+03	1.20E+04	9.04E+03	1.20E+04

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Cd-113	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	In-113m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Sn-121m		6.66E+02	2.81E-01	2.52E+02	1.13E+03	8.42E+02	4.56E+02	2.08E+02	7.43E+02	3.33E+02
	Sn-121	6.66E+02	2.81E-01	2.52E+02	1.13E+03	8.42E+02	2.87E+02	1.26E+02		
Sb-125		5.26E+02	2.22E-01	1.82E+02	8.71E+02	2.22E+01	7.95E+02	4.67E+02	9.60E+02	5.40E+02
	Te-125m	1.02E+02	4.31E-02	4.66E+01	1.85E+02	1.72E+01	1.65E+02	7.34E+01		
I-129		3.18E+02	1.34E-01	1.10E+02	5.27E+02	5.36E+00	1.73E+04	2.82E+04	1.73E+04	2.82E+04
Cs-134		1.60E-01	6.75E-05	5.60E-02	2.66E-01	1.35E-01	6.41E-01	2.47E+00	6.41E-01	2.47E+00
Cs-135		2.23E-01	9.39E-05	7.79E-02	3.70E-01	1.88E-01	1.28E-01	3.62E-01	1.28E-01	3.62E-01
Cs-137		2.18E-01	9.18E-05	7.61E-02	3.62E-01	1.84E-01	6.54E-01	2.30E+00	6.54E-01	2.30E+00
Ba-133		1.27E+00	5.37E-04	4.47E-01	2.12E+00	2.15E-03	1.96E+00	1.54E+00	1.96E+00	1.54E+00
La-137		2.82E-01	1.19E-04	9.74E-02	4.67E-01	3.56E-03	3.14E-02	1.84E-02	3.14E-02	1.84E-02
Ce-144		4.95E-02	2.09E-05	1.74E-02	8.23E-02	6.26E-04	4.78E-01	2.08E-01	4.82E-01	2.10E-01
	Pr-144	4.95E-02	2.09E-05	1.74E-02	8.23E-02	6.26E-04	4.29E-03	2.00E-03		
Pm-145		2.41E-01	1.02E-04	8.32E-02	3.99E-01	3.05E-03	4.05E-02	2.14E-02	4.05E-02	2.14E-02
Pm-146		2.21E-01	9.32E-05	7.64E-02	3.66E-01	2.80E-03	2.79E-01	1.60E-01	2.79E-01	1.60E-01
	Sm-146	1.82E-08	7.68E-12	6.29E-09	3.01E-08	1.92E-10	6.76E-07	7.92E-07		
Pm-147		1.92E-01	8.09E-05	6.63E-02	3.18E-01	2.43E-03	9.02E-02	4.02E-02	9.02E-02	4.02E-02
	Sm-147	8.61E-12	3.63E-15	2.97E-12	1.43E-11	0.00E+00	2.98E-10	3.40E-10		
Sm-151		3.28E-01	1.39E-04	1.14E-01	5.44E-01	3.46E-03	5.20E-02	2.59E-02	5.20E-02	2.59E-02
Eu-152		2.38E-01	1.00E-04	8.21E-02	3.93E-01	5.01E-03	4.35E-01	2.68E-01	4.35E-01	2.68E-01
	Gd-152	4.30E-14	1.81E-17	1.49E-14	7.13E-14	0.00E+00	1.28E-12	1.42E-12		
Eu-154		2.32E-01	9.77E-05	8.00E-02	3.83E-01	4.88E-03	6.88E-01	3.73E-01	6.88E-01	3.73E-01
Eu-155		2.18E-01	9.20E-05	7.53E-02	3.61E-01	4.60E-03	1.19E-01	5.63E-02	1.19E-01	5.63E-02
Gd-153		1.16E-01	4.88E-05	4.00E-02	1.92E-01	0.00E+00	5.16E-02	2.52E-02	5.16E-02	2.52E-02
Tb-157		3.29E-01	1.39E-04	1.14E-01	5.46E-01	3.47E-03	1.79E-02	9.03E-03	1.79E-02	9.03E-03
Ho-166m		3.31E-01	1.40E-04	1.14E-01	5.48E-01	3.49E-03	7.61E-01	5.33E-01	7.61E-01	5.33E-01
Tm-171		1.96E-01	8.25E-05	6.76E-02	3.24E-01	2.06E-03	3.78E-02	1.73E-02	3.78E-02	1.73E-02
Pt-193		4.84E+00	2.04E-03	1.95E+00	8.42E+00	2.04E-02	2.93E-01	1.23E-01	2.93E-01	1.23E-01
Tl-204		5.62E+02	2.37E-01	3.19E+02	1.11E+03	2.37E+03	1.32E+03	5.91E+02	1.32E+03	5.91E+02
Bi-207		6.62E+02	2.79E-01	2.36E+02	1.11E+03	4.19E+00	1.17E+03	6.95E+02	1.17E+03	6.95E+02
Th-229		4.36E-02	1.84E-05	1.51E-02	7.23E-02	1.84E-03	1.08E+01	1.72E+01	2.57E+01	2.16E+01
	Ra-225	4.36E-02	1.84E-05	1.51E-02	7.23E-02	1.84E-03	1.30E+01	3.48E+00		
	Ac-225	4.36E-02	1.84E-05	1.51E-02	7.23E-02	1.84E-03	1.94E+00	8.45E-01		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Fr-221									
	At-217									
	Bi-213	4.36E-02	1.84E-05	1.51E-02	7.23E-02	1.84E-03	1.51E-02	7.04E-03		
	Po-213									
	Tl-209									
	Pb-209	4.36E-02	1.84E-05	1.51E-02	7.23E-02	1.84E-03	4.11E-03	2.01E-03		
U-232		3.95E+00	1.67E-03	1.37E+00	6.54E+00	1.67E-02	8.01E+02	1.05E+03	8.12E+02	1.05E+03
	Th-228	3.92E-02	1.65E-05	1.35E-02	6.48E-02	1.65E-03	3.59E+00	2.27E+00		
	Ra-224	3.92E-02	1.65E-05	1.35E-02	6.48E-02	1.65E-03	6.40E+00	2.05E+00		
	Rn-220									
	Po-216									
	Pb-212	3.92E-02	1.65E-05	1.35E-02	6.48E-02	1.65E-03	6.11E-01	1.89E-01		
	Bi-212	3.92E-02	1.65E-05	1.35E-02	6.48E-02	1.65E-03	1.75E-02	8.21E-03		
	Po-212									
	Tl-208									
U-233		3.99E+00	1.68E-03	1.38E+00	6.61E+00	1.68E-02	1.38E+02	1.64E+02	1.38E+02	1.64E+02
	Th-229	4.10E-04	1.73E-07	1.42E-04	6.79E-04	1.73E-05	1.02E-01	1.62E-01		
	Ra-225	4.10E-04	1.73E-07	1.42E-04	6.79E-04	1.73E-05	1.22E-01	3.28E-02		
	Ac-225	4.10E-04	1.73E-07	1.42E-04	6.79E-04	1.73E-05	1.83E-02	7.94E-03		
	Fr-221									
	At-217									
	Bi-213	4.10E-04	1.73E-07	1.42E-04	6.79E-04	1.73E-05	1.42E-04	6.62E-05		
	Po-213									
	Tl-209									
	Pb-209	4.10E-04	1.73E-07	1.42E-04	6.79E-04	1.73E-05	3.86E-05	1.89E-05		
U-236		3.99E+00	1.68E-03	1.38E+00	6.61E+00	1.68E-02	1.28E+02	1.51E+02	1.28E+02	1.51E+02
	Th-232	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Np-237		1.18E+01	4.98E-03	4.13E+00	1.96E+01	1.50E-01	6.15E+02	1.05E+03	6.33E+02	1.06E+03
	Pa-233	1.18E+01	4.98E-03	4.13E+00	1.96E+01	1.50E-01	1.82E+01	8.30E+00		
	U-233	1.59E-03	6.72E-07	5.52E-04	2.64E-03	6.72E-06	5.53E-02	6.56E-02		
	Th-229	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-236		8.54E-02	3.60E-05	2.95E-02	1.41E-01	1.08E-03	4.65E+00	5.99E+00	3.29E+01	4.26E+01
	U-232	1.37E-01	5.78E-05	4.75E-02	2.27E-01	5.78E-04	2.78E+01	3.64E+01		
	Th-228	1.48E-03	6.24E-07	5.11E-04	2.45E-03	6.24E-05	1.35E-01	8.58E-02		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Ra-224	1.48E-03	6.24E-07	5.11E-04	2.45E-03	6.24E-05	2.42E-01	7.75E-02		
	Rn-220									
	Po-216									
	Pb-212	1.48E-03	6.24E-07	5.11E-04	2.45E-03	6.24E-05	2.31E-02	7.15E-03		
	Bi-212	1.48E-03	6.24E-07	5.11E-04	2.45E-03	6.24E-05	6.59E-04	3.10E-04		
	Po-212									
	Tl-208									
Pu-238		1.08E-01	4.58E-05	3.75E-02	1.80E-01	1.37E-03	1.07E+01	2.01E+01	1.08E+01	2.01E+01
	U-234	7.97E-04	3.36E-07	2.76E-04	1.32E-03	3.36E-06	2.57E-02	3.15E-02		
	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-239		1.09E-01	4.61E-05	3.78E-02	1.81E-01	1.38E-03	1.14E+01	2.20E+01	1.14E+01	2.20E+01
	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-240		1.09E-01	4.61E-05	3.78E-02	1.81E-01	1.38E-03	1.14E+01	2.20E+01	1.14E+01	2.20E+01
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-241		1.04E-01	4.39E-05	3.59E-02	1.72E-01	1.32E-03	1.47E-01	4.03E-01	8.25E+00	1.47E+01
	Am-241	8.85E-02	3.73E-05	3.06E-02	1.47E-01	1.12E-03	8.10E+00	1.43E+01		
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-242		1.09E-01	4.61E-05	3.78E-02	1.81E-01	1.38E-03	1.08E+01	2.12E+01	1.08E+01	2.12E+01
	U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Pu-244		1.09E-01	4.61E-05	3.78E-02	1.81E-01	1.38E-03	1.11E+01	2.12E+01	1.14E+01	2.15E+01
	U-240	1.09E-01	4.61E-05	3.78E-02	1.81E-01	1.38E-03	2.19E-01	9.70E-02		
	Np-240m									
	Np-240	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
	Pu-240	1.15E-03	4.84E-07	3.96E-04	1.90E-03	1.45E-05	1.19E-01	2.31E-01		
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Am-241		2.99E+00	1.26E-03	1.03E+00	4.95E+00	3.78E-02	2.74E+02	4.82E+02	2.74E+02	4.82E+02
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Am-242m		2.98E+00	1.26E-03	1.03E+00	4.93E+00	3.77E-02	2.21E+02	4.56E+02	2.27E+02	4.65E+02
	Am-242	2.97E+00	1.25E-03	1.02E+00	4.91E+00	3.75E-02	1.61E+00	7.17E-01		
	Cm-242	2.61E-02	1.10E-05	9.01E-03	4.32E-02	3.30E-04	4.91E-01	2.52E-01		
	Np-238	1.25E-02	5.28E-06	4.38E-03	2.08E-02	1.58E-04	1.92E-02	9.19E-03		
	Pu-238	3.81E-02	1.61E-05	1.32E-02	6.30E-02	4.82E-04	3.77E+00	7.06E+00		
	U-234	3.99E-04	1.68E-07	1.38E-04	6.61E-04	1.68E-06	1.28E-02	1.57E-02		
	Th-230	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
Am-243		2.99E+00	1.26E-03	1.03E+00	4.96E+00	3.79E-02	2.74E+02	4.83E+02	2.78E+02	4.85E+02
	Np-239	2.99E+00	1.26E-03	1.03E+00	4.96E+00	3.79E-02	4.22E+00	1.93E+00		
	Pu-239	3.17E-04	1.34E-07	1.10E-04	5.25E-04	4.01E-06	3.30E-02	6.39E-02		
	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-243		1.49E-01	6.27E-05	5.14E-02	2.46E-01	1.88E-03	1.21E+01	1.80E+01	1.22E+01	1.80E+01
	Pu-239	1.20E-04	5.07E-08	4.15E-05	1.99E-04	1.52E-06	1.25E-02	2.42E-02		
	U-235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-244		1.47E-01	6.18E-05	5.06E-02	2.43E-01	1.85E-03	1.05E+01	1.42E+01	1.05E+01	1.42E+01
	Pu-240	2.95E-04	1.24E-07	1.02E-04	4.89E-04	3.73E-06	3.07E-02	5.95E-02		
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-245		1.52E-01	6.42E-05	5.26E-02	2.52E-01	1.93E-03	1.39E+01	2.58E+01	4.67E+01	8.36E+01
	Pu-241	1.08E-01	4.54E-05	3.72E-02	1.78E-01	1.36E-03	1.52E-01	4.17E-01		
	Am-241	3.56E-01	1.50E-04	1.23E-01	5.90E-01	4.51E-03	3.26E+01	5.74E+01		
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-246		1.52E-01	6.42E-05	5.26E-02	2.52E-01	1.93E-03	1.39E+01	2.58E+01	1.39E+01	2.58E+01
	Pu-242	2.19E-05	9.22E-09	7.55E-06	3.62E-05	2.77E-07	2.16E-03	4.23E-03		
	U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-247		1.52E-01	6.42E-05	5.26E-02	2.52E-01	1.93E-03	1.32E+01	2.33E+01	1.59E+01	2.79E+01
	Pu-243	1.52E-01	6.42E-05	5.26E-02	2.52E-01	1.93E-03	2.34E-02	1.04E-02		
	Am-243	2.81E-02	1.19E-05	9.72E-03	4.66E-02	3.56E-04	2.58E+00	4.54E+00		
	Np-239	1.11E-01	4.68E-05	3.89E-02	1.85E-01	1.41E-03	1.57E-01	7.17E-02		
	Pu-239	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cm-248		1.52E-01	6.42E-05	5.26E-02	2.52E-01	1.93E-03	5.28E+01	9.45E+01	5.28E+01	9.45E+01
	Pu-244	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Bk-249		1.28E-01	5.41E-05	4.43E-02	2.12E-01	1.62E-03	9.20E-02	1.00E-01	3.89E-01	4.89E-01
	Cf-249	1.38E-03	5.82E-07	4.78E-04	2.29E-03	1.45E-05	2.97E-01	3.89E-01		
	Cm-245	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-248		2.60E-01	1.10E-04	9.01E-02	4.31E-01	2.74E-03	1.03E+01	5.87E+00	1.08E+01	6.49E+00
	Cm-244	6.32E-03	2.66E-06	2.18E-03	1.05E-02	7.99E-05	4.53E-01	6.11E-01		
	Pu-240	1.09E-05	4.61E-09	3.78E-06	1.81E-05	1.38E-07	1.14E-03	2.20E-03		
	U-236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-249		5.52E-01	2.33E-04	1.91E-01	9.14E-01	5.82E-03	1.19E+02	1.56E+02	1.19E+02	1.56E+02
	Cm-245	1.13E-03	4.75E-07	3.89E-04	1.87E-03	1.43E-05	1.03E-01	1.91E-01		
	Pu-241	6.45E-04	2.72E-07	2.23E-04	1.07E-03	8.16E-06	9.10E-04	2.50E-03		

Nuclide	Daugh-ter	well water concentr.	surface water concentr.	non-leafy vegetable concentr.	leafy vegetable concentr.	fish concentr.	effective dose 1-2 a	effective dose adults	total eff. dose 1-2 a	total eff. dose adults
		[Bq/l]	[Bq/l]	[Bq/kg]	[Bq/kg]	[Bq/kg]	[mSv/a]	[mSv/a]	[mSv/a]	[mSv/a]
	Am-241	1.20E-03	5.05E-07	4.14E-04	1.98E-03	1.52E-05	1.10E-01	1.93E-01		
	Np-237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-250		5.24E-01	2.21E-04	1.82E-01	8.68E-01	5.53E-03	7.13E+01	6.76E+01	7.14E+01	6.77E+01
	Cm-246	4.11E-04	1.73E-07	1.42E-04	6.81E-04	5.20E-06	3.77E-02	6.96E-02		
	Pu-242	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-251		5.52E-01	2.33E-04	1.91E-01	9.15E-01	5.82E-03	1.22E+02	1.60E+02	1.22E+02	1.60E+02
	Cm-247	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Cf-252		4.23E-01	1.79E-04	1.47E-01	7.02E-01	4.46E-03	5.34E+01	3.07E+01	5.34E+01	3.07E+01
	Cm-248	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
Es-254		1.13E-01	4.77E-05	3.91E-02	1.87E-01	1.43E-03	4.48E+00	2.55E+00	7.99E+00	5.90E+00
	Bk-250	1.13E-01	4.77E-05	3.91E-02	1.87E-01	1.43E-03	2.38E-02	1.28E-02		
	Cf-250	2.54E-02	1.07E-05	8.78E-03	4.20E-02	2.67E-04	3.45E+00	3.27E+00		
	Cm-246	3.05E-04	1.28E-07	1.05E-04	5.04E-04	3.85E-06	2.79E-02	5.16E-02		
	Pu-242	2.19E-05	9.22E-09	7.55E-06	3.62E-05	2.77E-07	2.16E-03	4.23E-03		
	U-238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		

TABLE I-XIII: Summary of Water Pathway Calculations

Nuclide	realistic model					low probability model						
	total dose 1-2 a	total dose adult	max. dose	excl. level	excl. level rounded	total dose 1-2 a	total dose adult	max. dose	excl. level	excl. level rounded	excl. level water	from
				10 μSv/a					1000 μSv/a			
	[mSv/a]	[mSv/a]	[mSv/a]	[Bq/g]	[Bq/g]	[mSv/a]	[mSv/a]	[mSv/a]	[Bq/g]	[Bq/g]	[Bq/g]	
H-3	2.85E-01	3.30E-01	3.30E-01	3.03E+01	1.00E+02	1.95E+01	2.21E+01	2.21E+01	4.53E+01	1.00E+02	**100**	identical
C-14	5.04E+00	5.80E+00	5.80E+00	1.72E+00	1.00E+00	3.41E+02	3.82E+02	3.82E+02	2.62E+00	1.00E+00	**1**	identical
Na-22	8.05E-12	5.71E-12	8.05E-12	1.00E+10	1.00E+10	1.70E+01	1.18E+01	1.70E+01	5.89E+01	1.00E+02	**100**	low prob.
Cl-36	4.76E-01	2.25E-01	4.76E-01	2.10E+01	1.00E+01	3.22E+01	1.48E+01	3.22E+01	3.10E+01	1.00E+02	**10**	realistic
Ca-41	2.41E-03	2.92E-03	2.92E-03	3.42E+03	1.00E+04	1.55E+00	1.83E+00	1.83E+00	5.46E+02	1.00E+03	**1,000**	low prob.
Mn-53	2.55E-04	1.15E-04	2.55E-04	3.92E+04	1.00E+05	6.62E-02	2.93E-02	6.62E-02	1.51E+04	1.00E+04	**10,000**	low prob.
Mn-54	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	7.26E-01	3.10E-01	7.26E-01	1.38E+03	1.00E+03	**1,000**	low prob.
Fe-55	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	1.73E-01	7.74E-02	1.73E-01	5.79E+03	1.00E+04	**10,000**	low prob.
Co-57	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	1.56E-01	6.66E-02	1.56E-01	6.41E+03	1.00E+04	**10,000**	low prob.
Co-60	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	5.89E+00	2.41E+00	5.89E+00	1.70E+02	1.00E+02	**100**	low prob.
Ni-59	7.25E-05	4.46E-05	7.25E-05	1.38E+05	1.00E+05	1.70E-02	1.03E-02	1.70E-02	5.87E+04	1.00E+05	**100,000**	identical
Ni-63	1.15E-32	6.83E-33	1.15E-32	1.00E+10	1.00E+10	4.18E-02	2.42E-02	4.18E-02	2.39E+04	1.00E+04	**10,000**	low prob.
Zn-65	6.77E+00	5.41E+00	6.77E+00	1.48E+00	1.00E+00	1.02E+03	7.93E+02	1.02E+03	9.82E-01	1.00E+00	**1**	identical
Se-79	7.23E+01	2.49E+01	7.23E+01	1.38E-01	1.00E-01	4.69E+03	1.58E+03	4.69E+03	2.13E-01	1.00E-01	**0.10**	identical
Rb-87	1.14E-01	5.68E-02	1.14E-01	8.76E+01	1.00E+02	7.42E+00	3.61E+00	7.42E+00	1.35E+02	1.00E+02	**100**	identical
Sr-90	1.08E-03	1.18E-03	1.18E-03	8.45E+03	1.00E+04	9.05E+01	9.71E+01	9.71E+01	1.03E+01	1.00E+01	**10**	low prob.
Zr-93	2.32E+00	1.02E+00	2.32E+00	4.31E+00	1.00E+01	1.51E+02	6.49E+01	1.51E+02	6.64E+00	1.00E+01	**10**	identical
Nb-93m	2.15E+00	9.42E-01	2.15E+00	4.66E+00	1.00E+01	1.45E+02	6.21E+01	1.45E+02	6.91E+00	1.00E+01	**10**	identical
Nb-94	2.50E+01	1.46E+01	2.50E+01	4.00E-01	1.00E+00	1.62E+03	9.25E+02	1.62E+03	6.17E-01	1.00E+00	**1**	identical
Mo-93	2.28E+00	1.08E+00	2.28E+00	4.38E+00	1.00E+01	1.59E+02	7.87E+01	1.59E+02	6.31E+00	1.00E+01	**10**	identical
Tc-97	1.42E+00	6.32E-01	1.42E+00	7.06E+00	1.00E+01	9.59E+01	4.14E+01	9.59E+01	1.04E+01	1.00E+01	**10**	identical
Tc-99	1.39E+01	5.95E+00	1.39E+01	7.20E-01	1.00E+00	9.39E+02	3.90E+02	9.39E+02	1.06E+00	1.00E+00	**1**	identical
Ru-106	1.82E+01	8.64E+00	1.82E+01	5.50E-01	1.00E+00	4.09E+03	1.90E+03	4.09E+03	2.44E-01	1.00E-01	**0.10**	low prob.
Rh-102	1.51E-43	1.31E-43	1.51E-43	1.00E+10	1.00E+10	2.65E+00	2.25E+00	2.65E+00	3.77E+02	1.00E+03	**1,000**	low prob.
Pd-107	2.15E-03	9.43E-04	2.15E-03	4.66E+03	1.00E+04	1.39E-01	5.99E-02	1.39E-01	7.18E+03	1.00E+04	**10,000**	identical
Ag-108m	2.81E+01	1.95E+01	2.81E+01	3.56E-01	1.00E+00	1.82E+03	1.24E+03	1.82E+03	5.48E-01	1.00E+00	**1**	identical
Ag-110m	5.94E+00	3.95E+00	5.94E+00	1.68E+00	1.00E+00	8.55E+02	5.57E+02	8.55E+02	1.17E+00	1.00E+00	**1**	identical

Nuclide	realistic model					low probability model						
	total dose 1-2 a	total dose adult	max. dose	excl. level	excl. level rounded	total dose 1-2 a	total dose adult	max. dose	excl. level	excl. level rounded	excl. level water	from
	10 µSv/a					1000 µSv/a						
	[mSv/a]	[mSv/a]	[mSv/a]	[Bq/g]	[Bq/g]	[mSv/a]	[mSv/a]	[mSv/a]	[Bq/g]	[Bq/g]	[Bq/g]	
Cd-109	5.58E+00	3.89E+00	5.58E+00	1.79E+00	1.00E+00	9.47E+02	6.46E+02	9.47E+02	1.06E+00	1.00E+00	**1**	identical
Cd-113m	1.33E+02	1.81E+02	1.81E+02	5.51E-02	1.00E-01	9.04E+03	1.20E+04	1.20E+04	8.31E-02	1.00E-01	**0.10**	identical
Sn-121m	1.13E+01	5.18E+00	1.13E+01	8.85E-01	1.00E+00	7.43E+02	3.33E+02	7.43E+02	1.35E+00	1.00E+00	**1**	identical
Sb-125	1.21E+01	6.99E+00	1.21E+01	8.23E-01	1.00E+00	9.60E+02	5.40E+02	9.60E+02	1.04E+00	1.00E+00	**1**	identical
I-129	2.67E+02	4.45E+02	4.45E+02	2.25E-02	1.00E-02	1.73E+04	2.82E+04	2.82E+04	3.55E-02	1.00E-01	**0.01**	realistic
Cs-134	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	6.41E-01	2.47E+00	2.47E+00	4.04E+02	1.00E+03	**1,000**	low prob.
Cs-135	5.32E-04	1.54E-03	1.54E-03	6.51E+03	1.00E+04	1.28E-01	3.62E-01	3.62E-01	2.76E+03	1.00E+03	**1,000**	low prob.
Cs-137	1.31E-93	4.71E-93	4.71E-93	1.00E+10	1.00E+10	6.54E-01	2.30E+00	2.30E+00	4.35E+02	1.00E+03	**1,000**	low prob.
Ba-133	5.54E-15	4.46E-15	5.54E-15	1.00E+10	1.00E+10	1.96E+00	1.54E+00	1.96E+00	5.11E+02	1.00E+03	**1,000**	low prob.
La-137	4.74E-04	2.84E-04	4.74E-04	2.11E+04	1.00E+04	3.14E-02	1.84E-02	3.14E-02	3.19E+04	1.00E+05	**10,000**	realistic
Ce-144	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	4.82E-01	2.10E-01	4.82E-01	2.07E+03	1.00E+03	**1,000**	low prob.
Pm-145	5.58E-45	3.00E-45	5.58E-45	1.00E+10	1.00E+10	4.05E-02	2.14E-02	4.05E-02	2.47E+04	1.00E+04	**10,000**	low prob.
Pm-146	2.24E-134	1.31E-134	2.24E-134	1.00E+10	1.00E+10	2.79E-01	1.60E-01	2.79E-01	3.59E+03	1.00E+04	**10,000**	low prob.
Pm-147	4.60E-12	5.36E-12	5.36E-12	1.00E+10	1.00E+10	9.02E-02	4.02E-02	9.02E-02	1.11E+04	1.00E+04	**10,000**	low prob.
Sm-151	2.72E-09	1.38E-09	2.72E-09	3.68E+09	1.00E+10	5.20E-02	2.59E-02	5.20E-02	1.92E+04	1.00E+04	**10,000**	low prob.
Eu-152	1.97E-14	2.24E-14	2.24E-14	1.00E+10	1.00E+10	4.35E-01	2.68E-01	4.35E-01	2.30E+03	1.00E+03	**1,000**	low prob.
Eu-154	3.22E-85	1.79E-85	3.22E-85	1.00E+10	1.00E+10	6.88E-01	3.73E-01	6.88E-01	1.45E+03	1.00E+03	**1,000**	low prob.
Eu-155	1.17E-148	5.66E-149	1.17E-148	1.00E+10	1.00E+10	1.19E-01	5.63E-02	1.19E-01	8.42E+03	1.00E+04	**10,000**	low prob.
Gd-153	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	5.16E-02	2.52E-02	5.16E-02	1.94E+04	1.00E+04	**10,000**	low prob.
Tb-157	1.45E-07	7.43E-08	1.45E-07	6.92E+07	1.00E+08	1.79E-02	9.03E-03	1.79E-02	5.57E+04	1.00E+05	**100,000**	low prob.
Ho-166m	4.57E-03	3.27E-03	4.57E-03	2.19E+03	1.00E+03	7.61E-01	5.33E-01	7.61E-01	1.31E+03	1.00E+03	**1,000**	identical
Tm-171	0.00E+00	0.00E+00	0.00E+00	1.00E+10	1.00E+10	3.78E-02	1.73E-02	3.78E-02	2.65E+04	1.00E+04	**10,000**	low prob.
Pt-193	9.75E-04	4.18E-04	9.75E-04	1.03E+04	1.00E+04	2.93E-01	1.23E-01	2.93E-01	3.42E+03	1.00E+04	**10,000**	identical
Tl-204	1.72E+01	7.89E+00	1.72E+01	5.81E-01	1.00E+00	1.32E+03	5.91E+02	1.32E+03	7.56E-01	1.00E+00	**1**	identical
Bi-207	1.77E+01	1.08E+01	1.77E+01	5.64E-01	1.00E+00	1.17E+03	6.95E+02	1.17E+03	8.57E-01	1.00E+00	**1**	identical
Th-229	4.92E-25	4.22E-25	4.92E-25	1.00E+10	1.00E+10	2.57E+01	2.16E+01	2.57E+01	3.89E+01	1.00E+02	**100**	low prob.
U-232	4.86E-02	6.51E-02	6.51E-02	1.54E+02	1.00E+02	8.12E+02	1.05E+03	1.05E+03	9.48E-01	1.00E+00	**1**	low prob.
U-233	6.41E-01	7.77E-01	7.77E-01	1.29E+01	1.00E+01	1.38E+02	1.64E+02	1.64E+02	6.09E+00	1.00E+01	**10**	identical
U-236	5.96E-01	7.18E-01	7.18E-01	1.39E+01	1.00E+01	1.28E+02	1.51E+02	1.51E+02	6.62E+00	1.00E+01	**10**	identical
Np-237	9.92E-01	1.69E+00	1.69E+00	5.91E+00	1.00E+01	6.33E+02	1.06E+03	1.06E+03	9.46E-01	1.00E+00	**1**	low prob.

Nuclide	realistic model					low probability model						
	total dose 1-2 a	total dose adult	max. dose	excl. level	excl. level rounded	total dose 1-2 a	total dose adult	max. dose	excl. level	excl. level rounded	excl. level water	from
				10 µSv/a					1000 µSv/a			
	[mSv/a]	[mSv/a]	[mSv/a]	[Bq/g]	[Bq/g]	[mSv/a]	[mSv/a]	[mSv/a]	[Bq/g]	[Bq/g]	[Bq/g]	
Pu-236	1.69E-03	2.26E-03	2.26E-03	4.43E+03	1.00E+04	3.29E+01	4.26E+01	4.26E+01	2.35E+01	1.00E+01	**10**	low prob.
Pu-238	1.19E-04	1.49E-04	1.49E-04	6.69E+04	1.00E+05	1.08E+01	2.01E+01	2.01E+01	4.96E+01	1.00E+02	**100**	low prob.
Pu-239	2.87E-02	5.68E-02	5.68E-02	1.76E+02	1.00E+02	1.14E+01	2.20E+01	2.20E+01	4.54E+01	1.00E+02	**100**	identical
Pu-240	7.08E-03	1.40E-02	1.40E-02	7.13E+02	1.00E+03	1.14E+01	2.20E+01	2.20E+01	4.54E+01	1.00E+02	**100**	low prob.
Pu-241	9.35E-02	1.68E-01	1.68E-01	5.95E+01	1.00E+02	8.25E+00	1.47E+01	1.47E+01	6.82E+01	1.00E+02	**100**	identical
Pu-242	4.45E-02	8.88E-02	8.88E-02	1.13E+02	1.00E+02	1.08E+01	2.12E+01	2.12E+01	4.73E+01	1.00E+02	**100**	identical
Pu-244	4.81E-02	9.23E-02	9.23E-02	1.08E+02	1.00E+02	1.14E+01	2.15E+01	2.15E+01	4.65E+01	1.00E+02	**100**	identical
Am-241	3.16E+00	5.68E+00	5.68E+00	1.76E+00	1.00E+00	2.74E+02	4.82E+02	4.82E+02	2.07E+00	1.00E+00	**1**	identical
Am-242m	1.49E+00	3.13E+00	3.13E+00	3.20E+00	1.00E+01	2.27E+02	4.65E+02	4.65E+02	2.15E+00	1.00E+00	**1**	low prob.
Am-243	4.23E+00	7.51E+00	7.51E+00	1.33E+00	1.00E+00	2.78E+02	4.85E+02	4.85E+02	2.06E+00	1.00E+00	**1**	identical
Cm-243	3.16E-05	6.25E-05	6.25E-05	1.60E+05	1.00E+05	1.22E+01	1.80E+01	1.80E+01	5.55E+01	1.00E+02	**100**	low prob.
Cm-244	1.91E-05	3.78E-05	3.78E-05	2.64E+05	1.00E+05	1.05E+01	1.42E+01	1.42E+01	7.02E+01	1.00E+02	**100**	low prob.
Cm-245	5.39E-01	9.84E-01	9.84E-01	1.02E+01	1.00E+01	4.67E+01	8.36E+01	8.36E+01	1.20E+01	1.00E+01	**10**	identical
Cm-246	1.27E-01	2.41E-01	2.41E-01	4.15E+01	1.00E+02	1.39E+01	2.58E+01	2.58E+01	3.88E+01	1.00E+02	**100**	identical
Cm-247	2.43E-01	4.38E-01	4.38E-01	2.28E+01	1.00E+01	1.59E+01	2.79E+01	2.79E+01	3.58E+01	1.00E+02	**10**	realistic
Cm-248	8.09E-01	1.48E+00	1.48E+00	6.76E+00	1.00E+01	5.28E+01	9.45E+01	9.45E+01	1.06E+01	1.00E+01	**10**	identical
Bk-249	6.59E-04	8.82E-04	8.82E-04	1.13E+04	1.00E+04	3.89E-01	4.89E-01	4.89E-01	2.04E+03	1.00E+03	**1,000**	low prob.
Cf-248	7.08E-07	1.40E-06	1.40E-06	7.13E+06	1.00E+07	1.08E+01	6.49E+00	1.08E+01	9.29E+01	1.00E+02	**100**	low prob.
Cf-249	2.66E-01	3.57E-01	3.57E-01	2.80E+01	1.00E+01	1.19E+02	1.56E+02	1.56E+02	6.41E+00	1.00E+01	**10**	identical
Cf-250	3.44E-04	6.50E-04	6.50E-04	1.54E+04	1.00E+04	7.14E+01	6.77E+01	7.14E+01	1.40E+01	1.00E+01	**10**	low prob.
Cf-251	8.83E-01	1.19E+00	1.19E+00	8.41E+00	1.00E+01	1.22E+02	1.60E+02	1.60E+02	6.24E+00	1.00E+01	**10**	identical
Cf-252	3.32E-114	1.95E-114	3.32E-114	1.00E+10	1.00E+10	5.34E+01	3.07E+01	5.34E+01	1.87E+01	1.00E+01	**10**	low prob.
Es-254	2.64E-04	4.99E-04	4.99E-04	2.00E+04	1.00E+04	7.99E+00	5.90E+00	7.99E+00	1.25E+02	1.00E+02	**100**	low prob.

TABLE II-I WEIGHTING FACTORS FOR THE INCLUSION OF DAUGHTER RADIONUCLIDES

Ca-47	1.0000	**Mn-52m**	1.0000	**Fe-52**	1.0000	**Co-58m**	1.0000	**Co-60m**	1.0000	**Zn-69m**	1.0000	**Sr-85m**	1.0000
Sc-47	0.4210	Mn-52	0.0000	Mn-52m	0.8420	Co-58	0.0052	Co-60	0.0000	Zn-69	0.8230	Sr-85	0.0006
				Mn-52	0.0007								
Sr-87m	1.0000	**Sr-90**	1.0000	**Sr-91**	1.0000	**Sr-92**	1.0000	**Y-91m**	1.0000	**Y-93**	1.0000	**Zr-93**	1.0000
Rb-87	0.0000	Y-90	0.9980	Y-91m	0.4546	Y-92	0.3200	Y-91	0.0006	Zr-93	0.0000	Nb-93m	0.9910
				Y-91	0.0065					Nb-93m	0.0000		
Zr-95	1.0000	**Zr-97**	1.0000	**Mo-93**	1.0000	**Mo-99**	1.0000	**Mo-101**	1.0000	**Tc-96m**	1.0000	**Tc-97m**	1.0000
Nb-95m	0.0067	Nb-97m	0.9404	Nb-93m	0.9760	Tc-99m	0.6964	Tc-101	0.3730	Tc-96	0.0079	Tc-97	0.0000
Nb-95	0.4818	Nb-97	0.8170			Tc-99	0.0000						
Tc-99m	1.0000	**Ru-97**	1.0000	**Ru-103**	1.0000	**Ru-105**	1.0000	**Ru-106**	1.0000	**Pd-103**	1.0000	**Pd-109**	1.0000
Tc-99	0.0000	Tc-97	0.0000	Rh-103m	0.9900	Rh-105m	0.2410	Rh-106	1.0000	Rh-103m	0.9860	Ag-109m	0.9930
						Rh-105	0.0931						
Ag-108m	1.0000	**Ag-110m**	1.0000	**Cd-109**	1.0000	**Cd-115**	1.0000	**Cd-115m**	1.0000	**In-114m**	1.0000	**In-115m**	1.0000
Ag-108	0.0930	Ag-110m	0.0130	Ag-109m	1.0000	In-115m	0.8010	In-115	0.0000	In-114	0.9550	In-115	0.0000
						In-115	0.0000						
Sn-113	1.0000	**Sn-125**	1.0000	**Sb-125**	1.0000	**Te-123m**	1.0000	**Te-127m**	1.0000	**Te-129**	1.0000	**Te-129m**	1.0000
In-113m	0.9960	Sb-125	0.0091	Te-125m	0.1940	Te-123	0.0000	Te-127	0.9620	I-129	0.0000	Te-129	0.6230
		Te-125m	0.0019									I-129	0.0000
Te-131	1.0000	**Te-131m**	1.0000	**Te-132**	1.0000	**Te-133**	1.0000	**Te-133m**	1.0000	**Te-134**	1.0000	**I-123**	1.0000
I-131	0.0021	Te-131	0.2090	I-132	0.8990	I-133	0.0096	Te-133	0.0842	I-134	0.3270	Te-123	0.0000
Xe-131m	0.0000	I-131	0.1100			Xe-133m	0.0001	I-133	0.0384				
		Xe-131m	0.0005			Xe-133	0.0012	Xe-133m	0.0003				
								Xe-133	0.0051				
I-131	1.0000	**I-133**	1.0000	**I-135**	1.0000	**Cs-134m**	1.0000	**Cs-137**	1.0000	**Ba-131**	1.0000	**Ba-140**	1.0000
Xe-131m	0.0033	Xe-133m	0.0063	Xe-135m	0.1450	Cs-134	0.0002	Ba-137m	0.9460	Cs-131	0.4050	La-140	0.7360
		Xe-133	0.1150	Xe-135	0.3110								
				Cs-135	0.0000								
Ce-143	1.0000	**Ce-144**	1.0000	**Nd-147**	1.0000	**Nd-149**	1.0000	**Pm-147**	1.0000	**Eu-152**	1.0000	**Eu-152m**	1.0000
Pr-143	0.0781	Pr-144m	0.0140	Pm-147	0.0109	Pm-149	0.0290	Sm-147	0.0000	Gd-152	0.0000	Gd-152	0.0000
		Pr-144	1.0000	Sm-147	0.0000								
Dy-166	1.0000	**Er-171**	1.0000	**W-187**	1.0000	**Re-186**	1.0000	**Os-191m**	1.0000	**Os-193**	1.0000	**Ir-190**	1.0000
Ho-166	0.5800	Tm-171	0.0004	Re-187	0.0000	Os-186	0.0000	Os-191	0.0311	Ir-193m	0.0003	Os-190m	0.9960
Pt-193m	1.0000	**Pt-197m**	1.0000	**Hg-197m**	1.0000	**At-211**	1.0000	**Ra-225**	1.0000	**Th-226**	1.0000	**Th-229**	1.0000
Pt-193	0.0002	Pt-197	0.0660	Hg-197	0.1925	Po-211	0.5830	Ac-225	0.4420	Ra-222	1.0000	Ra-225	1.0000
						Bi-207	0.0000	Fr-221	0.4420	Rn-218	1.0000	Ac-225	1.0000
								At-217	0.4420	Po-214	1.0000	Fr-221	1.0000
								Bi-213	0.4420	Pb-210	0.0000	At-217	1.0000
								Po-213	0.4325	Bi-210	0.0000	Bi-213	1.0000
								Tl-209	0.0096	Po-210	0.0000	Po-213	0.9784
								Pb-209	0.4420			Tl-209	0.0216
												Pb-209	1.0000

Pa-230	1.0000
U-230	0.0319
Th-226	0.0319
Ra-222	0.0319
Rn-218	0.0319
Po-214	0.0319
Pb-210	0.0002
Bi-210	0.0002
Po-210	0.0002
Th-230	0.0000
Ra-226	0.0000
Rn-222	0.0000
Po-218	0.0000
Pb-214	0.0000
Bi-214	0.0000

Pa-233	1.0000
U-233	0.0000
Th-229	0.0000
Ra-225	0.0000
Ac-225	0.0000
Fr-221	0.0000
At-217	0.0000
Bi-213	0.0000
Po-213	0.0000
Tl-209	0.0000
Pb-209	0.0000

U-230	1.0000
Th-226	0.9930
Ra-222	0.9930
Rn-218	0.9930
Po-214	0.9930
Pb-210	0.0025
Bi-210	0.0025
Po-210	0.0024

U-231	1.0000
Pa-231	0.0000
Ac-227	0.0000
Fr-223	0.0000
Th-227	0.0000
Ra-223	0.0000
Rn-219	0.0000
Po-215	0.0000
Pb-211	0.0000
Bi-211	0.0000
Po-211	0.0000
Tl-207	0.0000

U-232	1.0000
Th-228	0.9060
Ra-224	0.9060
Rn-220	0.9060
Po-216	0.9060
Pb-212	0.9060
Bi-212	0.9060
Po-212	0.5808
Tl-208	0.3253

U-233	1.0000
Th-229	0.0094
Ra-225	0.0094
Ac-225	0.0094
Fr-221	0.0094
At-217	0.0094
Bi-213	0.0094
Po-213	0.0092
Tl-209	0.0002
Pb-209	0.0094

U-236	1.0000
Th-232	0.0000
Ra-228	0.0000
Ac-228	0.0000
Th-228	0.0000
Ra-224	0.0000
Rn-220	0.0000
Po-216	0.0000
Pb-212	0.0000
Bi-212	0.0000
Po-212	0.0000
Tl-208	0.0000

U-237	1.0000
Np-237	0.0000
Pa-233	0.0000
U-233	0.0000
Th-229	0.0000
Ra-225	0.0000
Ac-225	0.0000
Fr-221	0.0000
At-217	0.0000
Bi-213	0.0000
Po-213	0.0000
Tl-209	0.0000
Pb-209	0.0000

U-239	1.0000
Np-239	0.0067
Pu-239	0.0000
U-235	0.0000

U-240	1.0000
Np-240m	0.9590
Np-240	0.0009
Pu-240	0.0000
U-236	0.0000
Th-232	0.0000

Np-237	1.0000
Pa-233	1.0000
U-233	0.0004
Th-229	0.0000
Ra-225	0.0000
Ac-225	0.0000
Fr-221	0.0000
At-217	0.0000
Bi-213	0.0000
Po-213	0.0000
Tl-209	0.0000
Pb-209	0.0000

Np-239	1.0000
Pu-239	0.0000
U-235	0.0000

Np-240	1.0000
Pu-240	0.0000
U-236	0.0000
Th-232	0.0000

Pu-236	1.0000
U-232	0.0347
Th-228	0.0342
Ra-224	0.0342
Rn-220	0.0342
Po-216	0.0342
Pb-212	0.0342
Bi-212	0.0342
Po-212	0.0219
Tl-208	0.0123

Pu-237	1.0000
Np-237	0.0000
Pa-233	0.0000
U-233	0.0000
Th-229	0.0000
Ra-225	0.0000
Ac-225	0.0000
Fr-221	0.0000
At-217	0.0000
Bi-213	0.0000
Po-213	0.0000
Tl-209	0.0000
Pb-209	0.0000

Pu-238	1.0000
U-234	0.0002
Th-230	0.0000
Ra-226	0.0000
Rn-222	0.0000
Po-218	0.0000
Pb-214	0.0000
Bi-214	0.0000
Po-214	0.0000
Pb-210	0.0000
Bi-210	0.0000
Po-210	0.0000

Pu-239	1.0000
U-235	0.0000

Pu-240	1.0000
U-236	0.0000
Th-232	0.0000

Pu-241	1.0000
Am-241	0.0296
Np-237	0.0000

Pu-242	1.0000
U-238	0.0000

Pu-243	1.0000
Am-243	0.0000
Np-239	0.0000
Pu-239	0.0000
U-235	0.0000

Pu-244	1.0000
U-240	1.0000
Np-240m	1.0000
Np-240	0.0011
Pu-240	0.0105
U-236	0.0000
Th-232	0.0000

Am-241	1.0000
Np-237	0.0000

Am-242	1.0000
Cu-242	0.0033
Pu-242	0.0000
Pu-238	0.0000
U-238	0.0000

Am-242m	1.0000
Am-242	0.9950
Cm-242	0.8090
Np-238	0.0050
Pu-238	0.3510
Pu-242	0.0000
U-234	0.0001
Th-230	0.0000

Am-243	1.0000
Np-239	1.0000
Pu-239	0.0029
U-235	0.0000

Cm-242	1.0000
Pu-238	0.0050
U-234	0.0000
Th-230	0.0000

Cm-243	1.0000
Pu-239	0.0011
Am-243	0.0000
Np-239	0.0000
U-235	0.0000

Cm-244	1.0000
Pu-240	0.0027
U-236	0.0000
Th-232	

Cm-245	1.0000
Pu-241	0.9850
Am-241	0.1190
Np-237	0.0000

Cm-246	1.0000
Pu-242	0.0002
U-238	0.0000

Cm-247	1.0000
Pu-243	1.0000
Am-243	0.0094
Np-239	0.0094
Pu-239	0.0000
U-235	0.0000

Cm-248	1.0000
Pu-244	0.0000
U-240	0.0000
Np-240m	0.0000
Np-240	0.0000
Pu-240	0.0000
U-236	0.0000
Th-232	0.0000

Bk-249	1.0000
Cf-249	0.0025
Cm-245	0.0000
Pu-241	0.0000
Am-241	0.0000
Np-237	0.0000

Cf-248	1.0000
Cm-244	0.0431
Pu-240	0.0001
U-236	0.0000
Th-232	0.0000

Cf-249	1.0000
Cm-245	0.0074
Pu-241	0.0059
Am-241	0.0004
Np-237	0.0000

Cf-250	1.0000
Cm-246	0.0027
Pu-242	0.0000
U-238	0.0000

Cf-252	1.0000
Cm-248	0.0000
Pu-244	0.0000
U-240	0.0000
Np-240m	0.0000
Np-240	0.0000
Pu-240	0.0000
U-236	0.0000
Th-232	0.0000

Cf-253	1.0000
Cm-249	0.0030
Es-253	0.3410
Bk-249	0.0444
Cf-249	0.0001
Cm-245	0.0000
Pu-241	0.0000
Am-241	0.0000
Np-237	0.0000

Cf-254	1.0000
Cm-250	0.0000
Bk-250	0.0000
Cf-250	0.0000
Pu-246	0.0000
Am-246	0.0000
Cm-246	0.0000
Pu-242	0.0000
U-238	

Es-253	1.0000
Bk-249	0.0531
Cf-249	0.0002
Cm-245	0.0000
Pu-241	0.0000
Am-241	0.0000
Np-237	0.0000

Es-254	1.0000
Bk-250	1.0000
Cf-250	0.0484
Cm-246	0.0002
Pu-242	0.0000
U-238	0.0000

Es-254m	1.0000
Fm-254	0.7960
Bk-250	0.0024
Cf-250	0.0003
Cm-246	0.0000
Pu-242	0.0000
U-238	0.0000

Fm-254	1.0000
Cf-250	0.0000
Cm-246	0.0000
Pu-242	0.0000
U-238	0.0000

Cf-251	0.0000
Cm-247	0.0000
Pu-243	0.0000
Am-243	0.0000
Np-239	0.0000
Pu-239	0.0000
U-235	0.0000