

# Calculation of Slope Factors and Dose Coefficients

**September 2014**

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Center for Radiation Protection Knowledge

## **CALULATIONS OF SLOPE FACTORS AND DOSE COEFFICIENTS**

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## **ABSTRACT**

There are many pathways in which radiation can provide dose to a human. In instances where radiological contamination occurs, dose coefficients for multiple ages and exposure types are useful in the determination of cancer risk and morbidity. The scenarios considered here can be categorized as either external exposure or internal exposure. For internal exposure, we estimated slope factors and dose coefficients (also known as risk coefficients and dose conversion factors, respectively) due to ingestion and inhalation of radionuclides. For external exposure, we estimated slope factors and dose coefficients due to submersion in contaminated air, immersion in contaminated water and exposure to soil contaminated to several depths. Progeny nuclide contribution from secular equilibrium over a 100 and 1000 year periods are also shown in Appendix A. Last, dose coefficients are given in the case where an infant from ingestion of breast milk contaminated by a mother's intake of radionuclides.

## **1. INTRODUCTION**

Risk factors (or slope factors) and dose coefficients were calculated for exposure to radionuclides in a variety of scenarios. The majority of the risk factors and dose coefficients were calculated using ORNL's DCAL software in the manner of Federal Guidance Report 12 and Federal Guidance Report 13 for internal intakes and for external exposure respectively. The only exceptions are for the nursing infant. Dose coefficients for the nursing infant were extracted from ICRP Publication 95.

The radionuclides considered in this study are those provided in the International Commission on Radiological Protection (ICRP) Publication 107. This document contains a revised database of nuclear decay data (energies and intensities of emitted radiations, physical half-lives and decay modes) for 1252 naturally occurring and manmade radionuclides. ICRP Publication 107 supersedes the previous database, ICRP Publication 38 published in 1983.

In addition to radionuclides in ICRP Publication 107, the assembled data files or tables contain entries that include the contribution of daughter products in secular equilibrium with their longer-lived parents. These entries are identified by the addition of +D and +E to the nuclide name where D and E refer to a 100 and 1000 year period of progeny ingrowth, respectively.

## **2. EXTERNAL EXPOSURE DOSE COEFFICIENTS**

Dose coefficients were calculated for external exposure to radionuclides in a variety of scenarios. We estimated dose coefficients due to submersion in contaminated air, immersion in contaminated water and exposure to soil contaminated to several depths. These coefficients were calculated using ORNL's DCAL software in the manner of Federal Guidance Report 12. The method is outlined below.

### **2.1 CONTAMINATED SOIL**

Dose coefficients were calculated for an individual standing on an infinite plane of contaminated soil. In this scenario, the contamination in the soil was assumed to be infinitely deep and the air was assumed to extend infinitely high. Both the soil and air were assumed to have uniform compositions and uniform densities of 1.6 and 0.00129 grams per cubic centimeter respectively.

The organ doses due to mono-energetic photons were obtained using a hybrid deterministic/Monte Carlo approach. In the first step, deterministic methods were used to simulate environmental radiation

transport from photons originating in the soil to a cylinder surrounding an adult phantom. In this step, several source depths were modeled: the soil surface, 0.04 mean free paths (MFP), 0.2 MFP, 1 MFP, 2.5 MFP and 4 MFP. Twelve photon energies ranging from 0.01 MeV to 10 MeV were considered. In the second step, a Monte Carlo radiation transport was performed to determine organ doses due to the calculated energy fluence incident on cylinder surrounding the phantom.

Next, radionuclide organ dose coefficients were calculated based using the ICRP 107 database of nuclear decay data. Only photons and electrons were considered in the external dose calculations. For radionuclides which emit electrons, an electron-to-photon treatment was used to estimate the photon flux arising from soil. This technique estimates the quantity of photons which could be expected due to bremsstrahlung production. Direct beta energy deposition was only considered from skin dose. For radionuclides which produce photons (including bremsstrahlung photons) the dose coefficient was determined by performing a weighted average of the contribution from each photon in the decay spectrum. Effective dose coefficients were computed from organ dose coefficients using ICRP 60 tissue weighting factors.

## **2.2 CONTAMINATED AIR**

Dose coefficients were calculated for an individual standing in a semi-infinite volume of contamination in the air. In this scenario, the individual was assumed to be standing on soil and the air was assumed to extend infinitely high. The air was assumed to have a uniform composition with density of 0.00129 grams per cubic centimeter. The radionuclide was assumed to be uniformly distributed in the air.

Organ doses due to mono-energetic photons in air were obtained in a similar manner to that used in contaminated soil. Deterministic radiation transport methods were used to determine the down scattered photon spectrum arising from an infinite contaminated air volume. This spectrum was calculated considering the interactions of photoelectric effect, Compton scattering and pair production. Electrons were treated in the same manner as soil and the bremsstrahlung yields were used to estimate the photon flux. Because the mono-energetic photon dose calculation assumed a fully infinite air volume and not a semi-infinite volume, the resulting dose numbers are double the desired quantity and as a result were multiplied by 0.5 correction factor. This assumption of using a fully infinite volume to simulate a semi-infinite volume ignores ground effect but this is known to be insignificant.

Radionuclide organ doses and effective doses for contaminated air were computed using the same method as contaminated soil with the exception that the air contamination mono-energetic organ doses were employed.

## **2.3 CONTAMINATED WATER**

Dose coefficients were calculated for an individual standing in an infinite volume of contaminated water. In this scenario, the individual was assumed to be immersed in an infinite volume of contaminated water. The water was assumed to be pure H<sub>2</sub>O with density of 1 gram per cubic centimeter and the contamination was assumed to be uniformly distributed.

Organ doses due to mono-energetic photons in air were obtained in a similar manner to that used in contaminated air. Deterministic radiation transport methods were used to determine the down scattered photon spectrum arising from an infinite contaminated water volume. This spectrum was calculated considering the interactions of photoelectric effect, Compton scattering and pair production. Electrons

were again treated in the same manner as air and the bremsstrahlung yields were used to estimate the photon flux. Unlike air, the resulting dose coefficients were not multiplied by the 0.5 correction factor because the infinite water assumption matched the scenario geometry.

Radionuclide organ doses and effective doses for contaminated air were computed using the same method as contaminated air with the exception that the water contamination mono-energetic organ doses were employed.

### 3. INTERNAL EXPOSURE DOSE COEFFICIENTS

Effective dose coefficients for internal exposure were calculated for inhalation and ingestion. Age specific biokinetic models were employed to determine the time-dependent activities of radionuclides after being introduced to the body. These calculations were performed for six ages: newborn, 1, 5, 10, 15 and 20 (maturity) years. The biokinetic models employed were those recommended by the ICRP for inhalation or ingestion of radionuclide by members of the public<sup>1</sup>. Dosimetric calculations were used to determine absorbed dose rates (per unit intake) from the time-dependent organ activities in the body.

Dosimetric models for internal emitters consider two sets of regions within the body. “Source regions” specify the location of radioactivity within the body. “Target regions” consist of organs and tissues for which the radiation dose may be calculated. The mean absorbed dose to a target region is considered the fundamental dosimetric quantity. Radioactivity is considered to be uniformly distributed within the source organs and all source regions are distributed by volume except mineral bone and the airways of the respiratory tract, which are distributed by surface area. All target regions have volumes averaged over the mass of the respective target. The esophagus dose rates were not directly calculated but the thymus was used as a surrogate.

The masses for the source and target regions, with the exception of urinary bladder tract, for children are taken from the phantom series of Christy and Eckerman<sup>2</sup>. The values for the adult male are taken from the Reference Male (ICRP Pub. 23, 1975). The masses for urinary bladder contents are from revisions of the reference male and are an average of filling and voiding cycles (Christy and Eckerman 1987). For the adult female, regional masses are mainly reference values from ICRP Pub. 23(1975) but where none are given, they are scaled from the reference adult male. For Urinary Bladder Contents, values for the 15 year old male are applied to the adult female. For the bone target and source regions of the adult female are taken to be 75% of the values for males.

In the case of exposure to decay products of radon, a combination of epidemiological and dosimetric data was used to derive both dose coefficients and risk factors. Since the typical dose from radon is mainly due to the progenies of radon, the numbers provided in this document take into account both radon and progeny dose and risk. Initial assumptions on the calculation of radon effective dose and risk were drawn from ICRP Pub. 115 (2010). The average inhalation rate of the per capita person is from FGR 13 (EPA 1999).

The internal dose due to noble gases is negligible. In instances where the progeny yields dose, the dose coefficients and risk factors are included in +D and +E. Solubility of noble gasses in body tissue is extremely low and therefore yields a committed dose that is not significant and can be excluded.

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<sup>1</sup> ICRP 1989, 1993, 1995a, 1995b, 1996

<sup>2</sup> Eckerman (1987)

### **3.1 INHALATION**

For inhalation, the age- and gender-specific breathing rates used are from the ICRP Publication 66(1994a). These rates are time-weighted averages of heavy, light, and resting breathing rates. The coefficients are based on an activity median aerodynamic diameter (AMAD) of 1 $\mu$ m unless specific physical characteristics were known about the given aerosol. The forms of inhaled materials in terms of rate of absorption from lungs to blood were Type F (fast), Type M (medium), and Type S (slow). Risk coefficients were derived for all three cases. There are specific cases that consider inhalation of vapor or gas. These cases were tritium vapor (HTO), tritium gas (HT), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), sulfur vapor (SO<sub>2</sub>), nickel vapor, ruthenium vapor (RuO<sub>4</sub>), iodine vapor and gas (methyl iodide and CH<sub>3</sub>I), tellurium vapor, and mercury vapor. Material and absorption models for the select cases are taken from ICRP (1995b).

### **3.2 INGESTION**

#### **3.2.1 Tap Water**

Dose coefficients for the ingestion of radionuclides in tap water use age-specific usage rates based on the 1977-1978 Nationwide Food Consumption Survey of the U.S. Dept of Agriculture. Gender-specified values assume a male-to-female intake rate ratio and are derived to be the same as the male-to-female ratio observed for food energy intake. Tap water in this instance includes: drinking water, water added to beverages, and water added to food during preparation. It does not include water intrinsic to food as purchased. Similar to food intake, separate risk coefficients for tap water are given for tritiated water, organically bound tritium, inorganic and organic forms of sulfur, mercury, and polonium.

#### **3.2.2 Dietary Food**

Internal exposure resulting from food intake is based off of using the intake rate to be proportional to food energy usage. Age- and gender- specific values for food energy usage are based on data from the Third National Health and Nutrition Examination Survey (NHANES III, Phase1, 1989-91). A special case is radioiodine in which a second set of risk coefficients is derived assuming intake rate is proportional to usage of cow's milk. The age- and gender- specific values for average daily usage of cow's milk are based on EPA (1984b). A few cases involve separate risk coefficients due to application of different systemic biokinetic models such as in examining: tritiated water, organically bound tritium, inorganic and organic forms of sulfur, mercury, and polonium.

## **4. RISK COEFFICIENTS**

The risk coefficients methodology employed in this study is the same as that used in Federal Guidance Report No. 13. For each type of cancer, values for lifetime risk per unit absorbed dose were used to convert the absorbed dose rates into life time cancer risk as a function of age. This calculation involves the absorbed dose as a function of age, the time-dependent intake of radionuclides, and the population's survival function. The survival function is the age dependent probability that a person will die at a particular age. It was assumed that the radiation dose to the population does not significantly alter the survival function.

Age- and gender-specific radiation risk models were taken from EPA (1994) which was based on data from Japanese atomic bomb survivors as well as other study groups. The age groups that were considered were: 0-9, 10-19, 20-29, 30-39, and 40+ y. Risk model coefficients in the EPA report (1994) were based

in majority on data from the Radiation Effects Research Foundation (RERF) Life Span Study (LSS) cohort of Hiroshima and Nagasaki atomic bomb survivors (Shimizu 1989, 1990). Risk model coefficients for the liver were based on data from patients injected with Thorotrast (NAS, 1980, 1988). Skin cancer mortality risk estimates are taken from ICRP Pub 60 (1991). Thyroid risk estimates were from NCRP Report 80 (1985). Risk estimates for radiation-induced bone sarcomas are based on alpha irradiation by <sup>224</sup>Ra (NAS, 1988). The model of Gilbert which was developed for the NRC (1991, 1993) was used for breast cancer estimates.

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## **APPENDIX A. RADIONUCLIDE DATA**





## APPENDIX A. RADIONUCLIDE DATA

**Table 1: Nuclide Activity and Particle Decay Energies**

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Ac-223	2.1	m	A	1.49E+10	6.672	0.02536	0.01903	3.74E-18
Ac-223+D				1.96E+16	22.1371	0.0258	0.0227	3.91E-18
Ac-223+E				1.96E+16	22.1371	0.0258	0.0227	3.91E-18
Ac-224	2.78	h	ECA	1.86E+08	0.5662	0.04901	0.23248	2.30E-17
Ac-225	10	d	A	2.15E+06	5.8919	0.02476	0.01708	6.78E-18
Ac-225+D				5.96E+13	19.5125	0.0337	0.0467	8.53E-18
Ac-225+E				5.96E+13	19.5125	0.0337	0.0467	8.53E-18
Ac-226	29.37	h	B-ECA	1.75E+07	0.0003	0.29143	0.13271	1.05E-17
Ac-227	21.772	y	B-A	2.68E+03	0.0692	0.01502	0.00105	1.01E-18
Ac-228	6.15	h	B-	8.27E+07	0	0.44945	0.86714	3.99E-17
Ac-230	122	s	B-	1.49E+10	0	0.92285	0.54396	2.28E-17
Ac-231	7.5	m	B-	4.02E+09	0	0.63605	0.41898	2.24E-17
Ac-232	119	s	B-	1.51E+10	0	0.97069	1.15279	4.36E-17
Ac-233	145	s	B-	1.24E+10	0	0.8355	0.49926	1.92E-17
Ag-100m	2.24	m	ECB+	3.08E+10	0	1.90681	2.82482	1.01E-16
Ag-101	11.1	m	ECB+	6.15E+09	0	0.83955	1.57031	5.98E-17
Ag-102	12.9	m	ECB+	5.24E+09	0	0.84299	3.40918	1.21E-16
Ag-102m	7.7	m	ECB+IT	8.78E+09	0	0.39638	1.99329	6.49E-17
Ag-103	65.7	m	ECB+	1.02E+09	0	0.19725	0.84396	3.66E-17
Ag-104	69.2	m	ECB+	9.59E+08	0	0.09166	2.70658	1.04E-16
Ag-104m	33.5	m	ECB+IT	1.98E+09	0	0.73307	1.80467	6.60E-17
Ag-105	41.29	d	EC	1.11E+06	0	0.01915	0.5138	2.80E-17
Ag-105m	7.23	m	ITECB+	9.09E+09	0	0.0252	0.00126	6.54E-20
Ag-106	23.96	m	ECB+B-	2.72E+09	0	0.49666	0.69964	2.96E-17
Ag-106m	8.28	d	EC	5.46E+06	0	0.01311	2.80912	1.09E-16
Ag-108	2.37	m	B-ECB+	2.70E+10	0	0.60708	0.01855	8.98E-19
Ag-108m	418	y	ECIT	2.91E+02	0	0.01591	1.62088	6.80E-17
Ag-108m+D				2.35E+09	0	0.0687	1.6225	6.81E-17
Ag-108m+E				2.35E+09	0	0.0687	1.6225	6.81E-17
Ag-109m	39.6	s	IT	9.59E+10	0	0.07695	0.01108	3.73E-18
Ag-110	24.6	s	B-EC	1.53E+11	0	1.1812	0.0307	1.17E-18
Ag-110m	249.76	d	B-IT	1.74E+05	0	0.07576	2.76056	9.94E-17
Ag-110m+D				2.08E+09	0	0.0918	2.761	9.94E-17
Ag-110m+E				2.08E+09	0	0.0918	2.761	9.94E-17
Ag-111	7.45	d	B-	5.80E+06	0	0.35388	0.02648	9.96E-19
Ag-111m	64.8	s	ITB-	5.76E+10	0	0.05677	0.00786	2.11E-18

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Ag-112	3.13	h	B-	3.28E+08	0	1.35399	0.69048	2.37E-17
Ag-113	5.37	h	B-	1.90E+08	0	0.7614	0.07194	2.66E-18
Ag-113m	68.7	s	ITB-	5.34E+10	0	0.22779	0.2134	8.60E-18
Ag-114	4.6	s	B-	7.90E+11	0	2.10913	0.25891	8.95E-18
Ag-115	20	m	B-	3.00E+09	0	1.09281	0.48314	1.60E-17
Ag-116	2.68	m	B-	2.22E+10	0	1.75402	2.14733	6.84E-17
Ag-117	73.6	s	B-	4.81E+10	0	1.28131	1.30275	4.08E-17
Ag-99	124	s	ECB+	3.37E+10	0	1.3076	2.30916	8.28E-17
Al-26	7.17E+05	y	ECB+	6.84E-01	0	0.44442	2.67506	8.87E-17
Al-28	2.2414	m	B-	1.07E+11	0	1.24165	1.77885	5.54E-17
Al-29	6.56	m	B-	3.54E+10	0	0.97635	1.37941	4.58E-17
Am-237	73	m	ECA	4.02E+08	0.0015	0.08015	0.37136	2.71E-17
Am-238	98	m	ECB+A	2.98E+08	0	0.04851	0.90232	4.51E-17
Am-239	11.9	h	ECA	4.08E+07	0.0005	0.17087	0.24355	2.94E-17
Am-240	50.8	h	ECA	9.51E+06	0	0.07575	1.03545	5.43E-17
Am-241	432.2	y	A	1.27E+02	5.5712	0.0373	0.02933	9.80E-18
Am-242	16.02	h	B-EC	2.99E+07	0	0.18061	0.01881	6.37E-18
Am-242m	141	y	ITA	3.88E+02	0.0238	0.04389	0.00562	5.20E-18
Am-242m+D				2.98E+07	0.0238	0.2248	0.027	1.17E-17
Am-242m+E				2.98E+07	0.0238	0.2248	0.027	1.17E-17
Am-243	7.37E+03	y	A	7.39E+00	5.3583	0.02337	0.05852	6.45E-18
Am-243+D				8.58E+06	5.3583	0.2857	0.2431	2.47E-17
Am-243+E				8.58E+06	5.3583	0.2857	0.2431	2.47E-17
Am-244	10.1	h	B-	4.71E+07	0	0.33295	0.80522	4.74E-17
Am-244m	26	m	B-	1.10E+09	0	0.5187	0.01719	3.09E-18
Am-245	2.05	h	B-	2.31E+08	0	0.28742	0.03242	2.95E-18
Am-246	39	m	B-	7.25E+08	0	0.72406	0.74978	5.22E-17
Am-246m	25	m	B-	1.13E+09	0	0.50326	0.97992	4.00E-17
Am-247	23	m	B-	1.22E+09	0	0.56834	0.1348	1.03E-17
Ar-37	35.04	d	EC	3.63E+06	0	0.00226	0.00028	0
Ar-39	269	y	B-	1.23E+03	0	0.21878	0	0
Ar-41	109.61	m	B-	1.51E+09	0	0.46374	1.28363	4.34E-17
Ar-42	32.9	y	B-	9.36E+03	0	0.23253	0	0
Ar-42+D				2.18E+08	0	1.6629	0.2787	9.05E-18
Ar-42+E				2.18E+08	0	1.6629	0.2787	9.05E-18
Ar-43	5.37	m	B-	2.95E+10	0	1.35695	1.53518	5.02E-17
Ar-44	11.87	m	B-	1.30E+10	0	0.52445	1.93763	6.14E-17
As-68	151.6	s	ECB+	4.00E+10	0	1.99847	3.71125	1.29E-16
As-69	15.23	m	ECB+	6.53E+09	0	1.21817	1.14315	4.27E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
As-70	52.6	m	ECB+	1.87E+09	0	0.87987	4.25285	1.49E-16
As-71	65.28	h	ECB+	2.47E+07	0	0.11671	0.5765	2.30E-17
As-72	26	h	ECB+	6.12E+07	0	1.04085	1.78318	6.58E-17
As-73	80.3	d	EC	8.14E+05	0	0.06062	0.01591	6.14E-18
As-74	17.77	d	ECB+B-	3.63E+06	0	0.26584	0.75823	2.96E-17
As-76	1.0778	d	B-	5.83E+07	0	1.06699	0.41658	1.53E-17
As-77	38.83	h	B-	3.83E+07	0	0.22584	0.00832	3.44E-19
As-78	90.7	m	B-	9.72E+08	0	1.24595	1.30659	4.52E-17
As-79	9.01	m	B-	9.66E+09	0	0.8771	0.03378	1.26E-18
At-204	9.2	m	ECB+A	3.69E+09	0.2306	0.44849	2.32336	9.80E-17
At-205	26.2	m	ECB+A	1.29E+09	0.602	0.25747	1.14438	5.42E-17
At-206	30.6	m	ECB+A	1.10E+09	0.0517	0.33236	2.48065	1.03E-16
At-207	1.8	h	ECB+A	3.10E+08	0.5049	0.1298	2.01359	8.60E-17
At-208	1.63	h	ECB+A	3.40E+08	0.0316	0.15975	3.04078	1.26E-16
At-209	5.41	h	ECB+A	1.02E+08	0.236	0.11717	2.28462	1.05E-16
At-210	8.1	h	ECB+A	6.79E+07	0.0097	0.07962	2.96215	1.19E-16
At-211	7.214	h	ECA	7.58E+07	2.4998	0.00594	0.03667	8.24E-18
At-211+D				2.22E+12	6.9149	0.006	0.0414	8.42E-18
At-211+E				2.22E+12	6.9149	0.006	0.0414	8.42E-18
At-215	1.00E-04	s	A	1.97E+16	8.1777	0.00003	0.00017	7.58E-21
At-216	3.00E-04	s	A	6.44E+15	7.9406	0.00134	0.00251	3.65E-19
At-217	3.23E-02	s	A	5.96E+13	7.2008	0.00008	0.00024	1.42E-20
At-218	1.5	s	A B-	1.28E+12	6.8041	0.00109	0	0
At-219	56	s	A	3.40E+10	6.1342	0	0	0
At-220	3.71	m	B-A	8.52E+09	0.4842	1.213	0.44965	1.91E-17
Au-186	10.7	m	ECB+	3.48E+09	0	1.07511	1.49834	5.91E-17
Au-187	8.4	m	ECB+A	4.41E+09	0.0001	0.13602	1.06523	4.58E-17
Au-190	42.8	m	ECB+	8.51E+08	0	0.21292	2.38071	8.05E-17
Au-191	3.18	h	ECB+	1.90E+08	0	0.08649	0.59462	3.20E-17
Au-192	4.94	h	ECB+	1.22E+08	0	0.09044	1.93919	6.87E-17
Au-193	17.65	h	EC	3.39E+07	0	0.0575	0.16734	1.44E-17
Au-193m	3.9	s	ITEC	5.52E+11	0	0.09039	0.1979	1.52E-17
Au-194	38.02	h	ECB+	1.56E+07	0	0.04206	1.03855	4.16E-17
Au-195	186.098	d	EC	1.33E+05	0	0.05202	0.08385	1.47E-17
Au-195m	30.5	s	IT	6.99E+10	0	0.11719	0.20136	1.58E-17
Au-196	6.183	d	ECB-	3.97E+06	0	0.03718	0.47336	2.35E-17
Au-196m	9.6	h	IT	6.13E+07	0	0.37601	0.24732	2.82E-17
Au-198	2.69517	d	B-	9.01E+06	0	0.3277	0.40293	1.54E-17
Au-198m	2.27	d	IT	1.07E+07	0	0.27478	0.53323	3.01E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Au-199	3.139	d	B-	7.70E+06	0	0.14506	0.09614	6.31E-18
Au-200	48.4	m	B-	7.15E+08	0	0.73034	0.27373	9.66E-18
Au-200m	18.7	h	B-IT	3.09E+07	0	0.2433	1.98427	7.75E-17
Au-201	26	m	B-	1.33E+09	0	0.42588	0.03464	1.90E-18
Au-202	28.8	s	B-	7.14E+10	0	1.07488	0.17203	6.19E-18
Ba-124	11	m	ECB+	5.06E+09	0	0.17433	0.57278	2.40E-17
Ba-126	100	m	ECB+	5.48E+08	0	0.01784	0.58026	2.41E-17
Ba-127	12.7	m	ECB+	4.28E+09	0	0.5971	0.72824	2.88E-17
Ba-128	2.43	d	EC	1.54E+07	0	0.00862	0.06651	5.57E-18
Ba-129	2.23	h	ECB+	4.00E+08	0	0.127	0.33313	1.48E-17
Ba-129m	2.16	h	ECB+	4.13E+08	0	0.04185	1.5833	5.96E-17
Ba-131	11.5	d	EC	3.19E+06	0	0.04551	0.47634	2.15E-17
Ba-131m	14.6	m	IT	3.61E+09	0	0.11017	0.07734	4.16E-18
Ba-133	10.52	y	EC	9.39E+03	0	0.05531	0.40295	1.98E-17
Ba-133m	38.9	h	ITEC	2.23E+07	0	0.22592	0.06856	5.03E-18
Ba-135m	28.7	h	IT	2.97E+07	0	0.20799	0.06023	4.19E-18
Ba-137m	2.552	m	IT	1.98E+10	0	0.06534	0.59631	2.26E-17
Ba-139	83.06	m	B-	5.99E+08	0	0.90124	0.04573	1.66E-18
Ba-140	12.752	d	B-	2.69E+06	0	0.32022	0.18264	7.90E-18
Ba-141	18.27	m	B-	2.68E+09	0	0.96241	0.9271	3.29E-17
Ba-142	10.6	m	B-	4.59E+09	0	0.4141	1.04693	3.79E-17
Be-10	1.51E+06	y	B-	8.75E-01	0	0.25247	0	0
Be-7	53.22	d	EC	1.29E+07	0	0	0.04986	1.89E-18
Bi-197	9.3	m	ECB+	3.78E+09	0	0.28868	1.6992	7.60E-17
Bi-200	36.4	m	ECB+	9.51E+08	0	0.24693	2.43552	1.07E-16
Bi-201	108	m	ECB+	3.19E+08	0	0.06117	1.73041	7.46E-17
Bi-202	1.72	h	ECB+	3.32E+08	0	0.15146	2.75612	1.14E-16
Bi-203	11.76	h	ECB+	4.84E+07	0	0.08089	2.38499	9.60E-17
Bi-204	11.22	h	ECB+	5.04E+07	0	0.08066	2.91615	1.21E-16
Bi-205	15.31	d	ECB+	1.53E+06	0	0.03459	1.6913	7.23E-17
Bi-206	6.243	d	ECB+	3.74E+06	0	0.1379	3.27958	1.36E-16
Bi-207	32.9	y	ECB+	1.93E+03	0	0.11929	1.53703	6.94E-17
Bi-208	3.68E+05	y	EC	1.72E-01	0	0.01437	2.646	8.58E-17
Bi-210	5.013	d	B-A	4.57E+06	0	0.3889	0	1.53E-23
Bi-210m	3.04E+06	y	A	2.06E-02	5.0064	0.0475	0.2607	1.21E-17
Bi-210m+D				8.00E+09	5.0064	0.5873	0.2608	1.22E-17
Bi-210m+E				8.00E+09	5.0064	0.5873	0.2608	1.22E-17
Bi-211	2.14	m	A B-	1.53E+10	6.6756	0.01003	0.04726	2.21E-18
Bi-212	60.55	m	B-A	5.40E+08	2.2163	0.50456	0.10376	7.05E-18

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Bi-212+D				4.20E+18	7.9523	0.5046	0.1038	7.05E-18
Bi-212+E				4.20E+18	7.9523	0.5046	0.1038	7.05E-18
Bi-212n	7	m	B-	4.67E+09	0	0.53514	0	0
Bi-213	45.59	m	B-A	7.13E+08	0.1245	0.44404	0.12773	5.44E-18
Bi-213+D				4.55E+17	8.483	0.444	0.1278	5.44E-18
Bi-213+E				4.55E+17	8.483	0.444	0.1278	5.44E-18
Bi-214	19.9	m	B-A	1.63E+09	0.0011	0.66313	1.47933	4.99E-17
Bi-214+D				1.18E+16	7.8328	0.6631	1.4794	4.99E-17
Bi-214+E				1.18E+16	7.8328	0.6631	1.4794	4.99E-17
Bi-215	7.6	m	B-	4.26E+09	0	0.66935	0.25343	1.19E-17
Bi-215+D				1.09E+15	7.5261	0.6694	0.2536	1.19E-17
Bi-215+E				1.09E+15	7.5261	0.6694	0.2536	1.19E-17
Bi-216	2.17	m	B-	1.48E+10	0	1.3295	0.73847	2.88E-17
Bk-245	4.94	d	ECA	3.99E+06	0.0074	0.13255	0.23518	2.21E-17
Bk-246	1.8	d	EC	1.09E+07	0	0.05543	0.85462	4.67E-17
Bk-247	1.38E+03	y	A	3.88E+01	5.7025	0.06911	0.14675	8.69E-18
Bk-248m	23.7	h	B-EC	1.97E+07	0	0.19102	0.05592	6.54E-18
Bk-249	330	d	B-A	5.88E+04	0	0.03239	0	3.66E-23
Bk-250	3.212	h	B-	1.44E+08	0	0.29491	0.89825	3.56E-17
Bk-251	55.6	m	B-	4.98E+08	0	0.36933	0.0915	1.18E-17
Br-72	78.6	s	ECB+	7.28E+10	0	2.788	2.96243	1.08E-16
Br-73	3.4	m	ECB+	2.77E+10	0	1.34337	1.43313	5.78E-17
Br-74	25.4	m	ECB+	3.66E+09	0	1.06163	4.61296	1.43E-16
Br-74m	46	m	ECB+	2.02E+09	0	1.27473	4.14665	1.40E-16
Br-75	96.7	m	ECB+	9.48E+08	0	0.52825	1.19805	5.14E-17
Br-76	16.2	h	ECB+	9.31E+07	0	0.64971	2.79329	1.03E-16
Br-76m	1.31	s	ITECB+	4.14E+12	0	0.06902	0.04328	3.21E-17
Br-77	57.036	h	ECB+	2.61E+07	0	0.00937	0.3209	3.58E-17
Br-77m	4.28	m	IT	2.09E+10	0	0.08762	0.01967	1.72E-17
Br-78	6.46	m	ECB+B-	1.37E+10	0	1.02345	1.03361	4.09E-17
Br-80	17.68	m	B-ECB+	4.86E+09	0	0.72466	0.07607	4.32E-18
Br-80m	4.4205	h	IT	3.24E+08	0	0.06173	0.02416	3.31E-17
Br-82	35.3	h	B-	3.96E+07	0	0.14543	2.63892	9.54E-17
Br-82m	6.13	m	ITB-	1.40E+10	0	0.07036	0.00809	1.75E-17
Br-83	2.4	h	B-	5.76E+08	0	0.32575	0.00687	2.61E-19
Br-84	31.8	m	B-	2.58E+09	0	1.23641	1.75946	5.35E-17
Br-84m	6	m	B-	1.38E+10	0	0.89826	2.76842	9.61E-17
Br-85	2.9	m	B-	2.79E+10	0	1.03842	0.06604	2.34E-18
C-10	19.255	s	ECB+	2.17E+12	0	0.80873	1.74433	6.56E-17

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C-11	20.39	m	ECB+	3.10E+10	0	0.38472	1.01961	3.86E-17
C-14	5.70E+03	y	B-	1.66E+02	0	0.04945	0	0
Ca-41	1.02E+05	y	EC	3.09E+00	0	0.00273	0.0005	0
Ca-45	162.67	d	B-	6.46E+05	0	0.0772	0	1.14E-24
Ca-47	4.536	d	B-	2.22E+07	0	0.3521	1.05211	3.59E-17
Ca-49	8.718	m	B-	1.60E+10	0	0.86934	3.16751	8.26E-17
Cd-101	1.36	m	ECB+	5.02E+10	0	1.06854	2.4853	8.93E-17
Cd-102	5.5	m	ECB+	1.23E+10	0	0.07558	0.83803	3.75E-17
Cd-103	7.3	m	ECB+	9.17E+09	0	0.36356	2.08914	7.51E-17
Cd-104	57.7	m	EC	1.15E+09	0	0.03059	0.25126	1.87E-17
Cd-105	55.5	m	ECB+	1.18E+09	0	0.21667	1.29945	4.92E-17
Cd-107	6.5	h	ECB+	1.65E+08	0	0.08697	0.0337	1.18E-17
Cd-109	461.4	d	EC	9.53E+04	0	0.0827	0.02652	1.09E-17
Cd-111m	48.5	m	IT	1.28E+09	0	0.10655	0.28425	1.35E-17
Cd-113	7.70E+15	y	B-	1.51E-11	0	0.0926	0	0
Cd-113m	14.1	y	B-IT	8.24E+03	0	0.18468	0.00007	7.13E-21
Cd-115	53.46	h	B-	1.87E+07	0	0.31817	0.19255	7.56E-18
Cd-115m	44.6	d	B-	9.35E+05	0	0.60448	0.03291	1.16E-18
Cd-117	2.49	h	B-	3.95E+08	0	0.43789	1.07963	3.74E-17
Cd-117m	3.36	h	B-	2.93E+08	0	0.22788	2.04368	6.67E-17
Cd-118	50.3	m	B-	1.16E+09	0	0.1614	0	0
Cd-119	2.69	m	B-	2.16E+10	0	0.81858	1.63799	5.34E-17
Cd-119m	2.2	m	B-	2.64E+10	0	0.6898	2.30207	7.58E-17
Ce-130	22.9	m	ECB+	2.32E+09	0	0.07379	0.50027	2.11E-17
Ce-131	10.2	m	ECB+	5.17E+09	0	0.61533	1.62671	6.07E-17
Ce-132	3.51	h	EC	2.49E+08	0	0.01804	0.27272	1.22E-17
Ce-133	97	m	ECB+	5.36E+08	0	0.38169	0.543	2.41E-17
Ce-133m	4.9	h	ECB+	1.77E+08	0	0.07393	1.73728	6.42E-17
Ce-134	3.16	d	EC	1.13E+07	0	0.00719	0.02809	3.53E-18
Ce-135	17.7	h	ECB+	4.82E+07	0	0.02959	0.82366	3.32E-17
Ce-137	9	h	ECB+	9.34E+07	0	0.01648	0.03882	4.38E-18
Ce-137m	34.4	h	ITEC	2.45E+07	0	0.20674	0.05578	3.68E-18
Ce-139	137.641	d	EC	2.51E+05	0	0.0355	0.15992	8.05E-18
Ce-141	32.508	d	B-	1.05E+06	0	0.17103	0.0768	2.92E-18
Ce-143	33.039	h	B-	2.44E+07	0	0.43636	0.27958	1.20E-17
Ce-144	284.91	d	B-	1.17E+05	0	0.09162	0.01936	8.53E-19
Ce-144+D				2.84E+09	0	1.3005	0.0483	1.80E-18
Ce-144+E				2.84E+09	0	1.3005	0.0483	1.80E-18
Ce-145	3.01	m	B-	1.58E+10	0	0.67942	0.81424	3.23E-17

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Cf-244	19.4	m	A	1.47E+09	7.3195	0.0075	0.00204	1.92E-18
Cf-246	35.7	h	A SF	1.32E+07	6.8526	0.00597	0.00144	1.32E-18
Cf-247	3.11	h	ECA	1.51E+08	0.0022	0.04634	0.10498	1.98E-17
Cf-248	334	d	A SF	5.83E+04	6.3518	0.00745	0.00202	1.63E-18
Cf-249	351	y	A SF	1.51E+02	5.9262	0.03994	0.32824	1.65E-17
Cf-250	13.08	y	A SF	4.05E+03	6.1168	0.01027	0.01112	2.91E-18
Cf-251	900	y	A	5.86E+01	5.879	0.17054	0.12453	1.38E-17
Cf-252	2.645	y	A SF	1.98E+04	6.0177	0.25158	0.45724	7.54E-17
Cf-253	17.81	d	B-A	1.07E+06	0.0188	0.09076	0.00483	3.44E-18
Cf-254	60.5	d	A SF	3.14E+05	0.0183	10.0441	16.8399	2.53E-15
Cf-255	85	m	B-	3.21E+08	0	0.21776	0	0
Cl-34	1.5264	s	ECB+	7.82E+12	0	2.05077	1.02119	3.87E-17
Cl-34m	32	m	ECB+IT	6.22E+09	0	0.45956	2.11265	6.63E-17
Cl-36	3.01E+05	y	B-ECB+	1.19E+00	0	0.27319	0.00014	5.38E-21
Cl-38	37.24	m	B-	4.80E+09	0	1.55041	1.443	4.37E-17
Cl-39	55.6	m	B-	3.13E+09	0	0.82463	1.45089	4.87E-17
Cl-40	1.35	m	B-	1.26E+11	0	1.52645	4.08208	1.17E-16
Cm-238	2.4	h	ECA	2.03E+08	0.2537	0.01165	0.08287	1.08E-17
Cm-239	2.9	h	ECB+	1.67E+08	0	0.02907	0.25927	1.95E-17
Cm-240	27	d	A SF	7.46E+05	6.365	0.01081	0.00221	2.42E-18
Cm-241	32.8	d	ECA	6.11E+05	0.0603	0.1342	0.50338	3.71E-17
Cm-242	162.8	d	A SF	1.23E+05	6.204	0.00955	0.00198	2.17E-18
Cm-243	29.1	y	A EC	1.87E+03	5.8928	0.13424	0.13528	1.51E-17
Cm-244	18.1	y	A SF	3.00E+03	5.8915	0.00793	0.00171	1.87E-18
Cm-245	8.50E+03	y	A SF	6.35E+00	5.4473	0.08239	0.1084	1.54E-17
Cm-246	4.76E+03	y	A SF	1.13E+01	5.4654	0.00847	0.00496	1.99E-18
Cm-247	1.56E+07	y	A	3.43E-03	5.0285	0.01135	0.31378	1.22E-17
Cm-247+D				9.63E+07	5.0285	0.1843	0.3397	1.56E-17
Cm-247+E				9.63E+07	5.0285	0.1843	0.3397	1.56E-17
Cm-248	3.48E+05	y	A SF	1.53E-01	4.7212	0.77158	1.31266	1.58E-16
Cm-249	64.15	m	B-	4.36E+08	0	0.28352	0.02	7.85E-19
Cm-250	8300	y	A B-SF	6.37E+00	0.9283	8.42701	13.3166	1.44E-15
Cm-250+D				2.16E+08	0.9283	8.5621	13.5906	1.45E-15
Cm-250+E				2.16E+08	0.9283	8.5621	13.5906	1.45E-15
Cm-251	16.8	m	B-	1.65E+09	0	0.45445	0.11124	5.29E-18
Co-54m	1.48	m	ECB+	1.87E+10	0	2.04843	3.93057	1.39E-16
Co-55	17.53	h	ECB+	1.18E+08	0	0.43119	1.99597	7.24E-17
Co-56	77.23	d	ECB+	1.10E+06	0	0.11983	3.64039	1.18E-16
Co-57	271.74	d	EC	3.07E+05	0	0.01863	0.12522	6.21E-18

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Co-58	70.86	d	ECB+	1.16E+06	0	0.03395	0.97493	3.59E-17
Co-58m	9.04	h	IT	2.18E+08	0	0.02287	0.00201	3.43E-21
Co-60	5.2713	y	B-	4.12E+04	0	0.09686	2.50384	8.53E-17
Co-60m	10.467	m	ITB-	1.09E+10	0	0.05647	0.00668	1.58E-19
Co-61	1.65	h	B-	1.14E+09	0	0.46642	0.09696	3.43E-18
Co-62	1.5	m	B-	7.37E+10	0	1.63356	1.60504	5.25E-17
Co-62m	13.91	m	B-	7.95E+09	0	1.09738	2.69231	8.99E-17
Cr-48	21.56	h	ECB+	1.10E+08	0	0.00856	0.43632	1.53E-17
Cr-49	42.3	m	ECB+	3.29E+09	0	0.60465	1.05379	3.92E-17
Cr-51	27.7025	d	EC	3.36E+06	0	0.00382	0.03289	1.17E-18
Cr-55	3.497	m	B-	3.56E+10	0	1.10067	0.00067	2.15E-20
Cr-56	5.94	m	B-	2.06E+10	0	0.60826	0.09175	5.89E-18
Cs-121	155	s	ECB+	2.21E+10	0	1.73905	1.17327	4.46E-17
Cs-121m	122	s	ECB+IT	2.81E+10	0	1.34751	1.18208	4.51E-17
Cs-123	5.88	m	ECB+	9.55E+09	0	0.95089	1.08595	4.26E-17
Cs-124	30.8	s	ECB+	1.09E+11	0	1.99081	1.1607	4.36E-17
Cs-125	45	m	ECB+	1.23E+09	0	0.35242	0.75504	3.03E-17
Cs-126	1.64	m	ECB+	3.34E+10	0	1.31927	1.1545	4.38E-17
Cs-127	6.25	h	ECB+	1.45E+08	0	0.02934	0.43336	1.98E-17
Cs-128	3.64	m	ECB+	1.48E+10	0	0.87344	0.89165	3.46E-17
Cs-129	32.06	h	ECB+	2.79E+07	0	0.01753	0.2802	1.54E-17
Cs-130	29.21	m	ECB+B-	1.82E+09	0	0.38685	0.50259	2.08E-17
Cs-130m	3.46	m	ITEC	1.54E+10	0	0.09373	0.07368	6.16E-18
Cs-131	9.689	d	EC	3.78E+06	0	0.00635	0.02315	4.29E-18
Cs-132	6.479	d	ECB+B-	5.61E+06	0	0.0143	0.71512	3.02E-17
Cs-134	2.0648	y	B-EC	4.75E+04	0	0.16388	1.55508	5.78E-17
Cs-134m	2.903	h	IT	2.96E+08	0	0.11216	0.02725	2.67E-18
Cs-135	2.30E+06	y	B-	4.23E-02	0	0.08938	0	0
Cs-135m	53	m	IT	9.66E+08	0	0.03606	1.59723	5.88E-17
Cs-136	13.16	d	B-	2.68E+06	0	0.1449	2.1283	7.67E-17
Cs-137	30.1671	y	B-	3.18E+03	0	0.18836	0	6.11E-23
Cs-137+D				1.87E+10	0	0.25	0.5629	2.14E-17
Cs-137+E				1.87E+10	0	0.25	0.5629	2.14E-17
Cs-138	33.41	m	B-	1.50E+09	0	1.24621	2.36111	7.74E-17
Cs-138m	2.91	m	ITB-	1.72E+10	0	0.3201	0.41487	1.60E-17
Cs-139	9.27	m	B-	5.37E+09	0	1.65982	0.30302	9.58E-18
Cs-140	63.7	s	B-	4.65E+10	0	1.93612	1.76923	5.59E-17
Cu-57	0.1963	s	ECB+	3.67E+13	0	3.59869	1.14073	4.27E-17
Cu-59	81.5	s	ECB+	8.55E+10	0	1.48918	1.44506	5.34E-17



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Cu-60	23.7	m	ECB+	4.82E+09	0	0.89751	3.91114	1.31E-16
Cu-61	3.333	h	ECB+	5.62E+08	0	0.30902	0.82369	3.09E-17
Cu-62	9.673	m	ECB+	1.14E+10	0	1.28431	1.00686	3.81E-17
Cu-64	12.7	h	ECB+B-	1.41E+08	0	0.12475	0.18548	6.95E-18
Cu-66	5.12	m	B-	2.03E+10	0	1.06637	0.0978	3.47E-18
Cu-67	61.83	h	B-	2.76E+07	0	0.15038	0.11535	3.77E-18
Cu-69	2.85	m	B-	3.49E+10	0	0.88627	0.52838	1.89E-17
Dy-148	3.3	m	ECB+	1.42E+10	0	0.02782	0.71699	2.78E-17
Dy-149	4.2	m	ECB+	1.11E+10	0	0.11202	1.62219	5.69E-17
Dy-150	7.17	m	ECB+A	6.43E+09	1.5663	0.007	0.27847	1.11E-17
Dy-151	17.9	m	ECB+A	2.56E+09	0.234	0.06526	1.37232	4.94E-17
Dy-152	2.38	h	ECA	3.19E+08	0.0037	0.01295	0.28669	1.12E-17
Dy-153	6.4	h	ECB+A	1.18E+08	0.0003	0.09012	0.87459	3.28E-17
Dy-154	3.00E+06	y	A	2.85E-02	2.947	0	0	0
Dy-155	9.9	h	ECB+	7.51E+07	0	0.02722	0.66867	2.46E-17
Dy-157	8.14	h	EC	9.02E+07	0	0.01378	0.34717	1.38E-17
Dy-159	144.4	d	EC	2.09E+05	0	0.01307	0.04561	2.80E-18
Dy-165	2.334	h	B-	2.99E+08	0	0.44728	0.02673	1.05E-18
Dy-165m	1.257	m	ITB-	3.34E+10	0	0.10485	0.01917	7.48E-19
Dy-166	81.6	h	B-	8.51E+06	0	0.16667	0.04333	2.00E-18
Dy-167	6.2	m	B-	6.68E+09	0	0.72621	0.53263	2.00E-17
Dy-168	8.7	m	B-	4.73E+09	0	0.43319	0.39483	1.50E-17
Er-154	3.73	m	ECB+A	1.20E+10	0.0201	0.03758	0.07593	5.45E-18
Er-156	19.5	m	EC	2.27E+09	0	0.09432	0.06781	4.05E-18
Er-159	36	m	ECB+	1.21E+09	0	0.07379	0.9635	3.50E-17
Er-161	3.21	h	ECB+	2.23E+08	0	0.05222	0.99052	3.64E-17
Er-163	75	m	ECB+	5.66E+08	0	0.00808	0.04032	2.14E-18
Er-165	10.36	h	EC	6.75E+07	0	0.00799	0.03788	2.02E-18
Er-167m	2.269	s	IT	1.10E+12	0	0.11114	0.09667	3.46E-18
Er-169	9.4	d	B-	3.03E+06	0	0.10346	0.00006	1.12E-22
Er-171	7.516	h	B-	8.97E+07	0	0.42045	0.3731	1.37E-17
Er-172	49.3	h	B-	1.36E+07	0	0.13865	0.51657	1.98E-17
Er-173	1.434	m	B-	2.79E+10	0	0.72134	0.83127	2.98E-17
Es-249	102.2	m	ECB+A	2.73E+08	0.0392	0.04369	0.41287	2.47E-17
Es-250	8.6	h	EC	5.39E+07	0	0.3281	1.2235	8.62E-17
Es-250m	2.22	h	ECB+	2.09E+08	0	0.03425	0.5549	2.92E-17
Es-251	33	h	ECA	1.40E+07	0.0329	0.05221	0.10161	1.67E-17
Es-253	20.47	d	A SF	9.33E+05	6.7335	0.0022	0.00084	4.66E-19
Es-254	275.7	d	A B-SF	6.90E+04	6.5243	0.07266	0.0208	1.53E-17

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Es-254+D				1.45E+08	6.5243	0.3676	0.9191	5.09E-17
Es-254+E				1.45E+08	6.5243	0.3676	0.9191	5.09E-17
Es-254m	39.3	h	B-A ECSEF	1.16E+07	0.0208	0.24077	0.47567	2.34E-17
Es-255	39.8	d	B-A SF	4.76E+05	0.5116	0.07366	0.00068	1.03E-19
Es-256	25.4	m	B-	1.07E+09	0	0.5822	0.00315	2.12E-18
Eu-142	2.34	s	ECB+	1.25E+12	0	2.76702	1.19703	4.43E-17
Eu-142m	1.223	m	ECB+	3.98E+10	0	1.76825	3.43049	1.26E-16
Eu-143	2.59	m	ECB+	1.87E+10	0	1.36757	1.12268	4.10E-17
Eu-144	10.2	s	ECB+	2.82E+11	0	2.0761	1.09174	4.03E-17
Eu-145	5.93	d	ECB+	5.58E+06	0	0.02538	1.27977	4.55E-17
Eu-146	4.61	d	ECB+	7.13E+06	0	0.04551	2.40067	8.68E-17
Eu-147	24.1	d	ECB+A	1.36E+06	0	0.04308	0.47206	1.87E-17
Eu-148	54.5	d	ECB+A	5.95E+05	0	0.02241	2.22867	8.31E-17
Eu-149	93.1	d	EC	3.46E+05	0	0.02411	0.06612	4.05E-18
Eu-150	36.9	y	ECB+	2.38E+03	0	0.02847	1.55539	5.89E-17
Eu-150m	12.8	h	B-ECB+	6.00E+07	0	0.31218	0.04935	1.95E-18
Eu-152	13.537	y	ECB+B-	6.39E+03	0	0.12856	1.17591	4.26E-17
Eu-152m	9.3116	h	B-ECB+	8.14E+07	0	0.50598	0.29632	1.11E-17
Eu-152n	96	m	IT	4.74E+08	0	0.06664	0.07526	2.93E-18
Eu-154	8.593	y	B-EC	9.94E+03	0	0.27301	1.24929	4.42E-17
Eu-154m	46	m	IT	9.76E+08	0	0.0745	0.07061	3.33E-18
Eu-155	4.7611	y	B-	1.78E+04	0	0.06471	0.06118	2.27E-18
Eu-156	15.19	d	B-	2.03E+06	0	0.45788	1.23416	4.11E-17
Eu-157	15.18	h	B-	4.84E+07	0	0.39611	0.29297	1.18E-17
Eu-158	45.9	m	B-	9.54E+08	0	0.89199	1.29776	4.54E-17
Eu-159	18.1	m	B-	2.40E+09	0	0.89226	0.30317	1.24E-17
F-17	64.49	s	ECB+	3.81E+11	0	0.73848	1.0208	3.87E-17
F-18	109.77	m	ECB+	3.34E+09	0	0.2416	0.98858	3.75E-17
Fe-52	8.275	h	ECB+	2.65E+08	0	0.19169	0.74045	2.71E-17
Fe-53	8.51	m	ECB+	1.52E+10	0	1.10131	1.17816	4.43E-17
Fe-53m	2.526	m	IT	5.11E+10	0	0.0023	3.05469	1.05E-16
Fe-55	2.737	y	EC	8.64E+04	0	0.00416	0.00166	4.93E-27
Fe-59	44.495	d	B-	1.81E+06	0	0.11788	1.18827	4.10E-17
Fe-60	1.50E+06	y	B-	1.45E-01	0	0.06472	0	0
Fe-60+D				1.09E+10	0	0.2178	2.5045	8.52E-17
Fe-60+E				1.09E+10	0	0.2178	2.5045	8.52E-17
Fe-61	5.98	m	B-	1.88E+10	0	1.09344	1.391	4.74E-17
Fe-62	68	s	B-	9.76E+10	0	0.82577	0.5061	1.92E-17
Fm-251	5.3	h	ECB+A	8.72E+07	0.1251	0.0337	0.15875	1.34E-17

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Fm-252	25.39	h	A SF	1.81E+07	7.1448	0.00637	0.00182	1.28E-18
Fm-253	3	d	ECA	6.36E+06	0.8351	0.10842	0.07129	1.47E-17
Fm-254	3.24	h	A SF	1.41E+08	7.2956	0.00948	0.0086	2.53E-18
Fm-255	20.07	h	A SF	2.27E+07	7.1292	0.09541	0.01696	1.32E-17
Fm-256	157.6	m	A SF	1.72E+08	0.5686	6.3116	12.4371	2.06E-15
Fm-257	100.5	d	A SF	1.87E+05	6.6128	0.14709	0.15209	2.02E-17
Fr-212	20	m	ECB+A	1.63E+09	2.773	0.12941	1.14151	5.55E-17
Fr-219	2.00E-02	s	A	9.53E+13	7.4436	0.00043	0.00357	1.65E-19
Fr-220	27.4	s	A B-	6.93E+10	6.7411	0.01627	0.01047	3.66E-18
Fr-220+D				6.42E+15	14.6539	0.0176	0.013	4.02E-18
Fr-220+E				6.42E+15	14.6539	0.0176	0.013	4.02E-18
Fr-221	4.9	m	A	6.43E+09	6.4198	0.0089	0.02941	1.74E-18
Fr-221+D				5.96E+13	13.6206	0.009	0.0296	1.76E-18
Fr-221+E				5.96E+13	13.6206	0.009	0.0296	1.76E-18
Fr-222	14.2	m	B-	2.21E+09	0	0.71452	0.18061	1.51E-17
Fr-223	22	m	B-A	1.42E+09	0.0003	0.38287	0.05825	1.13E-17
Fr-224	3.33	m	B-	9.33E+09	0	0.87506	0.5523	2.40E-17
Fr-227	2.47	m	B-	1.24E+10	0	0.79666	0.44993	2.48E-17
Ga-64	2.627	m	ECB+	4.08E+10	0	1.70307	3.37257	1.10E-16
Ga-65	15.2	m	ECB+	6.94E+09	0	0.81581	1.16497	4.31E-17
Ga-66	9.49	h	ECB+	1.83E+08	0	0.96337	2.49436	7.67E-17
Ga-67	3.2612	d	EC	2.18E+07	0	0.03633	0.15954	5.27E-18
Ga-68	67.71	m	ECB+	1.49E+09	0	0.73794	0.94869	3.58E-17
Ga-70	21.14	m	B-EC	4.64E+09	0	0.64408	0.00728	2.57E-19
Ga-72	14.1	h	B-	1.13E+08	0	0.50596	2.70709	8.86E-17
Ga-73	4.86	h	B-	3.23E+08	0	0.49989	0.35203	1.59E-17
Ga-74	8.12	m	B-	1.14E+10	0	0.99454	3.15401	1.00E-16
Gd-142	70.2	s	ECB+	4.16E+10	0	0.73904	1.04316	3.84E-17
Gd-143m	110	s	ECB+	2.64E+10	0	1.28541	2.12108	7.72E-17
Gd-144	4.47	m	ECB+	1.07E+10	0	0.58582	0.9086	3.21E-17
Gd-145	23	m	ECB+	2.07E+09	0	0.34561	2.42358	7.77E-17
Gd-145m	85	s	ITECB+	3.37E+10	0	0.1927	0.68138	2.58E-17
Gd-146	48.27	d	EC	6.81E+05	0	0.12735	0.25262	1.12E-17
Gd-147	38.1	h	ECB+	2.06E+07	0	0.06166	1.40302	5.22E-17
Gd-148	74.6	y	A	1.19E+03	3.2712	0	0	0
Gd-149	9.28	d	ECB+	3.47E+06	0	0.06859	0.52923	2.09E-17
Gd-150	1.79E+06	y	A	4.90E-02	2.809	0	0	0
Gd-151	124	d	ECA	2.57E+05	0	0.03937	0.07077	4.12E-18
Gd-152	1.08E+14	y	A	8.01E-10	2.2046	0	0	0

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Gd-153	240.4	d	EC	1.31E+05	0	0.04376	0.10566	5.48E-18
Gd-159	18.479	h	B-	3.92E+07	0	0.30958	0.05388	2.24E-18
Gd-162	8.4	m	B-	5.08E+09	0	0.33866	0.41701	1.58E-17
Ge-66	2.26	h	ECB+	7.67E+08	0	0.09835	0.67803	2.86E-17
Ge-67	18.9	m	ECB+	5.42E+09	0	1.16881	1.42541	5.20E-17
Ge-68	270.95	d	EC	2.59E+05	0	0.00495	0.0041	2.80E-18
Ge-68+D				1.49E+09	0	0.7429	0.9528	3.86E-17
Ge-68+E				1.49E+09	0	0.7429	0.9528	3.86E-17
Ge-69	39.05	h	ECB+	4.25E+07	0	0.1203	0.95049	3.62E-17
Ge-71	11.43	d	EC	5.88E+06	0	0.00501	0.00416	2.85E-18
Ge-75	82.78	m	B-	1.11E+09	0	0.42058	0.03524	1.31E-18
Ge-77	11.3	h	B-	1.32E+08	0	0.64934	1.07865	3.94E-17
Ge-78	88	m	B-	1.00E+09	0	0.22726	0.27807	1.02E-17
H-3	12.32	y	B-	3.56E+05	0	0.00567	0	0
Hf-167	2.05	m	ECB+	2.02E+10	0	0.49515	0.61711	2.37E-17
Hf-169	3.24	m	ECB+	1.26E+10	0	0.13089	0.64161	2.52E-17
Hf-170	16.01	h	EC	4.24E+07	0	0.0687	0.44027	1.80E-17
Hf-172	1.87	y	EC	4.09E+04	0	0.08284	0.10616	8.01E-18
Hf-172+D				1.09E+10	0	0.1232	0.1077	8.24E-18
Hf-172+E				1.09E+10	0	0.1232	0.1077	8.24E-18
Hf-173	23.6	h	ECB+	2.83E+07	0	0.05235	0.397	1.51E-17
Hf-174	2.00E+15	y	A	3.78E-11	2.4947	0	0	0
Hf-175	70	d	EC	3.92E+05	0	0.04502	0.35337	1.43E-17
Hf-177m	51.4	m	IT	7.61E+08	0	0.50777	2.28635	8.62E-17
Hf-178m	31	y	IT	2.39E+03	0	0.21132	2.23831	8.46E-17
Hf-179m	25.05	d	IT	1.07E+06	0	0.18969	0.92069	3.53E-17
Hf-180m	5.5	h	ITB-	1.17E+08	0	0.14374	0.98839	3.77E-17
Hf-181	42.39	d	B-	6.27E+05	0	0.20523	0.53242	2.02E-17
Hf-182	9.00E+06	y	B-	8.04E-03	0	0.06324	0.23972	8.78E-18
Hf-182+D				2.31E+05	0	0.2737	1.5315	5.42E-17
Hf-182+E				2.31E+05	0	0.2737	1.5315	5.42E-17
Hf-182m	61.5	m	B-IT	6.18E+08	0	0.24406	0.91347	3.47E-17
Hf-183	1.067	h	B-	5.91E+08	0	0.44782	0.77491	2.87E-17
Hf-184	4.12	h	B-	1.52E+08	0	0.47868	0.23867	1.10E-17
Hg-190	20	m	ECB+	1.82E+09	0	0.05388	0.20182	1.76E-17
Hg-191m	50.8	m	ECB+	7.14E+08	0	0.13781	1.4895	6.18E-17
Hg-192	4.85	h	EC	1.24E+08	0	0.06359	0.27489	2.11E-17
Hg-193	3.8	h	ECB+	1.57E+08	0	0.07401	0.83771	3.95E-17
Hg-193+D				1.97E+10	0	0.0772	0.8447	4.00E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Hg-193+E				1.97E+10	0	0.0772	0.8447	4.00E-17
Hg-193m	11.8	h	ECB+IT	5.07E+07	0	0.04695	1.02393	4.25E-17
Hg-194	440	y	EC	1.54E+02	0	0.00784	0.00271	4.64E-18
Hg-194+D				1.56E+07	0	0.0499	1.0413	4.62E-17
Hg-194+E				1.56E+07	0	0.0499	1.0413	4.62E-17
Hg-195	10.53	h	ECB+	5.62E+07	0	0.06503	0.2008	1.82E-17
Hg-195m	41.6	h	ITECB+	1.42E+07	0	0.14797	0.20473	2.10E-17
Hg-197	64.94	h	EC	9.02E+06	0	0.07024	0.07398	1.30E-17
Hg-197m	23.8	h	ITEC	2.46E+07	0	0.21704	0.09774	1.19E-17
Hg-199m	42.66	m	IT	8.16E+08	0	0.3487	0.18362	1.40E-17
Hg-203	46.612	d	B-	5.08E+05	0	0.09895	0.23804	1.11E-17
Hg-205	5.2	m	B-	6.50E+09	0	0.539	0.00534	3.20E-19
Hg-206	8.15	m	B-	4.13E+09	0	0.42109	0.12154	6.18E-18
Hg-207	2.9	m	B-	1.15E+10	0	0.82623	2.66136	9.23E-17
Ho-150	76.8	s	ECB+	3.60E+10	0	1.98571	1.88434	7.05E-17
Ho-153	2.01	m	ECB+A	2.25E+10	0.002	0.53867	1.02814	3.84E-17
Ho-153m	9.3	m	ECB+A	4.86E+09	0.0074	0.69516	1.06179	4.00E-17
Ho-154	11.76	m	ECB+A	3.82E+09	0.0007	1.09266	1.88173	6.89E-17
Ho-154m	3.1	m	ECB+A	1.45E+10	0	0.54335	2.4367	9.11E-17
Ho-155	48	m	ECB+	9.30E+08	0	0.21756	0.61419	2.28E-17
Ho-156	56	m	ECB+	7.92E+08	0	0.66547	2.10637	7.35E-17
Ho-157	12.6	m	ECB+	3.50E+09	0	0.09288	0.58349	2.29E-17
Ho-159	33.05	m	ECB+	1.32E+09	0	0.05759	0.38572	1.51E-17
Ho-160	25.6	m	ECB+	1.69E+09	0	0.07027	1.69501	6.28E-17
Ho-161	2.48	h	EC	2.89E+08	0	0.0336	0.0582	4.90E-18
Ho-162	15	m	ECB+	2.85E+09	0	0.05984	0.16404	6.69E-18
Ho-162m	67	m	ITECB+	6.37E+08	0	0.07394	0.56137	2.06E-17
Ho-163	4570	y	EC	1.77E+01	0	0.00051	0.00006	0
Ho-164	29	m	ECB-	1.46E+09	0	0.14702	0.02973	1.59E-18
Ho-164m	38	m	IT	1.11E+09	0	0.09264	0.04723	2.55E-18
Ho-166	26.8	h	B-	2.59E+07	0	0.69633	0.03007	1.06E-18
Ho-166m	1.20E+03	y	B-	6.60E+01	0	0.14973	1.6249	5.97E-17
Ho-167	3.1	h	B-	2.23E+08	0	0.2329	0.36606	1.37E-17
Ho-168	2.99	m	B-	1.38E+10	0	0.81383	0.87623	3.20E-17
Ho-168m	132	s	IT	1.87E+10	0	0.05176	0.00727	3.36E-19
Ho-170	2.76	m	B-	1.48E+10	0	0.83661	1.7041	6.13E-17
I-118	13.7	m	ECB+	4.27E+09	0	1.96453	2.01631	7.45E-17
I-118m	8.5	m	ECB+	4.79E+09	0	1.10546	3.75127	1.39E-16
I-119	19.1	m	ECB+	3.04E+09	0	0.51163	0.91102	3.62E-17

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I-120	81.6	m	ECB+	7.05E+08	0	1.168	2.66108	9.02E-17
I-120m	53	m	ECB+	1.09E+09	0	0.90697	3.52483	1.28E-16
I-121	2.12	h	ECB+	4.49E+08	0	0.06649	0.39947	1.86E-17
I-122	3.63	m	ECB+	1.56E+10	0	1.10552	0.9619	3.71E-17
I-123	13.27	h	EC	7.05E+07	0	0.02818	0.17303	1.08E-17
I-124	4.176	d	ECB+	9.26E+06	0	0.19428	1.11324	4.28E-17
I-125	59.4	d	EC	6.46E+05	0	0.01923	0.04283	9.86E-18
I-126	12.93	d	ECB+B-	2.95E+06	0	0.16058	0.43535	1.85E-17
I-128	24.99	m	B-ECB+	2.16E+09	0	0.74631	0.06762	2.85E-18
I-129	1.57E+07	y	B-	6.49E-03	0	0.06507	0.02517	4.38E-18
I-130	12.36	h	B-	7.17E+07	0	0.27864	2.13717	7.97E-17
I-130m	8.84	m	ITB-	6.06E+09	0	0.17782	0.10966	4.95E-18
I-131	8.0207	d	B-	4.57E+06	0	0.19184	0.38275	1.45E-17
I-132	2.295	h	B-	3.80E+08	0	0.49299	2.26451	8.26E-17
I-132m	1.387	h	ITB-	6.29E+08	0	0.16141	0.34034	1.47E-17
I-133	20.8	h	B-	4.16E+07	0	0.41415	0.612	2.29E-17
I-134	52.5	m	B-	9.82E+08	0	0.57758	2.59534	9.30E-17
I-134m	3.6	m	ITB-	1.44E+10	0	0.09131	0.28871	1.47E-17
I-135	6.57	h	B-	1.30E+08	0	0.34652	1.58148	5.32E-17
In-103	60	s	ECB+	6.70E+10	0	1.54041	2.75279	9.58E-17
In-105	5.07	m	ECB+	1.30E+10	0	1.03582	1.93074	7.07E-17
In-106	6.2	m	ECB+	1.05E+10	0	1.08435	3.55412	1.32E-16
In-106m	5.2	m	ECB+	1.25E+10	0	1.58887	2.8243	9.68E-17
In-107	32.4	m	ECB+	1.99E+09	0	0.32631	1.53072	5.64E-17
In-108	58	m	ECB+	1.10E+09	0	0.162	3.9164	1.44E-16
In-108m	39.6	m	ECB+	1.61E+09	0	0.70206	2.76548	9.12E-17
In-109	4.2	h	ECB+	2.51E+08	0	0.03344	0.64407	2.92E-17
In-109m	1.34	m	IT	4.73E+10	0	0.04159	0.6085	2.32E-17
In-110	4.9	h	ECB+	2.13E+08	0	0.01222	3.09716	1.20E-16
In-110m	69.1	m	ECB+	9.08E+08	0	0.62824	1.57824	5.95E-17
In-111	2.8047	d	EC	1.54E+07	0	0.03481	0.40611	2.14E-17
In-111m	7.7	m	IT	8.08E+09	0	0.06745	0.47056	1.85E-17
In-112	14.97	m	ECB+B-	4.12E+09	0	0.24517	0.26749	1.23E-17
In-112m	20.56	m	IT	3.00E+09	0	0.12166	0.03473	5.67E-18
In-113m	1.6579	h	IT	6.14E+08	0	0.13609	0.26063	1.18E-17
In-114	71.9	s	B-ECB+	5.05E+10	0	0.77402	0.00232	1.13E-19
In-114m	49.51	d	ITEC	8.49E+05	0	0.145	0.08041	5.79E-18
In-114m+D				4.89E+10	0	0.8939	0.0827	5.90E-18
In-114m+E				4.89E+10	0	0.8939	0.0827	5.90E-18

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In-115	4.41E+14	y	B-	2.59E-10	0	0.15256	0	0
In-115m	4.486	h	ITB-	2.23E+08	0	0.17484	0.16272	8.73E-18
In-116m	54.41	m	B-	1.09E+09	0	0.31279	2.46905	8.35E-17
In-117	43.2	m	B-	1.37E+09	0	0.2673	0.6939	2.62E-17
In-117m	116.2	m	B-IT	5.08E+08	0	0.4344	0.091	4.86E-18
In-118	5	s	B-	7.02E+11	0	1.87916	0.07782	2.67E-18
In-118m	4.364	m	B-	1.34E+10	0	0.67081	2.77649	9.71E-17
In-119	2.4	m	B-	2.42E+10	0	0.61478	0.77014	2.99E-17
In-119m	18	m	B-IT	3.22E+09	0	1.02214	0.06603	2.97E-18
In-121	23.1	s	B-	1.48E+11	0	0.98687	0.92662	3.36E-17
In-121m	3.88	m	B-IT	1.47E+10	0	1.52876	0.06346	4.89E-18
Ir-180	1.5	m	ECB+	2.56E+10	0	1.24394	1.59548	6.61E-17
Ir-182	15	m	ECB+	2.54E+09	0	1.04741	1.4121	5.93E-17
Ir-183	58	m	ECB+	6.52E+08	0	0.15157	1.18886	5.23E-17
Ir-184	3.09	h	ECB+	2.03E+08	0	0.3194	1.96436	7.99E-17
Ir-185	14.4	h	ECB+	4.33E+07	0	0.12278	0.8581	4.50E-17
Ir-186	16.64	h	ECB+	3.73E+07	0	0.14525	1.66514	6.82E-17
Ir-186m	1.92	h	ECB+IT	3.23E+08	0	0.11032	1.25227	4.97E-17
Ir-187	10.5	h	ECB+	5.88E+07	0	0.05677	0.33245	2.29E-17
Ir-188	41.5	h	ECB+	1.48E+07	0	0.05084	2.09741	7.48E-17
Ir-189	13.2	d	EC	1.93E+06	0	0.04577	0.07933	1.32E-17
Ir-190	11.78	d	EC	2.15E+06	0	0.07456	1.47679	6.33E-17
Ir-190m	1.12	h	IT	5.42E+08	0	0.02397	0.00237	2.16E-18
Ir-190n	3.087	h	ECIT	1.97E+08	0	0.02892	0.05774	9.05E-18
Ir-191m	4.94	s	IT	4.40E+11	0	0.09707	0.07643	1.39E-17
Ir-192	73.827	d	B-EC	3.39E+05	0	0.21769	0.81649	3.18E-17
Ir-192m	1.45	m	ITB-	2.49E+10	0	0.05395	0.00292	7.04E-18
Ir-192n	241	y	IT	2.85E+02	0	0.16166	0.00657	1.51E-17
Ir-193m	10.53	d	IT	2.37E+06	0	0.0776	0.00266	2.53E-18
Ir-194	19.28	h	B-	3.09E+07	0	0.81046	0.09107	3.39E-18
Ir-194m	171	d	B-	1.45E+05	0	0.14215	2.3339	9.06E-17
Ir-195	2.5	h	B-	2.37E+08	0	0.38034	0.05932	9.45E-18
Ir-195m	3.8	h	B-IT	1.56E+08	0	0.26058	0.37661	1.96E-17
Ir-196	52	s	B-	4.08E+10	0	1.17377	0.23219	8.65E-18
Ir-196m	1.4	h	B-	4.21E+08	0	0.38444	2.4677	9.85E-17
K-38	7.636	m	ECB+	2.34E+10	0	1.21071	3.18665	1.02E-16
K-40	1.25E+09	y	B-ECB+	2.58E-04	0	0.52176	0.15671	5.15E-18
K-42	12.36	h	B-	2.18E+08	0	1.43034	0.27869	9.05E-18
K-43	22.3	h	B-	1.18E+08	0	0.30974	0.96414	3.62E-17

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K-44	22.13	m	B-	6.99E+09	0	1.45667	2.38464	7.41E-17
K-45	17.3	m	B-	8.75E+09	0	0.99593	1.83595	5.74E-17
K-46	105	s	B-	8.47E+10	0	2.31611	2.87096	8.49E-17
Kr-74	11.5	m	ECB+	8.08E+09	0	0.60062	1.05792	4.89E-17
Kr-75	4.29	m	ECB+	2.14E+10	0	1.54302	1.27998	5.34E-17
Kr-76	14.8	h	EC	1.02E+08	0	0.01539	0.42764	4.26E-17
Kr-76+D				3.37E+10	0	0.016	0.428	4.28E-17
Kr-76+E				3.37E+10	0	0.016	0.428	4.28E-17
Kr-77	74.4	m	ECB+	1.20E+09	0	0.67444	1.03839	4.40E-17
Kr-79	35.04	h	ECB+	4.14E+07	0	0.02372	0.2549	2.98E-17
Kr-81	2.29E+05	y	EC	7.05E-01	0	0.00518	0.00719	2.12E-17
Kr-81m	13.1	s	ITEC	3.89E+11	0	0.0596	0.13085	1.05E-17
Kr-83m	1.83	h	IT	7.74E+08	0	0.03881	0.00275	5.47E-18
Kr-85	10.756	y	B-	1.43E+04	0	0.25068	0.00223	8.51E-20
Kr-85m	4.48	h	B-IT	3.01E+08	0	0.2549	0.15741	7.29E-18
Kr-87	76.3	m	B-	1.04E+09	0	1.32812	0.79192	2.52E-17
Kr-88	2.84	h	B-	4.59E+08	0	0.36887	1.95383	6.18E-17
Kr-89	3.15	m	B-	2.46E+10	0	1.37053	1.93125	6.15E-17
La-128	5.18	m	ECB+	1.04E+10	0	1.33399	2.82825	1.03E-16
La-129	11.6	m	ECB+	4.62E+09	0	0.61348	0.92118	3.60E-17
La-130	8.7	m	ECB+	6.11E+09	0	1.11133	2.23242	8.13E-17
La-131	59	m	ECB+	8.94E+08	0	0.19626	0.66332	2.74E-17
La-132	4.8	h	ECB+	1.82E+08	0	0.56931	1.99523	7.08E-17
La-132m	24.3	m	ITECB+	2.15E+09	0	0.11262	0.67061	2.63E-17
La-133	3.912	h	ECB+	2.21E+08	0	0.05033	0.16047	9.13E-18
La-134	6.45	m	ECB+	8.00E+09	0	0.76474	0.71962	2.81E-17
La-135	19.5	h	ECB+	4.38E+07	0	0.00669	0.03607	4.18E-18
La-136	9.87	m	ECB+	5.15E+09	0	0.29406	0.40703	1.72E-17
La-137	6.00E+04	y	EC	1.60E+00	0	0.00648	0.02502	3.67E-18
La-138	1.02E+11	y	ECB-	9.34E-07	0	0.03772	1.23159	4.31E-17
La-140	1.6781	d	B-	2.04E+07	0	0.53455	2.30837	7.70E-17
La-141	3.92	h	B-	2.09E+08	0	0.98758	0.02678	8.85E-19
La-142	91.1	m	B-	5.34E+08	0	0.86966	2.37378	7.25E-17
La-143	14.2	m	B-	3.41E+09	0	1.29946	0.26306	8.65E-18
Lu-165	10.74	m	ECB+	3.90E+09	0	0.37506	1.11023	3.97E-17
Lu-167	51.5	m	ECB+	8.05E+08	0	0.11094	1.69202	5.80E-17
Lu-169	34.06	h	ECB+	2.00E+07	0	0.04769	1.31663	4.59E-17
Lu-169m	160	s	IT	1.54E+10	0	0.02735	0.00168	7.33E-19
Lu-170	2.012	d	ECB+	1.41E+07	0	0.05847	2.56355	8.08E-17



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Lu-171	8.24	d	ECB+	3.41E+06	0	0.09278	0.65032	2.68E-17
Lu-171m	79	s	IT	3.07E+10	0	0.06905	0.00208	8.69E-19
Lu-172	6.7	d	ECB+	4.17E+06	0	0.11535	1.95648	6.98E-17
Lu-172m	3.7	m	IT	1.09E+10	0	0.04038	0.00151	2.22E-19
Lu-173	1.37	y	EC	5.55E+04	0	0.05259	0.18342	7.53E-18
Lu-174	3.31	y	ECB+	2.29E+04	0	0.04582	0.11625	4.58E-18
Lu-174m	142	d	ITEC	1.95E+05	0	0.1188	0.0626	4.33E-18
Lu-176	3.85E+10	y	B-	1.94E-06	0	0.30261	0.4799	1.81E-17
Lu-176m	3.635	h	B-EC	1.80E+08	0	0.47825	0.01461	9.15E-19
Lu-177	6.647	d	B-	4.09E+06	0	0.14792	0.03509	1.32E-18
Lu-177m	160.4	d	B-IT	1.69E+05	0	0.26872	1.00048	3.77E-17
Lu-178	28.4	m	B-	1.37E+09	0	0.75607	0.12561	4.45E-18
Lu-178m	23.1	m	B-	1.68E+09	0	0.49073	1.04813	3.94E-17
Lu-179	4.59	h	B-	1.40E+08	0	0.48693	0.02976	1.05E-18
Lu-180	5.7	m	B-	6.75E+09	0	0.63518	1.51475	5.31E-17
Lu-181	3.5	m	B-	1.09E+10	0	0.85115	0.57403	2.25E-17
Mg-27	9.458	m	B-	2.63E+10	0	0.70206	0.89122	3.23E-17
Mg-28	20.915	h	B-	1.91E+08	0	0.16099	1.36996	5.04E-17
Mn-50m	1.75	m	ECB+	1.37E+11	0	1.52428	4.63966	1.64E-16
Mn-51	46.2	m	ECB+	2.90E+09	0	0.93435	0.99772	3.78E-17
Mn-52	5.591	d	ECB+	1.63E+07	0	0.07504	3.45846	1.21E-16
Mn-52m	21.1	m	ECB+IT	6.23E+09	0	1.1321	2.40857	8.43E-17
Mn-53	3.70E+06	y	EC	6.63E-02	0	0.00398	0.00135	0
Mn-54	312.12	d	ECB+B-	2.82E+05	0	0.0042	0.836	3.06E-17
Mn-56	2.5789	h	B-	7.90E+08	0	0.82993	1.69157	5.65E-17
Mn-57	85.4	s	B-	8.44E+10	0	1.10127	0.09959	6.18E-18
Mn-58m	65.2	s	B-	1.11E+11	0	1.74428	2.38541	8.18E-17
Mo-101	14.61	m	B-	4.67E+09	0	0.5524	1.47059	5.11E-17
Mo-102	11.3	m	B-	5.98E+09	0	0.35085	0.01854	7.00E-19
Mo-89	2.11	m	ECB+	3.67E+10	0	1.96204	1.21727	4.56E-17
Mo-90	5.56	h	ECB+	2.29E+08	0	0.2107	0.83314	4.62E-17
Mo-91	15.49	m	ECB+	4.89E+09	0	1.45096	0.97729	3.77E-17
Mo-91m	64.6	s	ECB+IT	7.11E+10	0	0.55587	1.38572	5.04E-17
Mo-93	4.00E+03	y	EC	3.52E+01	0	0.00555	0.0107	1.25E-17
Mo-93m	6.85	h	ITEC	1.80E+08	0	0.1045	2.31827	8.35E-17
Mo-99	65.94	h	B-	1.76E+07	0	0.39288	0.14841	6.01E-18
N-13	9.965	m	ECB+	5.37E+10	0	0.49085	1.01999	3.86E-17
N-16	7.13	s	B-	3.66E+12	0	2.76461	4.49324	9.58E-17
Na-22	2.6019	y	ECB+	2.21E+05	0	0.19406	2.19257	7.81E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Na-24	14.959	h	B-	3.10E+08	0	0.55381	4.12319	1.21E-16
Nb-87	3.75	m	ECB+	2.11E+10	0	1.77093	1.22021	5.48E-17
Nb-88	14.5	m	ECB+	5.40E+09	0	1.45549	4.21883	1.62E-16
Nb-88m	7.78	m	ECB+	1.02E+10	0	1.4589	4.1063	1.48E-16
Nb-89	2.03	h	ECB+	6.35E+08	0	1.08593	1.36679	5.04E-17
Nb-89m	66	m	ECB+	1.17E+09	0	0.78551	1.3058	5.21E-17
Nb-90	14.6	h	ECB+	8.74E+07	0	0.40318	4.21354	1.45E-16
Nb-91	680	y	ECB+	2.12E+02	0	0.00578	0.01181	1.41E-17
Nb-91m	60.86	d	ITECB+	8.64E+05	0	0.0963	0.03399	1.14E-17
Nb-92	3.47E+07	y	EC	4.10E-03	0	0.00785	1.50547	6.85E-17
Nb-92m	10.15	d	ECB+	5.12E+06	0	0.00647	0.96885	4.86E-17
Nb-93m	16.13	y	IT	8.83E+03	0	0.02944	0.002	2.23E-18
Nb-94	2.03E+04	y	B-	6.87E+00	0	0.1684	1.55813	5.74E-17
Nb-94m	6.263	m	ITB-	1.20E+10	0	0.03564	0.01168	8.60E-18
Nb-95	34.991	d	B-	1.44E+06	0	0.04456	0.76449	2.83E-17
Nb-95m	3.61	d	ITB-	1.40E+07	0	0.17998	0.06967	1.06E-17
Nb-96	23.35	h	B-	5.13E+07	0	0.25344	2.46144	8.95E-17
Nb-97	72.1	m	B-	9.86E+08	0	0.46832	0.665	2.49E-17
Nb-98m	51.3	m	B-	1.39E+09	0	0.76358	2.8177	9.96E-17
Nb-99	15	s	B-	2.79E+11	0	1.51322	0.17425	1.25E-17
Nb-99m	2.6	m	B-IT	2.68E+10	0	1.41475	0.75669	2.43E-17
Nd-134	8.5	m	ECB+	6.07E+09	0	0.17276	0.54209	2.16E-17
Nd-135	12.4	m	ECB+	4.13E+09	0	1.05508	1.26172	4.87E-17
Nd-136	50.65	m	ECB+	1.00E+09	0	0.08046	0.27933	1.32E-17
Nd-137	38.5	m	ECB+	1.31E+09	0	0.32466	1.17894	4.47E-17
Nd-138	5.04	h	EC	1.66E+08	0	0.00818	0.04382	3.66E-18
Nd-139	29.7	m	ECB+	1.68E+09	0	0.20841	0.44311	1.80E-17
Nd-139m	5.5	h	ECB+IT	1.51E+08	0	0.0795	1.58523	5.94E-17
Nd-140	3.37	d	EC	1.02E+07	0	0.00693	0.02874	3.05E-18
Nd-141	2.49	h	ECB+	3.28E+08	0	0.01648	0.07648	4.78E-18
Nd-141m	62	s	ITECB+	4.75E+10	0	0.06218	0.69467	2.59E-17
Nd-144	2.29E+15	y	A	3.99E-11	1.9051	0	0	0
Nd-147	10.98	d	B-	2.98E+06	0	0.27015	0.14078	6.04E-18
Nd-149	1.728	h	B-	4.48E+08	0	0.50422	0.37132	1.40E-17
Nd-151	12.44	m	B-	3.68E+09	0	0.61946	0.85175	3.03E-17
Nd-152	11.4	m	B-	3.99E+09	0	0.33137	0.16436	7.18E-18
Ne-19	17.22	s	ECB+	1.21E+12	0	0.96242	1.02102	3.87E-17
Ne-24	3.38	m	B-	8.24E+10	0	0.80354	0.54193	2.04E-17
Ni-56	6.075	d	ECB+	1.40E+07	0	0.00734	1.72067	6.17E-17

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Ni-57	35.6	h	ECB+	5.62E+07	0	0.15714	1.93816	6.56E-17
Ni-59	1.01E+05	y	ECB+	2.19E+00	0	0.00453	0.00236	5.88E-22
Ni-63	100.1	y	B-	2.07E+03	0	0.01742	0	0
Ni-65	2.51719	h	B-	6.99E+08	0	0.62765	0.55831	1.87E-17
Ni-66	54.6	h	B-	3.17E+07	0	0.07336	0	0
Np-232	14.7	m	ECB+	2.04E+09	0	0.10732	1.19689	6.19E-17
Np-233	36.2	m	ECA	8.25E+08	0	0.01436	0.09105	1.27E-17
Np-234	4.4	d	ECB+	4.69E+06	0	0.05742	1.10861	5.06E-17
Np-235	396.1	d	ECA	5.19E+04	0.0001	0.01054	0.0071	8.45E-18
Np-235+D				4.60E+06	0.0001	0.0105	0.0071	8.45E-18
Np-235+E				4.60E+06	0.0001	0.0105	0.0071	8.45E-18
Np-236	1.54E+05	y	ECB-A	3.64E-01	0.0073	0.23718	0.15936	3.59E-17
Np-236m	22.5	h	ECB-	2.18E+07	0	0.08802	0.05066	7.97E-18
Np-237	2.14E+06	y	A	2.60E-02	4.8493	0.0681	0.03495	1.55E-17
Np-237+D				7.69E+05	4.8493	0.2832	0.2579	3.61E-17
Np-237+E				7.69E+05	4.8493	0.2832	0.2579	3.61E-17
Np-238	2.117	d	B-	9.59E+06	0	0.25191	0.58789	2.79E-17
Np-239	2.3565	d	B-	8.58E+06	0	0.2623	0.1846	1.83E-17
Np-240	61.9	m	B-	4.68E+08	0	0.50945	1.05379	5.75E-17
Np-240m	7.22	m	B-IT	4.02E+09	0	0.67793	0.32249	1.80E-17
Np-241	13.9	m	B-	2.08E+09	0	0.4341	0.03954	4.87E-18
Np-242	2.2	m	B-	1.31E+10	0	0.90269	0.26544	1.01E-17
Np-242m	5.5	m	B-	5.23E+09	0	0.75505	0.91935	5.23E-17
O-14	70.606	s	ECB+	4.22E+11	0	0.77634	3.32012	1.05E-16
O-15	122.24	s	ECB+	2.14E+11	0	0.73468	1.02098	3.87E-17
O-19	26.464	s	B-	8.30E+11	0	1.76084	0.93972	3.14E-17
Os-180	21.5	m	ECB+	1.79E+09	0	0.02984	0.12653	1.71E-17
Os-181	105	m	ECB+	3.64E+08	0	0.09182	1.3835	5.95E-17
Os-182	22.1	h	EC	2.87E+07	0	0.05649	0.43169	2.54E-17
Os-183	13	h	ECB+	4.85E+07	0	0.07922	0.62882	3.47E-17
Os-183m	9.9	h	ECB+IT	6.37E+07	0	0.04163	1.0062	4.18E-17
Os-185	93.6	d	EC	2.78E+05	0	0.0184	0.69172	3.20E-17
Os-186	2.00E+15	y	A	3.54E-11	2.8219	0	0	0
Os-189m	5.8	h	IT	1.05E+08	0	0.0286	0.00225	2.38E-18
Os-190m	9.9	m	IT	3.68E+09	0	0.11655	1.58935	6.68E-17
Os-191	15.4	d	B-	1.64E+06	0	0.13716	0.0843	1.39E-17
Os-191m	13.1	h	IT	4.61E+07	0	0.06635	0.00803	3.87E-18
Os-193	30.11	h	B-	1.99E+07	0	0.37968	0.06742	4.82E-18
Os-194	6	y	B-	1.13E+04	0	0.04533	0.00451	4.20E-18

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Os-194+D				3.09E+07	0	0.8558	0.0956	7.60E-18
Os-194+E				3.09E+07	0	0.8558	0.0956	7.60E-18
Os-196	34.9	m	B-	1.02E+09	0	0.3807	0.08049	4.12E-18
P-30	2.498	m	ECB+	8.99E+10	0	1.43885	1.02217	3.87E-17
P-32	14.263	d	B-	1.03E+07	0	0.69477	0	0
P-33	25.34	d	B-	5.61E+06	0	0.07642	0	0
Pa-227	38.3	m	A EC	8.00E+08	5.5649	0.02261	0.02335	7.37E-18
Pa-228	22	h	ECB+A	2.31E+07	0.1216	0.13196	1.36942	7.39E-17
Pa-229	1.5	d	ECA	1.41E+07	0.0273	0.01313	0.06656	1.28E-17
Pa-230	17.4	d	ECB-A	1.21E+06	0.0001	0.06679	0.67077	3.99E-17
Pa-231	3.28E+04	y	A	1.75E+00	5.0586	0.0538	0.04495	1.66E-17
Pa-232	1.31	d	B-EC	1.59E+07	0	0.1738	0.93929	4.51E-17
Pa-233	26.967	d	B-	7.69E+05	0	0.21505	0.22291	2.05E-17
Pa-234	6.7	h	B-	7.40E+07	0	0.40371	1.47182	7.43E-17
Pa-234m	1.17	m	B-IT	2.54E+10	0	0.81712	0.01623	7.37E-19
Pa-235	24.5	m	B-	1.21E+09	0	0.48861	0.00079	3.48E-20
Pa-236	9.1	m	B-	3.24E+09	0	0.80492	0.91478	3.87E-17
Pa-237	8.7	m	B-	3.37E+09	0	0.57804	0.60947	2.29E-17
Pb-194	12	m	ECB+A	2.97E+09	0	0.08444	1.08324	5.64E-17
Pb-195m	15	m	ECB+	2.37E+09	0	0.31674	1.6547	8.83E-17
Pb-196	37	m	ECB+	9.55E+08	0	0.09688	0.494	3.72E-17
Pb-197	8	m	ECB+	4.39E+09	0	0.08176	1.53192	6.67E-17
Pb-197m	43	m	ECB+IT	8.17E+08	0	0.2477	1.17319	6.66E-17
Pb-198	2.4	h	EC	2.43E+08	0	0.07813	0.43848	3.48E-17
Pb-199	90	m	ECB+	3.87E+08	0	0.0584	1.03938	5.01E-17
Pb-200	21.5	h	EC	2.68E+07	0	0.09965	0.20864	3.01E-17
Pb-201	9.33	h	ECB+	6.15E+07	0	0.05938	0.75624	4.33E-17
Pb-201m	61	s	IT	3.39E+10	0	0.26329	0.36582	1.96E-17
Pb-202	5.25E+04	y	ECA	1.24E+00	0.0259	0.00614	0.00249	1.06E-17
Pb-202+D				1.93E+06	0.0259	0.0292	0.4636	3.35E-17
Pb-202+E				1.93E+06	0.0259	0.0292	0.4636	3.35E-17
Pb-202m	3.53	h	ITEC	1.62E+08	0	0.13209	1.99254	8.01E-17
Pb-203	51.873	h	EC	1.10E+07	0	0.05296	0.31427	2.74E-17
Pb-204m	67.2	m	IT	5.05E+08	0	0.10304	2.06339	7.73E-17
Pb-205	1.53E+07	y	EC	4.20E-03	0	0.00621	0.00252	1.07E-17
Pb-209	3.253	h	B-	1.70E+08	0	0.19744	0	0
Pb-210	22.2	y	B-A	2.82E+03	0	0.04039	0.00534	9.72E-18
Pb-211	36.1	m	B-	9.09E+08	0	0.45425	0.06441	2.60E-18
Pb-212	10.64	h	B-	5.12E+07	0	0.17663	0.14503	1.09E-17

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Pb-214	26.8	m	B-	1.22E+09	0	0.29482	0.25328	1.48E-17
Pd-100	3.63	d	EC	1.32E+07	0	0.04546	0.12314	1.97E-17
Pd-101	8.47	h	ECB+	1.34E+08	0	0.03277	0.35177	2.84E-17
Pd-103	16.991	d	EC	2.74E+06	0	0.00581	0.01457	9.04E-18
Pd-107	6.50E+06	y	B-	1.89E-02	0	0.00958	0	0
Pd-109	13.7012	h	B-	7.70E+07	0	0.43795	0.01177	3.77E-18
Pd-109m	4.69	m	IT	1.35E+10	0	0.0777	0.11119	6.64E-18
Pd-111	23.4	m	B-	2.66E+09	0	0.84089	0.0478	1.77E-18
Pd-112	21.03	h	B-	4.88E+07	0	0.08998	0.00508	4.31E-18
Pd-114	2.42	m	B-	2.50E+10	0	0.53173	0.02588	9.89E-19
Pd-96	122	s	ECB+	3.53E+10	0	0.2257	1.44027	5.90E-17
Pd-97	3.1	m	ECB+	2.29E+10	0	0.75244	2.38128	8.48E-17
Pd-98	17.7	m	ECB+	3.97E+09	0	0.04548	0.41539	2.54E-17
Pd-99	21.4	m	ECB+	3.25E+09	0	0.44984	1.28326	5.06E-17
Pm-136	107	s	ECB+	2.85E+10	0	2.14362	2.71776	1.02E-16
Pm-137m	2.4	m	ECB+	2.10E+10	0	1.11202	1.78348	6.71E-17
Pm-139	4.15	m	ECB+	1.20E+10	0	1.04164	0.93901	3.56E-17
Pm-140	9.2	s	ECB+	3.22E+11	0	2.04317	1.05056	3.96E-17
Pm-140m	5.95	m	ECB+	8.30E+09	0	0.99317	3.03242	1.12E-16
Pm-141	20.9	m	ECB+	2.35E+09	0	0.60535	0.7349	2.78E-17
Pm-142	40.5	s	ECB+	7.21E+10	0	1.31217	0.85613	3.25E-17
Pm-143	265	d	EC	1.27E+05	0	0.00827	0.31572	1.35E-17
Pm-144	363	d	EC	9.19E+04	0	0.01712	1.56311	6.05E-17
Pm-145	17.7	y	ECA	5.12E+03	0	0.01258	0.0315	2.91E-18
Pm-146	5.53	y	ECB-	1.63E+04	0	0.0941	0.75123	2.93E-17
Pm-147	2.6234	y	B-	3.41E+04	0	0.06193	0	1.79E-22
Pm-148	5.368	d	B-	6.05E+06	0	0.7284	0.57434	1.99E-17
Pm-148m	41.29	d	B-IT	7.86E+05	0	0.16994	1.99156	7.44E-17
Pm-149	53.08	h	B-	1.46E+07	0	0.36503	0.01189	4.43E-19
Pm-150	2.68	h	B-	2.87E+08	0	0.8101	1.47046	5.08E-17
Pm-151	28.4	h	B-	2.69E+07	0	0.30477	0.3289	1.26E-17
Pm-152	4.12	m	B-	1.10E+10	0	1.32829	0.28658	1.01E-17
Pm-152m	7.52	m	B-	6.05E+09	0	0.90552	1.51888	5.32E-17
Pm-153	5.25	m	B-	8.61E+09	0	0.68808	0.07643	3.35E-18
Pm-154	1.73	m	B-	2.60E+10	0	0.87055	1.79326	5.83E-17
Pm-154m	2.68	m	B-	1.68E+10	0	0.94922	1.7996	6.17E-17
Po-203	36.7	m	ECB+A	9.30E+08	0.006	0.16716	1.63477	7.42E-17
Po-204	3.53	h	ECA	1.60E+08	0.0362	0.18386	1.16498	7.53E-17
Po-205	1.66	h	ECB+A	3.39E+08	0.0021	0.06602	1.58456	7.11E-17

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Po-206	8.8	d	ECA	2.65E+06	0.2902	0.1655	1.19277	7.03E-17
Po-207	5.8	h	ECB+A	9.61E+07	0.001	0.04896	1.28466	5.97E-17
Po-208	2.898	y	A EC	2.18E+04	5.2153	0	0.00002	1.48E-21
Po-209	102	y	A EC	6.18E+02	4.9528	0.00303	0.00629	3.30E-19
Po-210	138.376	d	A	1.66E+05	5.4074	0	0	3.60E-22
Po-211	0.516	s	A	3.82E+12	7.586	0.00018	0.00817	3.05E-19
Po-212	2.99E-07	s	A	6.56E+18	8.9541	0	0	0
Po-212m	45.1	s	A	4.35E+10	11.775	0.00036	0.07923	2.32E-18
Po-213	4.20E-06	s	A	4.65E+17	8.5369	0	0.00003	1.41E-21
Po-214	1.64E-04	s	A	1.18E+16	7.8333	0	0.00008	3.07E-21
Po-215	1.78E-03	s	A	1.09E+15	7.5261	0	0.00017	6.88E-21
Po-216	0.145	s	A	1.33E+13	6.9063	0	0.00001	5.66E-22
Po-218	3.1	m	A B-	1.03E+10	6.1134	0.00001	0	0
Pr-134	11	m	ECB+	4.69E+09	0	1.08006	3.15043	1.16E-16
Pr-134m	17	m	ECB+	3.03E+09	0	1.52736	2.31011	8.19E-17
Pr-135	24	m	ECB+	2.13E+09	0	0.57931	0.87411	3.44E-17
Pr-136	13.1	m	ECB+	3.88E+09	0	0.75448	2.14584	7.72E-17
Pr-137	1.28	h	ECB+	6.57E+08	0	0.19469	0.36931	1.54E-17
Pr-138	1.45	m	ECB+	3.46E+10	0	1.16169	0.81529	3.13E-17
Pr-138m	2.12	h	ECB+	3.94E+08	0	0.22079	2.47756	9.19E-17
Pr-139	4.41	h	ECB+	1.88E+08	0	0.04783	0.12984	6.89E-18
Pr-140	3.39	m	ECB+	1.46E+10	0	0.55163	0.54666	2.18E-17
Pr-142	19.12	h	B-EC	4.24E+07	0	0.80978	0.0581	1.87E-18
Pr-142m	14.6	m	IT	3.34E+09	0	0.00362	0.0001	0
Pr-143	13.57	d	B-	2.47E+06	0	0.315	0	3.31E-25
Pr-144	17.28	m	B-	2.78E+09	0	1.20843	0.02885	9.36E-19
Pr-144m	7.2	m	ITB-	6.67E+09	0	0.04746	0.01335	1.26E-18
Pr-145	5.984	h	B-	1.33E+08	0	0.67572	0.01861	6.94E-19
Pr-146	24.15	m	B-	1.96E+09	0	1.32772	1.01048	3.42E-17
Pr-147	13.4	m	B-	3.51E+09	0	0.88963	0.48872	1.97E-17
Pr-148	2.29	m	B-	2.04E+10	0	1.66373	0.99049	3.39E-17
Pr-148m	2.01	m	B-	2.33E+10	0	1.6807	0.93374	3.44E-17
Pt-184	17.3	m	ECB+A	2.18E+09	0	0.20038	0.72661	4.66E-17
Pt-186	2.08	h	ECA	2.98E+08	0	0.04513	0.68442	3.41E-17
Pt-187	2.35	h	ECB+	2.63E+08	0	0.1549	0.61825	3.55E-17
Pt-188	10.2	d	ECA	2.51E+06	0	0.08234	0.20548	1.76E-17
Pt-189	10.87	h	ECB+	5.62E+07	0	0.09962	0.48704	3.12E-17
Pt-190	6.50E+11	y	A	1.07E-07	3.249	0	0	0
Pt-191	2.802	d	EC	8.98E+06	0	0.07485	0.29602	2.31E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Pt-193	50	y	EC	1.36E+03	0	0.00714	0.00258	4.73E-18
Pt-193m	4.33	d	IT	5.75E+06	0	0.13773	0.01322	4.49E-18
Pt-195m	4.02	d	IT	6.13E+06	0	0.18449	0.07716	1.64E-17
Pt-197	19.8915	h	B-	2.95E+07	0	0.25522	0.02563	5.42E-18
Pt-197m	95.41	m	ITB-	3.68E+08	0	0.32499	0.08389	1.47E-17
Pt-199	30.8	m	B-	1.13E+09	0	0.54552	0.19951	8.31E-18
Pt-200	12.5	h	B-	4.62E+07	0	0.23208	0.06052	7.37E-18
Pt-202	44	h	B-	1.31E+07	0	0.65365	0	0
Pt-202+D				7.14E+10	0	1.7285	0.172	6.18E-18
Pt-202+E				7.14E+10	0	1.7285	0.172	6.18E-18
Pu-232	33.7	m	ECA	8.90E+08	1.5402	0.00868	0.06334	9.08E-18
Pu-234	8.8	h	ECA	5.63E+07	0.3775	0.01137	0.06933	1.09E-17
Pu-235	25.3	m	ECA	1.17E+09	0.0001	0.02279	0.09572	1.57E-17
Pu-236	2.858	y	A SF	1.96E+04	5.8523	0.01282	0.00224	2.85E-18
Pu-237	45.2	d	ECA	4.51E+05	0.0002	0.01714	0.05365	1.21E-17
Pu-238	87.7	y	A SF	6.34E+02	5.5802	0.01068	0.00205	2.64E-18
Pu-239	2.41E+04	y	A	2.30E+00	5.2357	0.00745	0.00107	1.11E-18
Pu-239+D				1.14E+09	5.2357	0.0075	0.0011	1.11E-18
Pu-239+E				1.14E+09	5.2357	0.0075	0.0011	1.11E-18
Pu-240	6564	y	A SF	8.40E+00	5.2434	0.01051	0.00193	2.48E-18
Pu-241	14.35	y	B-A	3.83E+03	0.0001	0.00523	0	3.71E-22
Pu-242	3.75E+05	y	A SF	1.46E-01	4.9738	0.00895	0.00173	2.13E-18
Pu-243	4.956	h	B-	9.63E+07	0	0.17294	0.02587	3.39E-18
Pu-244	8.00E+07	y	A SF	6.78E-04	4.6513	0.01974	0.02112	3.50E-18
Pu-244+D				4.05E+09	4.6513	0.8248	0.3542	2.82E-17
Pu-244+E				4.05E+09	4.6513	0.8248	0.3542	2.82E-17
Pu-245	10.5	h	B-	4.51E+07	0	0.31904	0.40268	1.80E-17
Pu-246	10.84	d	B-	1.81E+06	0	0.11591	0.14308	1.44E-17
Ra-219	10	m	sA	1.91E+14	7.9011	0.05997	0.17015	9.16E-18
Ra-219+D				8.52E+17	16.7401	0.06	0.1701	9.15E-18
Ra-219+E				8.52E+17	16.7401	0.06	0.1701	9.15E-18
Ra-220	1.79E-02	s	A	1.06E+14	7.5903	0.00017	0.00467	1.82E-19
Ra-221	28	s	A	6.75E+10	6.7915	0.06897	0.03901	9.00E-18
Ra-221+D				4.68E+17	23.2139	0.069	0.039	9.00E-18
Ra-221+E				4.68E+17	23.2139	0.069	0.039	9.00E-18
Ra-222	38	s	A	4.95E+10	6.671	0.00085	0.00919	3.75E-19
Ra-223	11.43	d	A	1.90E+06	5.7701	0.07809	0.14126	1.32E-17
Ra-223+D				1.09E+15	20.1763	0.0849	0.2	1.57E-17
Ra-223+E				1.09E+15	20.1763	0.0849	0.2	1.57E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Ra-224	3.66	d	A	5.89E+06	5.7765	0.00232	0.01039	4.96E-19
Ra-224+D				1.34E+13	19.0868	0.0023	0.011	5.21E-19
Ra-224+E				1.34E+13	19.0868	0.0023	0.011	5.21E-19
Ra-225	14.9	d	B-	1.44E+06	0	0.10496	0.01446	5.14E-18
Ra-226	1600	y	A	3.66E+01	4.8602	0.00391	0.00739	5.23E-19
Ra-226+D				1.18E+16	24.3976	0.9621	1.741	6.52E-17
Ra-226+E				1.18E+16	24.3976	0.9621	1.741	6.52E-17
Ra-227	42.2	m	B-	7.26E+08	0	0.45106	0.15083	1.91E-17
Ra-228	5.75	y	B-	1.01E+04	0	0.01319	0.00306	3.85E-18
Ra-228+D				8.27E+07	0	0.4626	0.8702	4.38E-17
Ra-228+E				8.27E+07	0	0.4626	0.8702	4.38E-17
Ra-230	93	m	B-	3.25E+08	0	0.22006	0.07944	6.49E-18
Rb-77	3.77	m	ECB+	2.37E+10	0	1.68653	1.54522	6.14E-17
Rb-78	17.66	m	ECB+	4.99E+09	0	1.28892	4.09184	1.27E-16
Rb-78m	5.74	m	ECB+IT	1.56E+10	0	1.49924	3.21486	1.13E-16
Rb-79	22.9	m	ECB+	3.80E+09	0	0.80987	1.44927	6.42E-17
Rb-80	33.4	s	ECB+	1.55E+11	0	2.04545	1.19001	4.53E-17
Rb-81	4.576	h	ECB+	3.09E+08	0	0.12223	0.50813	3.36E-17
Rb-81m	30.5	m	ITECB+	2.79E+09	0	0.08169	0.03028	1.49E-17
Rb-82	1.273	m	ECB+	6.59E+10	0	1.41123	1.1083	4.27E-17
Rb-82m	6.472	h	ECB+	2.16E+08	0	0.09352	2.92115	1.21E-16
Rb-83	86.2	d	EC	6.68E+05	0	0.0083	0.49143	3.84E-17
Rb-84	32.77	d	ECB+B-	1.74E+06	0	0.16334	0.90769	4.71E-17
Rb-84m	20.26	m	IT	4.05E+09	0	0.08133	0.38305	2.00E-17
Rb-86	18.642	d	B-EC	2.98E+06	0	0.66799	0.09304	3.28E-18
Rb-86m	1.017	m	IT	8.06E+10	0	0.00997	0.54609	2.10E-17
Rb-87	4.92E+10	y	B-	3.06E-06	0	0.1154	0	0
Rb-88	17.78	m	B-	4.40E+09	0	2.07196	0.63696	2.00E-17
Rb-89	15.15	m	B-	5.11E+09	0	0.95283	2.24304	7.33E-17
Rb-90	158	s	B-	2.91E+10	0	2.04429	2.02857	5.51E-17
Rb-90m	258	s	B-IT	1.78E+10	0	1.41041	3.24062	9.91E-17
Re-178	13.2	m	ECB+	2.95E+09	0	0.61924	1.70849	5.66E-17
Re-179	19.5	m	ECB+	1.98E+09	0	0.06683	1.08411	3.93E-17
Re-180	2.44	m	ECB+	1.58E+10	0	0.17201	1.20279	4.47E-17
Re-181	19.9	h	ECB+	3.20E+07	0	0.136	0.80444	3.09E-17
Re-182	64	h	EC	9.90E+06	0	0.20453	1.79821	6.48E-17
Re-182m	12.7	h	ECB+	4.99E+07	0	0.09222	1.22138	4.35E-17
Re-183	70	d	EC	3.75E+05	0	0.10926	0.15746	7.57E-18
Re-184	38	d	ECB+	6.88E+05	0	0.0562	0.89185	3.36E-17



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Re-184m	169	d	ITEC	1.55E+05	0	0.14129	0.38358	2.01E-17
Re-186	3.7183	d	B-EC	6.95E+06	0	0.33624	0.02079	1.63E-18
Re-186m	2.00E+05	y	IT	3.54E-01	0	0.12669	0.02067	1.52E-17
Re-186m+D				6.95E+06	0	0.4629	0.0415	1.68E-17
Re-186m+E				6.95E+06	0	0.4629	0.0415	1.68E-17
Re-187	4.12E+10	y	B-	1.71E-06	0	0.00061	0	0
Re-188	17.004	h	B-	3.61E+07	0	0.77934	0.06125	3.05E-18
Re-188m	18.59	m	IT	1.98E+09	0	0.09761	0.07153	1.22E-17
Re-189	24.3	h	B-	2.51E+07	0	0.32599	0.05564	3.40E-18
Re-190	3.1	m	B-	1.18E+10	0	0.68627	1.33758	5.11E-17
Re-190m	3.2	h	B-IT	1.90E+08	0	0.44561	0.92573	3.93E-17
Rh-100	20.8	h	ECB+	5.53E+07	0	0.04943	2.74253	9.89E-17
Rh-100m	4.6	m	ITECB+	1.50E+10	0	0.08017	0.0637	1.31E-17
Rh-101	3.3	y	EC	3.93E+04	0	0.02665	0.28781	2.03E-17
Rh-101m	4.34	d	ECIT	1.09E+07	0	0.01993	0.28767	1.99E-17
Rh-102	207	d	ECB+B-	2.27E+05	0	0.17172	0.50597	2.49E-17
Rh-102m	3.742	y	ECB+IT	3.44E+04	0	0.01249	2.15356	8.88E-17
Rh-103m	56.114	m	IT	1.19E+09	0	0.03768	0.00172	9.62E-19
Rh-104	42.3	s	B-EC	9.41E+10	0	0.98225	0.01242	5.09E-19
Rh-104m	4.34	m	ITB-	1.53E+10	0	0.08461	0.04409	9.99E-18
Rh-105	35.36	h	B-	3.10E+07	0	0.15331	0.07727	2.90E-18
Rh-106	29.8	s	B-	1.31E+11	0	1.41114	0.20606	7.68E-18
Rh-106m	131	m	B-	4.97E+08	0	0.34922	2.85258	1.02E-16
Rh-107	21.7	m	B-	2.97E+09	0	0.44067	0.31326	1.17E-17
Rh-108	16.8	s	B-	2.28E+11	0	1.82094	0.31716	1.20E-17
Rh-109	80	s	B-	4.75E+10	0	0.93199	0.29948	1.21E-17
Rh-94	70.6	s	ECB+	6.23E+10	0	2.90116	3.76337	1.30E-16
Rh-95	5.02	m	ECB+	1.45E+10	0	0.89725	2.56033	9.12E-17
Rh-95m	1.96	m	ITECB+	3.70E+10	0	0.18219	0.89725	3.09E-17
Rh-96	9.9	m	ECB+	7.25E+09	0	0.74193	3.92656	1.45E-16
Rh-96m	1.51	m	ITECB+	4.76E+10	0	0.56729	1.28185	4.85E-17
Rh-97	30.7	m	ECB+	2.32E+09	0	0.52114	1.44483	5.65E-17
Rh-97m	46.2	m	ECB+IT	1.54E+09	0	0.19919	2.20169	7.81E-17
Rh-98	8.7	m	ECB+	8.09E+09	0	1.33706	1.8115	6.77E-17
Rh-99	16.1	d	ECB+	3.00E+06	0	0.06114	0.56269	3.40E-17
Rh-99m	4.7	h	ECB+	2.47E+08	0	0.03674	0.65108	3.28E-17
Rn-207	9.25	m	ECB+A	3.62E+09	1.3126	0.21973	0.98536	4.54E-17
Rn-209	28.5	m	ECB+A	1.16E+09	1.0465	0.11671	1.19527	5.29E-17
Rn-210	2.4	h	A EC	2.29E+08	5.9121	0.00906	0.06095	3.41E-18

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Rn-211	14.6	h	ECB+A	3.75E+07	1.6204	0.06627	1.87269	7.89E-17
Rn-212	23.9	m	A	1.37E+09	6.3846	0	0.00033	1.27E-20
Rn-215	2.3	u	sA	8.52E+17	8.839	0	0	0
Rn-216	4.50E-05	s	A	4.30E+16	8.1999	0	0	0
Rn-217	5.40E-04	s	A	3.56E+15	7.8855	0	0	0
Rn-218	3.50E-02	s	A	5.47E+13	7.2618	0.00001	0.00075	2.88E-20
Rn-219	3.96	s	A	4.81E+11	6.8801	0.00683	0.05859	2.54E-18
Rn-219+D				1.09E+15	14.4062	0.0068	0.0588	2.55E-18
Rn-219+E				1.09E+15	14.4062	0.0068	0.0588	2.55E-18
Rn-220	55.6	s	A	3.41E+10	6.404	0.00001	0.00062	2.41E-20
Rn-222	3.8235	d	A	5.69E+06	5.5898	0.00001	0.00038	1.50E-20
Rn-222+D				1.03E+10	11.7032	0	0.0004	1.50E-20
Rn-222+E				1.03E+10	11.7032	0	0.0004	1.50E-20
Rn-223	24.3	m	B-	1.28E+09	0	0.62824	0.34435	2.29E-17
Ru-103	39.26	d	B-	1.19E+06	0	0.06604	0.49616	1.89E-17
Ru-105	4.44	h	B-	2.47E+08	0	0.4406	0.74802	2.93E-17
Ru-106	373.59	d	B-	1.21E+05	0	0.01003	0	0
Ru-106+D				1.31E+11	0	1.4212	0.2061	7.68E-18
Ru-106+E				1.31E+11	0	1.4212	0.2061	7.68E-18
Ru-107	3.75	m	B-	1.72E+10	0	1.07035	0.34532	1.24E-17
Ru-108	4.55	m	B-	1.40E+10	0	0.48028	0.06258	3.07E-18
Ru-92	3.65	m	ECB+	2.05E+10	0	0.79394	2.08437	9.32E-17
Ru-94	51.8	m	ECB+	1.42E+09	0	0.00846	0.51969	2.96E-17
Ru-95	1.643	h	ECB+	7.36E+08	0	0.08308	1.24186	5.33E-17
Ru-97	2.9	d	EC	1.70E+07	0	0.01318	0.24077	1.92E-17
S-35	87.51	d	B-	1.54E+06	0	0.04872	0	0
S-37	5.05	m	B-	3.63E+10	0	0.7998	2.93105	7.67E-17
S-38	170.3	m	B-	1.05E+09	0	0.48984	1.69528	5.14E-17
Sb-111	75	s	ECB+	4.97E+10	0	1.36395	1.48589	5.66E-17
Sb-113	6.67	m	ECB+	9.16E+09	0	0.72027	1.2683	4.96E-17
Sb-114	3.49	m	ECB+	1.74E+10	0	1.21836	2.6893	9.52E-17
Sb-115	32.1	m	ECB+	1.87E+09	0	0.23417	0.88939	3.70E-17
Sb-116	15.8	m	ECB+	3.77E+09	0	0.51382	2.27877	8.05E-17
Sb-116m	60.3	m	ECB+	9.87E+08	0	0.14077	3.10294	1.16E-16
Sb-117	2.8	h	ECB+	3.51E+08	0	0.02981	0.18642	1.21E-17
Sb-118	3.6	m	ECB+	1.63E+10	0	0.87303	0.80386	3.17E-17
Sb-118m	5	h	ECB+	1.95E+08	0	0.03737	2.61302	1.01E-16
Sb-119	38.19	h	EC	2.53E+07	0	0.02583	0.02341	7.43E-18
Sb-120	15.89	m	ECB+	3.62E+09	0	0.30771	0.45213	2.02E-17

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Sb-120m	5.76	d	EC	6.94E+06	0	0.04492	2.46628	9.27E-17
Sb-122	2.7238	d	B-ECB+	1.44E+07	0	0.56183	0.44532	1.69E-17
Sb-122m	4.191	m	IT	1.35E+10	0	0.09368	0.07073	7.40E-18
Sb-124	60.2	d	B-	6.43E+05	0	0.38311	1.85311	6.32E-17
Sb-124m	93	s	ITB-	3.59E+10	0	0.11566	0.44013	1.66E-17
Sb-124n	20.2	m	IT	2.76E+09	0	0.02561	0.00037	2.44E-22
Sb-125	2.75856	y	B-	3.81E+04	0	0.10098	0.43731	1.94E-17
Sb-126	12.35	d	B-	3.08E+06	0	0.35449	2.75524	1.03E-16
Sb-126m	19.15	m	B-IT	2.86E+09	0	0.63215	1.5483	5.80E-17
Sb-127	3.85	d	B-	9.81E+06	0	0.316	0.69335	2.61E-17
Sb-128	9.01	h	B-	9.99E+07	0	0.49992	3.09344	1.15E-16
Sb-128m	10.4	m	B-IT	5.19E+09	0	0.95798	1.90628	7.06E-17
Sb-129	4.4	h	B-	2.03E+08	0	0.39525	1.46008	5.16E-17
Sb-130	39.5	m	B-	1.35E+09	0	0.75788	3.27238	1.19E-16
Sb-130m	6.3	m	B-	8.44E+09	0	1.029	2.70773	9.79E-17
Sb-131	23.03	m	B-	2.29E+09	0	0.58674	2.0733	7.11E-17
Sb-133	2.5	m	B-	2.08E+10	0	0.67848	2.74338	8.99E-17
Sc-42m	62	s	ECB+	5.03E+10	0	1.25647	4.20422	1.47E-16
Sc-43	3.891	h	ECB+	6.78E+08	0	0.41945	0.98405	3.72E-17
Sc-44	3.97	h	ECB+	6.50E+08	0	0.59606	2.13692	7.71E-17
Sc-44m	58.61	h	ITEC	4.40E+07	0	0.03278	0.27433	9.86E-18
Sc-46	83.79	d	B-	1.23E+06	0	0.11207	2.00958	7.14E-17
Sc-47	3.3492	d	B-	3.01E+07	0	0.16241	0.10886	3.51E-18
Sc-48	43.67	h	B-	5.43E+07	0	0.22155	3.35287	1.17E-16
Sc-49	57.2	m	B-	2.44E+09	0	0.81773	0.00104	3.27E-20
Sc-50	102.5	s	B-	7.99E+10	0	1.63619	3.20223	1.09E-16
Se-70	41.1	m	ECB+	2.39E+09	0	0.23745	0.72112	6.91E-17
Se-71	4.74	m	ECB+	2.04E+10	0	1.38435	1.60563	6.03E-17
Se-72	8.4	d	EC	7.89E+06	0	0.02275	0.03432	3.90E-17
Se-73	7.15	h	ECB+	2.19E+08	0	0.38709	1.09237	5.54E-17
Se-73m	39.8	m	ITECB+	2.37E+09	0	0.16421	0.26325	1.57E-17
Se-75	119.779	d	EC	5.31E+05	0	0.01444	0.38898	4.25E-17
Se-77m	17.36	s	IT	3.17E+11	0	0.07368	0.08884	1.35E-17
Se-79	2.95E+05	y	B-	5.61E-01	0	0.05292	0	0
Se-79m	3.92	m	ITB-	2.34E+10	0	0.08196	0.01375	1.91E-17
Se-81	18.45	m	B-	4.60E+09	0	0.61081	0.00801	2.98E-19
Se-81m	57.28	m	ITB-	1.48E+09	0	0.0871	0.01834	1.92E-17
Se-83	22.3	m	B-	3.72E+09	0	0.45282	2.62541	9.05E-17
Se-83m	70.1	s	B-	7.27E+10	0	1.25701	0.98493	3.37E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Se-84	3.1	m	B-	2.64E+10	0	0.54994	0.42017	1.59E-17
Si-31	157.3	m	B-	1.38E+09	0	0.59485	0.00088	3.01E-20
Si-32	132	y	B-	3.04E+03	0	0.06862	0	0
Si-32+D				1.03E+07	0	0.7634	0	0.00E+00
Si-32+E				1.03E+07	0	0.7634	0	0.00E+00
Sm-139	2.57	m	ECB+	1.94E+10	0	1.08707	1.45395	5.39E-17
Sm-140	14.82	m	ECB+	3.33E+09	0	0.17098	0.56773	2.18E-17
Sm-141	10.2	m	ECB+	4.81E+09	0	0.71255	1.40891	5.16E-17
Sm-141m	22.6	m	ECB+IT	2.17E+09	0	0.39951	1.94938	7.08E-17
Sm-142	72.49	m	ECB+	6.72E+08	0	0.04458	0.11051	5.63E-18
Sm-143	8.75	m	ECB+	5.53E+09	0	0.49778	0.5289	2.07E-17
Sm-143m	66	s	ITECB+	4.40E+10	0	0.072	0.68442	2.55E-17
Sm-145	340	d	EC	9.74E+04	0	0.03072	0.06424	5.24E-18
Sm-146	1.03E+08	y	A	8.74E-04	2.529	0	0	0
Sm-147	1.06E+11	y	A	8.44E-07	2.3105	0	0	0
Sm-148	7.00E+15	y	A	1.27E-11	1.986	0	0	0
Sm-151	90	y	B-	9.68E+02	0	0.01997	0.00001	3.68E-21
Sm-153	46.5	h	B-	1.62E+07	0	0.26987	0.06425	3.12E-18
Sm-155	22.3	m	B-	2.00E+09	0	0.56737	0.10294	3.54E-18
Sm-156	9.4	h	B-	7.86E+07	0	0.20925	0.11498	4.36E-18
Sm-157	8.03	m	B-	5.49E+09	0	0.875	0.41416	1.49E-17
Sn-106	1.92	m	ECB+	3.39E+10	0	0.12787	1.20914	5.01E-17
Sn-108	10.3	m	ECB+	6.20E+09	0	0.02693	0.68472	3.18E-17
Sn-109	18	m	ECB+	3.52E+09	0	0.0571	2.2063	7.85E-17
Sn-110	4.11	h	EC	2.54E+08	0	0.01517	0.2918	1.65E-17
Sn-111	35.3	m	ECB+	1.76E+09	0	0.19153	0.4903	2.17E-17
Sn-113	115.09	d	EC	3.69E+05	0	0.00626	0.02369	6.63E-18
Sn-113m	21.4	m	ITEC	2.86E+09	0	0.05879	0.01368	4.14E-18
Sn-117m	13.76	d	IT	2.98E+06	0	0.16158	0.1581	9.97E-18
Sn-119m	293.1	d	IT	1.38E+05	0	0.07808	0.01509	4.89E-18
Sn-121	27.03	h	B-	3.52E+07	0	0.11558	0	0
Sn-121m	43.9	y	ITB-	2.47E+03	0	0.03539	0.00515	1.22E-18
Sn-121m+D				2.73E+07	0	0.1251	0.0052	1.22E-18
Sn-121m+E				2.73E+07	0	0.1251	0.0052	1.22E-18
Sn-123	129.2	d	B-	3.02E+05	0	0.52269	0.00689	2.42E-19
Sn-123m	40.06	m	B-	1.40E+09	0	0.47884	0.14072	5.26E-18
Sn-125	9.64	d	B-	3.98E+06	0	0.80369	0.33463	1.17E-17
Sn-125m	9.52	m	B-	5.81E+09	0	0.80701	0.34636	1.29E-17
Sn-126	2.30E+05	y	B-	4.53E-01	0	0.13802	0.05685	4.39E-18

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Sn-126+D				2.86E+09	0	0.8198	1.9909	7.68E-17
Sn-126+E				2.86E+09	0	0.8198	1.9909	7.68E-17
Sn-127	2.1	h	B-	4.32E+08	0	0.5199	1.90751	6.59E-17
Sn-127m	4.13	m	B-	1.32E+10	0	1.11402	0.56857	2.10E-17
Sn-128	59.07	m	B-	9.14E+08	0	0.24571	0.60406	3.19E-17
Sn-129	2.23	m	B-	2.40E+10	0	1.25759	1.00806	3.64E-17
Sn-130	3.72	m	B-	1.43E+10	0	0.46118	0.93717	3.76E-17
Sn-130m	1.7	m	B-	3.13E+10	0	1.40399	0.88606	3.35E-17
Sr-79	2.25	m	ECB+	3.87E+10	0	1.85724	1.18008	5.33E-17
Sr-80	106.3	m	ECB+	8.09E+08	0	0.04184	0.43709	3.28E-17
Sr-81	22.3	m	ECB+	3.81E+09	0	0.97425	1.3866	5.50E-17
Sr-82	25.36	d	EC	2.30E+06	0	0.00535	0.00788	1.81E-17
Sr-82+D				6.59E+10	0	1.4166	1.1162	6.08E-17
Sr-82+E				6.59E+10	0	1.4166	1.1162	6.08E-17
Sr-83	32.41	h	ECB+	4.26E+07	0	0.16038	0.8213	5.43E-17
Sr-85	64.84	d	EC	8.68E+05	0	0.0089	0.50013	3.71E-17
Sr-85m	67.63	m	ITECB+	1.20E+09	0	0.01296	0.21773	1.05E-17
Sr-87m	2.815	h	ITEC	4.80E+08	0	0.06724	0.32016	1.49E-17
Sr-89	50.53	d	B-	1.06E+06	0	0.58453	0.00008	3.16E-21
Sr-90	28.79	y	B-	5.06E+03	0	0.19572	0	0
Sr-90+D				1.99E+07	0	1.1288	0	1.65E-21
Sr-90+E				1.99E+07	0	1.1288	0	1.65E-21
Sr-91	9.63	h	B-	1.31E+08	0	0.65493	0.70716	2.55E-17
Sr-92	2.66	h	B-	4.69E+08	0	0.20253	1.33679	4.48E-17
Sr-93	7.423	m	B-	9.98E+09	0	0.80942	2.26365	8.06E-17
Sr-94	75.3	s	B-	5.84E+10	0	0.8381	1.42697	4.73E-17
Ta-170	6.76	m	ECB+	6.02E+09	0	1.60492	1.06024	4.03E-17
Ta-172	36.8	m	ECB+	1.09E+09	0	0.55129	1.69665	6.09E-17
Ta-173	3.14	h	ECB+	2.12E+08	0	0.16864	0.5824	2.23E-17
Ta-174	1.14	h	ECB+	5.82E+08	0	0.46704	0.97671	3.53E-17
Ta-175	10.5	h	ECB+	6.28E+07	0	0.06632	1.11262	3.94E-17
Ta-176	8.09	h	ECB+	8.10E+07	0	0.08492	2.23217	7.41E-17
Ta-177	56.56	h	EC	1.15E+07	0	0.02396	0.06775	3.45E-18
Ta-178	9.31	m	ECB+	4.18E+09	0	0.03912	0.12182	5.42E-18
Ta-178m	2.36	h	EC	2.75E+08	0	0.16155	1.1558	4.43E-17
Ta-179	1.82	y	EC	4.04E+04	0	0.0078	0.0256	1.76E-18
Ta-180	8.152	h	ECB-	7.86E+07	0	0.05651	0.04824	2.70E-18
Ta-182	114.43	d	B-	2.31E+05	0	0.21045	1.29183	4.55E-17
Ta-182m	15.84	m	IT	2.40E+09	0	0.26647	0.2659	1.10E-17

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Ta-183	5.1	d	B-	5.15E+06	0	0.35366	0.29628	1.24E-17
Ta-184	8.7	h	B-	7.21E+07	0	0.54255	1.57267	5.84E-17
Ta-185	49.4	m	B-	7.57E+08	0	0.74155	0.15474	6.41E-18
Ta-186	10.5	m	B-	3.54E+09	0	1.07104	1.42016	5.24E-17
Tb-146	23	s	ECB+	1.24E+11	0	1.46436	3.62561	1.21E-16
Tb-147	1.64	h	ECB+	4.78E+08	0	0.28101	2.18449	7.69E-17
Tb-147m	1.87	m	ECB+	2.52E+10	0	0.31957	1.91163	6.44E-17
Tb-148	60	m	ECB+	7.79E+08	0	0.84113	2.359	8.23E-17
Tb-148m	2.2	m	ECB+	2.12E+10	0	0.31055	3.13898	1.17E-16
Tb-149	4.118	h	ECB+A	1.88E+08	0.681	0.08706	1.36116	4.81E-17
Tb-149m	4.16	m	ECB+A	1.12E+10	0.0009	0.20905	1.37476	5.17E-17
Tb-150	3.48	h	ECB+A	2.21E+08	0	0.28896	2.44026	8.04E-17
Tb-150m	5.8	m	ECB+	7.95E+09	0	0.12671	2.52024	9.54E-17
Tb-151	17.609	h	ECB+A	4.34E+07	0.0003	0.07996	0.99413	3.77E-17
Tb-151m	25	s	ITECB+	1.10E+11	0	0.07927	0.08079	3.45E-18
Tb-152	17.5	h	ECB+	4.33E+07	0	0.25033	1.49324	5.18E-17
Tb-152m	4.2	m	ITECB+	1.08E+10	0	0.15198	0.76193	2.92E-17
Tb-153	2.34	d	ECB+	1.34E+07	0	0.0481	0.33184	1.33E-17
Tb-154	21.5	h	ECB+	3.48E+07	0	0.06809	2.28313	7.33E-17
Tb-155	5.32	d	EC	5.83E+06	0	0.0434	0.17769	7.58E-18
Tb-156	5.35	d	EC	5.76E+06	0	0.08351	1.93705	6.93E-17
Tb-156m	24.4	h	IT	3.03E+07	0	0.01705	0.03695	1.94E-18
Tb-156n	5.3	h	IT	1.39E+08	0	0.08738	0.00476	1.96E-19
Tb-157	71	y	EC	1.18E+03	0	0.00573	0.00565	3.18E-19
Tb-158	180	y	ECB-	4.63E+02	0	0.11165	0.80481	3.00E-17
Tb-160	72.3	d	B-	4.15E+05	0	0.25925	1.12635	4.02E-17
Tb-161	6.906	d	B-	4.32E+06	0	0.20248	0.03652	3.30E-18
Tb-162	7.6	m	B-	5.62E+09	0	0.5327	1.10658	4.03E-17
Tb-163	19.5	m	B-	2.18E+09	0	0.35968	0.78873	2.97E-17
Tb-164	3	m	B-	1.41E+10	0	0.82488	2.44553	8.59E-17
Tb-165	2.11	m	B-	1.99E+10	0	0.89664	0.83631	2.84E-17
Tc-101	14.2	m	B-	4.81E+09	0	0.47245	0.33672	1.26E-17
Tc-102	5.28	s	B-	7.68E+11	0	1.9441	0.08076	2.89E-18
Tc-102m	4.35	m	B-IT	1.55E+10	0	0.7902	2.47442	8.33E-17
Tc-104	18.3	m	B-	3.62E+09	0	1.60136	2.24529	7.32E-17
Tc-105	7.6	m	B-	8.64E+09	0	1.27082	0.79812	3.00E-17
Tc-91	3.14	m	ECB+	2.41E+10	0	1.6985	2.48465	8.35E-17
Tc-91m	3.3	m	ECB+	2.29E+10	0	1.88709	1.42305	5.36E-17
Tc-92	4.25	m	ECB+	1.76E+10	0	1.79844	3.82781	1.37E-16

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Tc-93	2.75	h	ECB+	4.49E+08	0	0.04359	1.56864	6.25E-17
Tc-93m	43.5	m	ITECB+	1.70E+09	0	0.10153	0.95221	3.36E-17
Tc-94	293	m	ECB+	2.50E+08	0	0.04754	2.66077	1.08E-16
Tc-94m	52	m	ECB+	1.41E+09	0	0.75434	1.95665	7.31E-17
Tc-95	20	h	EC	6.05E+07	0	0.00685	0.79647	4.08E-17
Tc-95m	61	d	ECB+IT	8.26E+05	0	0.01544	0.68874	3.65E-17
Tc-96	4.28	d	EC	1.17E+07	0	0.00887	2.5032	1.03E-16
Tc-96m	51.5	m	ITECB+	1.39E+09	0	0.02689	0.04799	6.95E-18
Tc-97	2.60E+06	y	EC	5.20E-02	0	0.00554	0.01136	1.13E-17
Tc-97m	90.1	d	IT	5.48E+05	0	0.08686	0.00955	7.81E-18
Tc-98	4.20E+06	y	B-	3.19E-02	0	0.14152	1.41272	5.27E-17
Tc-99	2.11E+05	y	B-	6.27E-01	0	0.10125	0	1.05E-22
Tc-99m	6.015	h	ITB-	1.93E+08	0	0.01618	0.12659	5.11E-18
Te-113	1.7	m	ECB+	3.59E+10	0	1.70227	2.22081	7.85E-17
Te-114	15.2	m	ECB+	3.98E+09	0	0.1551	1.28165	5.01E-17
Te-115	5.8	m	ECB+	1.04E+10	0	0.81236	2.24486	8.11E-17
Te-115m	6.7	m	ECB+	8.96E+09	0	0.69388	2.60412	9.25E-17
Te-116	2.49	h	ECB+	3.98E+08	0	0.06178	0.11223	1.13E-17
Te-117	62	m	ECB+	9.52E+08	0	0.21387	1.54921	5.69E-17
Te-118	6	d	EC	6.77E+06	0	0.00609	0.01993	5.36E-18
Te-118+D				1.63E+10	0	0.8791	0.8238	3.70E-17
Te-118+E				1.63E+10	0	0.8791	0.8238	3.70E-17
Te-119	16.05	h	ECB+	6.03E+07	0	0.0143	0.76793	3.29E-17
Te-119m	4.7	d	ECB+	8.57E+06	0	0.01801	1.50589	5.65E-17
Te-121	19.16	d	EC	2.07E+06	0	0.00978	0.57746	2.66E-17
Te-121m	154	d	ITEC	2.57E+05	0	0.08167	0.21759	1.07E-17
Te-123	6.00E+14	y	EC	1.78E-10	0	0.00275	0.00035	9.32E-21
Te-123m	119.25	d	IT	3.27E+05	0	0.09899	0.14772	7.60E-18
Te-125m	57.4	d	IT	6.69E+05	0	0.10907	0.03598	8.14E-18
Te-127	9.35	h	B-	9.70E+07	0	0.22456	0.00488	1.89E-19
Te-127m	109	d	ITB-	3.47E+05	0	0.08237	0.01133	2.53E-18
Te-129	69.6	m	B-	7.70E+08	0	0.54356	0.06254	3.27E-18
Te-129m	33.6	d	ITB-	1.11E+06	0	0.27088	0.03757	2.97E-18
Te-131	25	m	B-	2.11E+09	0	0.71218	0.41998	1.55E-17
Te-131m	30	h	B-IT	2.93E+07	0	0.18701	1.45447	5.33E-17
Te-132	3.204	d	B-	1.14E+07	0	0.1108	0.23444	1.22E-17
Te-133	12.5	m	B-	4.16E+09	0	0.6897	1.20067	4.15E-17
Te-133m	55.4	m	B-IT	9.38E+08	0	0.38795	1.8597	6.69E-17
Te-134	41.8	m	B-	1.23E+09	0	0.22655	0.87139	3.36E-17

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Th-223	0.6	s	A	3.12E+12	7.4133	0.05753	0.07541	1.31E-17
Th-224	1.05	s	A	1.78E+12	7.2635	0.0129	0.02318	1.66E-18
Th-226	30.57	m	A	1.01E+09	6.4218	0.02111	0.0089	2.40E-18
Th-227	18.68	d	A	1.14E+06	5.9882	0.07547	0.13174	2.11E-17
Th-228	1.9116	y	A	3.04E+04	5.4955	0.02101	0.0036	2.82E-18
Th-229	7.34E+03	y	A	7.87E+00	4.9576	0.12174	0.09705	2.73E-17
Th-229+D				1.44E+06	4.9576	0.2267	0.1115	3.24E-17
Th-229+E				1.44E+06	4.9576	0.2267	0.1115	3.24E-17
Th-230	7.54E+04	y	A	7.63E-01	4.7538	0.01459	0.00177	2.45E-18
Th-231	25.52	h	B-	1.97E+07	0	0.1622	0.02686	1.90E-17
Th-232	1.41E+10	y	A	4.06E-06	4.0688	0.01261	0.00148	2.26E-18
Th-232+D				8.27E+07	4.0688	0.4753	0.8717	4.60E-17
Th-232+E				8.27E+07	4.0688	0.4753	0.8717	4.60E-17
Th-233	22.3	m	B-	1.34E+09	0	0.41398	0.03748	3.75E-18
Th-234	24.1	d	B-	8.57E+05	0	0.06223	0.01051	2.87E-18
Th-234+D				2.54E+10	0	0.8793	0.0267	3.61E-18
Th-234+E				2.54E+10	0	0.8793	0.0267	3.61E-18
Th-235	7.1	m	B-	4.17E+09	0	0.67134	0.0537	2.17E-18
Th-236	37.5	m	B-	7.86E+08	0	0.36705	0.03463	2.96E-18
Ti-44	60	y	EC	4.90E+03	0	0.01081	0.13961	4.55E-18
Ti-44+D				6.50E+08	0	0.6069	2.2765	8.17E-17
Ti-44+E				6.50E+08	0	0.6069	2.2765	8.17E-17
Ti-45	184.8	m	ECB+	8.19E+08	0	0.37275	0.87034	3.30E-17
Ti-51	5.76	m	B-	2.33E+10	0	0.86915	0.36916	1.36E-17
Ti-52	1.7	m	B-	7.73E+10	0	0.75304	0.12819	7.23E-18
Tl-190	2.6	m	ECB+	1.40E+10	0	1.52881	1.29142	5.06E-17
Tl-190m	3.7	m	ECB+	9.85E+09	0	0.79845	2.45502	9.50E-17
Tl-194	33	m	ECB+	1.08E+09	0	0.59718	0.91433	3.82E-17
Tl-194m	32.8	m	ECB+	1.09E+09	0	0.30367	2.52177	1.03E-16
Tl-195	1.16	h	ECB+	5.10E+08	0	0.07401	1.22504	5.13E-17
Tl-196	1.84	h	ECB+	3.20E+08	0	0.17821	1.87336	6.87E-17
Tl-197	2.84	h	ECB+	2.06E+08	0	0.05436	0.45866	2.33E-17
Tl-198	5.3	h	ECB+	1.10E+08	0	0.04142	2.01075	7.30E-17
Tl-198m	1.87	h	ECB+IT	3.12E+08	0	0.20064	1.21682	6.04E-17
Tl-199	7.42	h	ECB+	7.82E+07	0	0.05998	0.25203	1.64E-17
Tl-200	26.1	h	ECB+	2.21E+07	0	0.04076	1.31059	5.24E-17
Tl-201	72.912	h	EC	7.88E+06	0	0.04469	0.09381	1.15E-17
Tl-202	12.23	d	EC	1.95E+06	0	0.02328	0.46577	2.32E-17
Tl-204	3.78	y	B-EC	1.71E+04	0	0.23721	0.00127	1.92E-19



Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Tl-206	4.2	m	B-	8.00E+09	0	0.53982	0.0001	1.69E-20
Tl-206m	3.74	m	IT	8.99E+09	0	0.20034	2.4192	9.71E-17
Tl-207	4.77	m	B-	7.01E+09	0	0.49517	0.00235	8.63E-20
Tl-208	3.053	m	B-	1.09E+10	0	0.61134	3.36025	1.02E-16
Tl-209	2.161	m	B-	1.53E+10	0	0.68754	2.14263	7.52E-17
Tl-210	1.3	m	B-	2.54E+10	0	1.26989	2.76317	1.02E-16
Tm-161	30.2	m	ECB+	1.42E+09	0	0.23076	1.2992	4.52E-17
Tm-162	21.7	m	ECB+	1.97E+09	0	0.56475	1.91552	6.38E-17
Tm-163	1.81	h	ECB+	3.91E+08	0	0.07161	1.31998	4.62E-17
Tm-164	2	m	ECB+	2.11E+10	0	0.59935	0.77604	2.80E-17
Tm-165	30.06	h	ECB+	2.33E+07	0	0.06371	0.56246	2.13E-17
Tm-166	7.7	h	ECB+	9.02E+07	0	0.08918	1.97676	6.69E-17
Tm-167	9.25	d	EC	3.11E+06	0	0.13317	0.14823	5.89E-18
Tm-168	93.1	d	ECB+B-	3.07E+05	0	0.08471	1.24319	4.60E-17
Tm-170	128.6	d	B-EC	2.20E+05	0	0.32799	0.00414	1.50E-19
Tm-171	1.92	y	B-	4.01E+04	0	0.02547	0.00062	2.78E-20
Tm-172	63.6	h	B-	1.05E+07	0	0.53273	0.47442	1.58E-17
Tm-173	8.24	h	B-	8.09E+07	0	0.31026	0.38848	1.47E-17
Tm-174	5.4	m	B-	7.37E+09	0	0.51285	1.77868	6.41E-17
Tm-175	15.2	m	B-	2.60E+09	0	0.51957	1.08477	3.98E-17
Tm-176	1.85	m	B-	2.13E+10	0	0.99716	1.96821	6.55E-17
U-227	1.1	m	A	2.79E+10	6.9978	0.09604	0.11986	1.28E-17
U-228	9.1	m	A	3.35E+09	6.6045	0.02313	0.00558	2.64E-18
U-230	20.8	d	A	1.01E+06	5.9681	0.02156	0.00323	3.15E-18
U-231	4.2	d	ECA	4.98E+06	0.0002	0.08467	0.08964	3.17E-17
U-232	68.9	y	A	8.28E+02	5.3948	0.01638	0.00231	3.04E-18
U-233	1.59E+05	y	A	3.57E-01	4.9012	0.0059	0.00129	1.56E-18
U-234	2.46E+05	y	A	2.30E-01	4.843	0.01365	0.00201	2.78E-18
U-235	7.04E+08	y	A	8.00E-05	4.4689	0.053	0.16686	1.33E-17
U-235+D				1.97E+07	4.4689	0.2152	0.1937	3.23E-17
U-235+E				1.97E+07	4.4689	0.2152	0.1937	3.23E-17
U-235m	26	m	IT	1.14E+09	0	0.00007	0	0
U-236	2.34E+07	y	A	2.39E-03	4.5591	0.01137	0.00178	2.53E-18
U-237	6.75	d	B-	3.02E+06	0	0.19907	0.14424	1.95E-17
U-238	4.47E+09	y	A SF	1.24E-05	4.2584	0.00917	0.00143	2.04E-18
U-238+D				2.54E+10	4.2584	0.8892	0.0305	5.76E-18
U-238+E				2.54E+10	4.2584	0.8892	0.0305	5.76E-18
U-239	23.45	m	B-	1.24E+09	0	0.41079	0.05185	4.96E-18
U-240	14.1	h	B-	3.43E+07	0	0.12758	0.00986	6.68E-18

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
U-242	16.8	m	B-	1.71E+09	0	0.38592	0.04129	2.16E-18
V-47	32.6	m	ECB+	4.45E+09	0	0.80266	0.99512	3.76E-17
V-48	15.9735	d	ECB+	6.18E+06	0	0.15259	2.914	1.02E-16
V-49	330	d	EC	2.93E+05	0	0.00353	0.00091	0
V-50	1.50E+17	y	ECB-	1.73E-12	0	0.0158	1.42351	4.66E-17
V-52	3.743	m	B-	3.51E+10	0	1.06841	1.44488	4.77E-17
V-53	1.61	m	B-	8.01E+10	0	1.00481	1.03816	3.68E-17
W-177	132	m	ECB+	2.96E+08	0	0.09698	0.9185	3.50E-17
W-178	21.6	d	EC	1.25E+06	0	0.00749	0.01637	1.30E-18
W-178+D				4.18E+09	0	0.0466	0.1382	6.72E-18
W-178+E				4.18E+09	0	0.0466	0.1382	6.72E-18
W-179	37.05	m	EC	1.04E+09	0	0.03257	0.05539	4.17E-18
W-179m	6.4	m	ITEC	6.04E+09	0	0.16608	0.05605	2.66E-18
W-181	121.2	d	EC	2.19E+05	0	0.01289	0.04042	2.24E-18
W-185	75.1	d	B-	3.46E+05	0	0.12696	0.00005	5.08E-21
W-185m	1.597	m	IT	2.40E+10	0	0.17378	0.02873	2.70E-18
W-187	23.72	h	B-	2.60E+07	0	0.29948	0.44833	1.88E-17
W-188	69.78	d	B-	3.67E+05	0	0.09966	0.00189	1.03E-19
W-190	30	m	B-	1.22E+09	0	0.47711	0.15111	1.41E-17
Xe-120	40	m	ECB+	1.44E+09	0	0.0461	0.40146	2.23E-17
Xe-121	40.1	m	ECB+	1.42E+09	0	0.58189	1.47199	5.22E-17
Xe-122	20.1	h	EC	4.69E+07	0	0.01	0.06839	6.53E-18
Xe-123	2.08	h	ECB+	4.50E+08	0	0.18749	0.64106	2.63E-17
Xe-125	16.9	h	ECB+	5.45E+07	0	0.03504	0.27231	1.50E-17
Xe-127	36.4	d	EC	1.04E+06	0	0.03251	0.28063	1.44E-17
Xe-127m	69.2	s	IT	4.72E+10	0	0.12927	0.16854	7.92E-18
Xe-129m	8.88	d	IT	4.19E+06	0	0.18442	0.05172	7.91E-18
Xe-131m	11.84	d	IT	3.09E+06	0	0.14704	0.02057	3.30E-18
Xe-133	5.243	d	B-	6.88E+06	0	0.13791	0.04744	3.63E-18
Xe-133m	2.19	d	IT	1.65E+07	0	0.19235	0.04097	4.07E-18
Xe-135	9.14	h	B-	9.34E+07	0	0.32084	0.24828	9.10E-18
Xe-135m	15.29	m	ITB-	3.35E+09	0	0.10078	0.42491	1.67E-17
Xe-137	3.818	m	B-	1.32E+10	0	1.69515	0.19076	6.95E-18
Xe-138	14.08	m	B-	3.56E+09	0	0.65964	1.12218	3.65E-17
Y-81	70.4	s	ECB+	7.24E+10	0	1.96581	1.17016	5.38E-17
Y-83	7.08	m	ECB+	1.17E+10	0	1.31382	1.34575	6.19E-17
Y-83m	2.85	m	ECB+IT	2.91E+10	0	0.81768	0.83695	3.67E-17
Y-84m	39.5	m	ECB+	2.10E+09	0	1.22525	3.97508	1.45E-16
Y-85	2.68	h	ECB+	5.04E+08	0	0.48814	1.07946	4.63E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Y-85m	4.86	h	ECB+	2.78E+08	0	0.57651	1.32421	5.34E-17
Y-86	14.74	h	ECB+	9.05E+07	0	0.21787	3.5777	1.35E-16
Y-86m	48	m	ITECB+	1.67E+09	0	0.0243	0.22029	8.54E-18
Y-87	79.8	h	ECB+	1.65E+07	0	0.00715	0.44622	3.35E-17
Y-87m	13.37	h	ITECB+	9.87E+07	0	0.07941	0.30719	1.46E-17
Y-88	106.65	d	ECB+	5.10E+05	0	0.00674	2.69495	1.04E-16
Y-89m	15.663	s	IT	3.00E+11	0	0.00768	0.9014	3.28E-17
Y-90	64.1	h	B-	1.99E+07	0	0.9331	0	1.65E-21
Y-90m	3.19	h	ITB-	4.00E+08	0	0.04696	0.63536	2.51E-17
Y-91	58.51	d	B-	8.99E+05	0	0.60318	0.00313	1.08E-19
Y-91m	49.71	m	IT	1.52E+09	0	0.02793	0.52826	2.07E-17
Y-92	3.54	h	B-	3.53E+08	0	1.44942	0.25166	8.89E-18
Y-93	10.18	h	B-	1.21E+08	0	1.17212	0.0961	3.24E-18
Y-94	18.7	m	B-	3.92E+09	0	1.81329	0.77245	2.71E-17
Y-95	10.3	m	B-	7.04E+09	0	1.42878	1.10805	3.29E-17
Yb-162	18.87	m	ECB+	2.26E+09	0	0.03736	0.25191	9.31E-18
Yb-163	11.05	m	ECB+	3.84E+09	0	0.27183	0.72773	2.64E-17
Yb-164	75.8	m	EC	5.57E+08	0	0.00945	0.0542	2.47E-18
Yb-165	9.9	m	ECB+	4.24E+09	0	0.15178	0.33904	1.28E-17
Yb-166	56.7	h	EC	1.23E+07	0	0.04173	0.08676	3.90E-18
Yb-167	17.5	m	ECB+	2.37E+09	0	0.0952	0.26961	1.03E-17
Yb-169	32.026	d	EC	8.88E+05	0	0.14713	0.33015	1.28E-17
Yb-175	4.185	d	B-	6.56E+06	0	0.13077	0.0391	1.49E-18
Yb-177	1.911	h	B-	3.41E+08	0	0.43576	0.19518	6.90E-18
Yb-178	74	m	B-	5.25E+08	0	0.19251	0.03813	1.47E-18
Yb-179	8	m	B-	4.83E+09	0	0.70926	0.97429	3.68E-17
Zn-60	2.38	m	ECB+	4.80E+10	0	1.13011	1.52824	5.76E-17
Zn-61	89.1	s	ECB+	7.57E+10	0	1.8571	1.5327	5.51E-17
Zn-62	9.186	h	ECB+	2.01E+08	0	0.03264	0.44305	1.71E-17
Zn-63	38.47	m	ECB+	2.83E+09	0	0.9204	1.09669	4.12E-17
Zn-65	244.06	d	ECB+	3.00E+05	0	0.00687	0.58193	2.03E-17
Zn-69	56.4	m	B-	1.76E+09	0	0.32155	0	2.21E-22
Zn-69m	13.76	h	ITB-	1.21E+08	0	0.0226	0.41616	1.57E-17
Zn-71	2.45	m	B-	3.95E+10	0	1.04736	0.31503	1.16E-17
Zn-71m	3.96	h	B-	4.07E+08	0	0.54303	1.56064	5.83E-17
Zn-72	46.5	h	B-	3.42E+07	0	0.10214	0.15194	9.12E-18
Zr-85	7.86	m	ECB+	1.03E+10	0	1.32521	1.47181	5.60E-17
Zr-86	16.5	h	ECB+	8.09E+07	0	0.03103	0.29523	3.94E-17
Zr-87	1.68	h	ECB+	7.85E+08	0	0.82177	0.92706	3.75E-17

Nuclide	T <sub>1/2</sub> --	--	Decay	Specific Activity (TBq/kg)	Alpha (MeV/nt)	Electron (MeV/nt)	Photon (MeV/nt)	G Const (Gy m <sup>2</sup> /nt)
Zr-88	83.4	d	EC	6.52E+05	0	0.01603	0.39177	3.00E-17
Zr-89	78.41	h	ECB+	1.65E+07	0	0.10194	1.15808	5.41E-17
Zr-89m	4.161	m	ITECB+	1.86E+10	0	0.03184	0.63439	2.48E-17
Zr-93	1.53E+06	y	B-	9.21E-02	0	0.01941	0	0
Zr-95	64.032	d	B-	7.87E+05	0	0.11852	0.73212	2.72E-17
Zr-97	16.744	h	B-	7.07E+07	0	0.72121	0.87923	3.26E-17

**Table 2: Decay Chain for 100 year Progeny Ingrowth (+D)**

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
Ac-223+D	2.10m		
2	Fr-219	2.0E-2s	9.90E-01
3	At-215	1.00E-4s	9.90E-01
Ac-225+D	10.0d		
2	Fr-221	4.9m	1.00E+00
3	At-217	3.23E-2s	1.00E+00
Ag-108m+D	418y		
2	Ag-108	2.37m	8.70E-02
Ag-110m+D	249.76d		
2	Ag-110	24.6s	1.36E-02
Am-242m+D	141y		
2	Am-242	16.02h	9.96E-01
3	Np-238	2.117d	4.50E-03
Am-243+D	7.37E+3y		
2	Np-239	2.3565d	1.00E+00
Ar-42+D	32.9y		
2	K-42	12.360h	1.00E+00
At-211+D	7.214h		
2	Po-211	0.516s	5.82E-01
Bi-210m+D	3.04E+6y		
2	Tl-206	4.200m	1.00E+00
Bi-212+D	60.55m		
2	Po-212	2.99E-7s	6.41E-01
Bi-213+D	45.59m		
2	Po-213	4.2E-6s	9.79E-01
Bi-214+D	19.9m		
2	Po-214	1.643E-4s	1.00E+00
Bi-215+D	7.6m		
2	Po-215	1.781E-3s	1.00E+00
Ce-144+D	284.91d		
2	Pr-144m	7.2m	9.77E-03
3	Pr-144	17.28m	1.00E+00
Cm-247+D	1.56E+7y		
2	Pu-243	4.956h	1.00E+00
Cm-250+D	8300y		
2	Pu-246	10.84d	1.80E-01
3	Bk-250	3.212h	8.00E-02
4	Am-246m	25.0m	1.80E-01

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
Cs-137+D	30.1671y		
2	Ba-137m	2.552m	9.44E-01
Es-254+D	275.7d		
2	Bk-250	3.212h	1.00E+00
3	Fm-254	3.240h	1.74E-06
Fe-60+D	1.5E+6y		
2	Co-60m	10.467m	1.00E+00
3	Co-60	5.2713y	9.98E-01
Fr-220+D	27.4s		
2	At-216	3.00E-4s	9.97E-01
Fr-221+D	4.9m		
2	At-217	3.23E-2s	1.00E+00
Ge-68+D	270.95d		
2	Ga-68	67.71m	1.00E+00
Hf-172+D	1.87y		
2	Lu-172m	3.7m	1.00E+00
Hf-182+D	9E+6y		
2	Ta-182	114.43d	1.00E+00
Hg-193+D	3.80h		
2	Au-193m	3.9s	3.54E-02
Hg-194+D	440y		
2	Au-194	38.02h	1.00E+00
In-114m+D	49.51d		
2	In-114	71.9s	9.68E-01
Kr-76+D	14.8h		
2	Br-76m	1.31s	8.11E-03
Np-235+D	396.1d		
2	U-235m	26m	3.99E-03
Np-237+D	2.144E+6y		
2	Pa-233	26.967d	1.00E+00
Os-194+D	6.0y		
2	Ir-194	19.28h	1.00E+00
Pb-202+D	5.25E+4y		
2	Tl-202	12.23d	9.90E-01
Pt-202+D	44h		
2	Au-202	28.8s	1.00E+00
Pu-239+D	2.411E+4y		
2	U-235m	26m	9.99E-01
Pu-244+D	8.00E+7y		
2	U-240	14.1h	9.99E-01

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
3	Np-240m	7.22m	9.99E-01
4	Np-240	61.9m	1.10E-03
<b>Ra-219+D</b>	<b>10ms</b>		
2	Rn-215	2.30us	1.00E+00
<b>Ra-221+D</b>	<b>28s</b>		
2	Rn-217	5.40E-4s	1.00E+00
3	Po-213	4.2E-6s	1.00E+00
<b>Ra-223+D</b>	<b>11.43d</b>		
2	Rn-219	3.96s	1.00E+00
3	Po-215	1.781E-3s	1.00E+00
<b>Ra-224+D</b>	<b>3.66d</b>		
2	Rn-220	55.6s	1.00E+00
3	Po-216	0.145s	1.00E+00
<b>Ra-226+D</b>	<b>1600y</b>		
2	Rn-222	3.8235d	1.00E+00
3	Po-218	3.10m	1.00E+00
4	Pb-214	26.8m	1.00E+00
5	At-218	1.5s	2.00E-04
6	Bi-214	19.9m	1.00E+00
7	Rn-218	3.5E-2s	2.00E-07
8	Po-214	1.643E-4s	1.00E+00
9	Tl-210	1.30m	2.10E-04
<b>Ra-228+D</b>	<b>5.75y</b>		
2	Ac-228	6.15h	1.00E+00
<b>Re-186m+D</b>	<b>2.00E+5y</b>		
2	Re-186	3.7183d	1.00E+00
<b>Rn-219+D</b>	<b>3.96s</b>		
2	Po-215	1.781E-3s	1.00E+00
<b>Rn-222+D</b>	<b>3.8235d</b>		
2	Po-218	3.10m	1.00E+00
<b>Ru-106+D</b>	<b>373.59d</b>		
2	Rh-106	29.80s	1.00E+00
<b>Si-32+D</b>	<b>132y</b>		
2	P-32	14.263d	1.00E+00
<b>Sn-121m+D</b>	<b>43.9y</b>		
2	Sn-121	27.03h	7.76E-01
<b>Sn-126+D</b>	<b>2.30E+5y</b>		
2	Sb-126m	19.15m	1.00E+00
3	Sb-126	12.35d	1.40E-01
<b>Sr-82+D</b>	<b>25.36d</b>		

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
2	Rb-82	1.273m	1.00E+00
Sr-90+D	28.79y		
2	Y-90	64.10h	1.00E+00
Te-118+D	6.00d		
2	Sb-118	3.6m	1.00E+00
Th-229+D	7.34E+3y		
2	Ra-225	14.9d	1.00E+00
Th-232+D	1.405E10y		
2	Ra-228	5.75y	1.00E+00
3	Ac-228	6.15h	1.00E+00
Th-234+D	24.10d		
2	Pa-234m	1.17m	1.00E+00
Ti-44+D	60.0y		
2	Sc-44	3.97h	1.00E+00
U-235+D	7.04E+8y		
2	Th-231	25.52h	1.00E+00
U-238+D	4.468E+9y		
2	Th-234	24.10d	1.00E+00
3	Pa-234m	1.17m	1.00E+00
4	Pa-234	6.70h	1.60E-03
W-178+D	21.6d		
2	Ta-178	9.31m	1.00E+00



**Table 3: Decay Chain for 1000 year Progeny Ingrowth (+E)**

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
Ac-223+E	2.10m		
2	Fr-219	2.0E-2s	9.90E-01
3	At-215	1.00E-4s	9.90E-01
Ac-225+E	10.0d		
2	Fr-221	4.9m	1.00E+00
3	At-217	3.23E-2s	1.00E+00
4	Bi-213	45.59m	1.00E+00
5	Po-213	4.2E-6s	9.79E-01
6	Tl-209	2.161m	2.09E-02
Ac-227+E	21.772y		
2	Th-227	18.68d	9.86E-01
3	Fr-223	22.00m	1.38E-02
4	Ra-223	11.43d	1.00E+00
5	Rn-219	3.96s	1.00E+00
6	At-219	56s	8.28E-07
7	Bi-215	7.6m	8.03E-07
8	Po-215	1.781E-3s	1.00E+00
9	Pb-211	36.1m	1.00E+00
10	Bi-211	2.14m	1.00E+00
11	Tl-207	4.77m	9.97E-01
12	Po-211	0.516s	2.76E-03
Ag-108m+E	418y		
2	Ag-108	2.37m	8.70E-02
Ag-110m+E	249.76d		
2	Ag-110	24.6s	1.36E-02
Am-242m+E	141y		
2	Am-242	16.02h	9.96E-01
3	Np-238	2.117d	4.50E-03
4	Cm-242	162.8d	8.23E-01
Am-243+E	7.37E+3y		
2	Np-239	2.3565d	1.00E+00
Ar-42+E	32.9y		
2	K-42	12.360h	1.00E+00
At-211+E	7.214h		
2	Po-211	0.516s	5.82E-01
Ba-128+E	2.43d		
2	Cs-128	3.640m	1.00E+00
Bi-210m+E	3.04E+6y		

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
2	Tl-206	4.200m	1.00E+00
Bi-212+E	60.55m		
2	Po-212	2.99E-7s	6.41E-01
Bi-213+E	45.59m		
2	Po-213	4.2E-6s	9.79E-01
Bi-214+E	19.9m		
2	Po-214	1.643E-4s	1.00E+00
Bi-215+E	7.6m		
2	Po-215	1.781E-3s	1.00E+00
Bi-216+E	2.17m		
2	Po-216	0.145s	1.00E+00
Cd-118+E	50.3m		
2	In-118	5.0s	1.00E+00
Ce-134+E	3.16d		
2	La-134	6.45m	1.00E+00
Ce-144+E	284.91d		
2	Pr-144m	7.2m	9.77E-03
3	Pr-144	17.28m	1.00E+00
Cl-34m+E	32.00m		
2	Cl-34	1.5264s	4.46E-01
Cm-245+E	8.5E+3y		
2	Pu-241	14.35y	1.00E+00
Cm-247+E	1.56E+7y		
2	Pu-243	4.956h	1.00E+00
Cm-250+E	8300y		
2	Pu-246	10.84d	1.80E-01
3	Bk-250	3.212h	8.00E-02
4	Am-246m	25.0m	1.80E-01
5	Cf-250	13.08y	8.00E-02
Cs-137+E	30.1671y		
2	Ba-137m	2.552m	9.44E-01
Es-254+E	275.7d		
2	Bk-250	3.212h	1.00E+00
3	Fm-254	3.240h	1.74E-06
Fe-60+E	1.5E+6y		
2	Co-60m	10.467m	1.00E+00
3	Co-60	5.2713y	9.98E-01
Fr-220+E	27.4s		
2	At-216	3.00E-4s	9.97E-01
3	Ra-220	1.79E-2s	3.50E-03

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
Fr-221+E	4.9m		
2	At-217	3.23E-2s	1.00E+00
Ge-68+E	270.95d		
2	Ga-68	67.71m	1.00E+00
Hf-172+E	1.87y		
2	Lu-172m	3.7m	9.93E-01
Hf-182+E	9E+6y		
2	Ta-182	114.43d	1.00E+00
Hg-193+E	3.80h		
2	Au-193m	3.9s	3.54E-02
Hg-194+E	440y		
2	Au-194	38.02h	1.00E+00
In-114m+E	49.51d		
2	In-114	71.9s	9.68E-01
Ir-192n+E	241y		
2	Ir-192	73.827d	1.00E+00
Kr-76+E	14.8h		
2	Br-76m	1.31s	8.11E-03
Mg-28+E	20.915h		
2	Al-28	2.2414m	1.00E+00
Nd-140+E	3.37d		
2	Pr-140	3.39m	1.00E+00
Ni-66+E	54.6h		
2	Cu-66	5.120m	1.00E+00
Np-235+E	396.1d		
2	U-235m	26m	3.99E-03
Np-237+E	2.144E+6y		
2	Pa-233	26.967d	1.00E+00
Os-194+E	6.0y		
2	Ir-194	19.28h	1.00E+00
Pa-231+E	3.276E+4y		
2	Ac-227	21.772y	1.00E+00
3	Th-227	18.68d	9.86E-01
4	Fr-223	22.00m	1.38E-02
5	Ra-223	11.43d	1.00E+00
6	Rn-219	3.96s	1.00E+00
7	At-219	56s	8.28E-07
8	Bi-215	7.6m	8.03E-07
9	Po-215	1.781E-3s	1.00E+00
10	Pb-211	36.1m	1.00E+00

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
11	Bi-211	2.14m	1.00E+00
12	Tl-207	4.77m	9.97E-01
13	Po-211	0.516s	2.76E-03
Pb-202+E	5.25E+4y		
2	Tl-202	12.23d	9.90E-01
Pb-210+E	22.20y		
2	Bi-210	5.013d	1.00E+00
3	Hg-206	8.15m	1.90E-08
Pd-103+E	16.991d		
2	Rh-103m	56.114m	9.99E-01
Pt-202+E	44h		
2	Au-202	28.8s	1.00E+00
Pu-239+E	2.411E+4y		
2	U-235m	26m	9.99E-01
Pu-244+E	8.00E+7y		
2	U-240	14.1h	9.99E-01
3	Np-240m	7.22m	9.99E-01
4	Np-240	61.9m	1.10E-03
Pu-246+E	10.84d		
2	Am-246m	25.0m	1.00E+00
Ra-219+E	10ms		
2	Rn-215	2.30us	1.00E+00
Ra-220+E	1.79E-2s		
2	Rn-216	4.5E-5s	1.00E+00
3	Po-212	2.99E-7s	1.00E+00
Ra-221+E	28s		
2	Rn-217	5.40E-4s	1.00E+00
3	Po-213	4.2E-6s	1.00E+00
Ra-222+E	38.0s		
2	Rn-218	3.5E-2s	1.00E+00
3	Po-214	1.643E-4s	1.00E+00
Ra-223+E	11.43d		
2	Rn-219	3.96s	1.00E+00
3	Po-215	1.781E-3s	1.00E+00
4	Pb-211	36.1m	1.00E+00
5	Bi-211	2.14m	1.00E+00
6	Tl-207	4.77m	9.97E-01
7	Po-211	0.516s	2.76E-03
Ra-224+E	3.66d		
2	Rn-220	55.6s	1.00E+00

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
3	Po-216	0.145s	1.00E+00
Ra-226+E	1600y		
2	Rn-222	3.8235d	1.00E+00
3	Po-218	3.10m	1.00E+00
4	Pb-214	26.8m	1.00E+00
5	At-218	1.5s	2.00E-04
6	Bi-214	19.9m	1.00E+00
7	Rn-218	3.5E-2s	2.00E-07
8	Po-214	1.643E-4s	1.00E+00
9	Tl-210	1.30m	2.10E-04
Ra-228+E	5.75y		
2	Ac-228	6.15h	1.00E+00
Rb-81+E	4.576h		
2	Kr-81m	13.10s	9.57E-01
Rb-83+E	86.2d		
2	Kr-83m	1.83h	7.43E-01
Re-186m+E	2.00E+5y		
2	Re-186	3.7183d	1.00E+00
Rn-219+E	3.96s		
2	Po-215	1.781E-3s	1.00E+00
Rn-220+E	55.6s		
2	Po-216	0.145s	1.00E+00
Rn-222+E	3.8235d		
2	Po-218	3.10m	1.00E+00
Ru-103+E	39.26d		
2	Rh-103m	56.114m	9.88E-01
Ru-106+E	373.59d		
2	Rh-106	29.80s	1.00E+00
Si-32+E	132y		
2	P-32	14.263d	1.00E+00
Sn-113+E	115.09d		
2	In-113m	1.6579h	1.00E+00
Sn-121m+E	43.9y		
2	Sn-121	27.03h	7.76E-01
Sn-126+E	2.30E+5y		
2	Sb-126m	19.15m	1.00E+00
3	Sb-126	12.35d	1.40E-01
Sr-82+E	25.36d		
2	Rb-82	1.273m	1.00E+00
Sr-90+E	28.79y		

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
2	Y-90	64.10h	1.00E+00
Te-118+E	6.00d		
2	Sb-118	3.6m	1.00E+00
Te-129m+E	33.6d		
2	Te-129	69.6m	6.30E-01
Th-229+E	7.34E+3y		
2	Ra-225	14.9d	1.00E+00
3	Ac-225	10.0d	1.00E+00
4	Fr-221	4.9m	1.00E+00
5	At-217	3.23E-2s	1.00E+00
6	Bi-213	45.59m	1.00E+00
7	Po-213	4.2E-6s	9.79E-01
8	Tl-209	2.161m	2.09E-02
9	Pb-209	3.253h	1.00E+00
Th-232+E	1.405E10y		
2	Ra-228	5.75y	1.00E+00
3	Ac-228	6.15h	1.00E+00
4	Th-228	1.9116y	1.00E+00
5	Ra-224	3.66d	1.00E+00
6	Rn-220	55.6s	1.00E+00
7	Po-216	0.145s	1.00E+00
8	Pb-212	10.64h	1.00E+00
9	Bi-212	60.55m	1.00E+00
10	Po-212	2.99E-7s	6.41E-01
11	Tl-208	3.053m	3.59E-01
Th-234+E	24.10d		
2	Pa-234m	1.17m	9.97E-01
Ti-44+E	60.0y		
2	Sc-44	3.97h	1.00E+00
U-228+E	9.1m		
2	Th-224	1.05s	9.75E-01
3	Ra-220	1.79E-2s	9.75E-01
4	Rn-216	4.5E-5s	9.75E-01
5	Po-212	2.99E-7s	9.75E-01
U-230+E	20.8d		
2	Th-226	30.57m	1.00E+00
3	Ra-222	38.0s	1.00E+00
4	Rn-218	3.5E-2s	1.00E+00
5	Po-214	1.643E-4s	1.00E+00
U-235+E	7.04E+8y		

Parent Radioisotope	Parent Half-Life/ Progeny Radioisotope	Progeny Half-Life	Emitted Energy
2	Th-231	25.52h	1.00E+00
U-238+E	4.468E+9y		
2	Th-234	24.10d	1.00E+00
3	Pa-234m	1.17m	9.97E-01
4	Pa-234	6.70h	4.16E-03
W-178+E	21.6d		
2	Ta-178	9.31m	1.00E+00
Xe-122+E	20.1h		
2	I-122	3.63m	1.00E+00
Zr-93+E	1.53E+6y		
2	Nb-93m	16.13y	9.75E-01