

Chapter 2.7

Class 7 – Radioactive material

Note: For class 7, the type of packaging may have a decisive effect on classification.

2.7.1 Definitions

2.7.1.1 *Radioactive material* means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 2.7.2.2.1 to 2.7.2.2.6.

2.7.1.2 Contamination

Contamination means the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm² for beta and gamma emitters and low-toxicity alpha emitters, or 0.04 Bq/cm² for all other alpha emitters.

Non-fixed contamination means contamination that can be removed from a surface during routine conditions of transport.

Fixed contamination means contamination other than non-fixed contamination.

2.7.1.3 Definitions of specific terms

A_1 and A_2

A_1 means the activity value of special form radioactive material which is listed in the table in 2.7.2.2.1 or derived in 2.7.2.2.2 and is used to determine the activity limits for the provisions of this Code.

A_2 means the activity value of radioactive material, other than special form radioactive material, which is listed in the table in 2.7.2.2.1 or derived in 2.7.2.2.2 and is used to determine the activity limits for the provisions of this Code.

Fissile nuclides means uranium-233, uranium-235, plutonium-239 and plutonium-241. *Fissile material* means a material containing any of the fissile nuclides. Excluded from the definition of fissile material are the following:

- .1 natural uranium or depleted uranium which is unirradiated;
- .2 natural uranium or depleted uranium which has been irradiated in thermal reactors only;
- .3 material with fissile nuclides less than a total of 0.25 g;
- .4 any combination of .1, .2 and/or .3.

These exclusions are only valid if there is no other material with fissile nuclides in the package or in the consignment if shipped unpackaged.

Low dispersible radioactive material means either a solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form.

Low specific activity (LSA) material means radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material shall not be considered in determining the estimated average specific activity.

Low toxicity alpha emitters are: natural uranium; depleted uranium; natural thorium; uranium-235 or uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates; or alpha emitters with a half-life of less than 10 days.

Specific activity of a radionuclide means the activity per unit mass of that nuclide. The specific activity of a material shall mean the activity per unit mass of the material in which the radionuclides are essentially uniformly distributed.

Special form radioactive material means either:

- .1 an indispersible solid radioactive material; or
- .2 a sealed capsule containing radioactive material.

Surface contaminated object (SCO) means a solid object which is not itself radioactive but which has radioactive material distributed on its surface.

Unirradiated thorium means thorium containing not more than 10^{-7} g of uranium-233 per gram of thorium-232.

Unirradiated uranium means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235 and not more than 5×10^{-3} g of uranium-236 per gram of uranium-235.

Uranium – natural, depleted, enriched means the following:

Natural uranium means uranium (which may be chemically separated) containing the naturally occurring distribution of uranium isotopes (approximately 99.28% uranium-238, and 0.72% uranium-235 by mass).

Depleted uranium means uranium containing a lesser mass percentage of uranium-235 than in natural uranium.

Enriched uranium means uranium containing a greater mass percentage of uranium-235 than 0.72%.

In all cases, a very small mass percentage of uranium-234 is present.

2.7.2 Classification

2.7.2.1 General provisions

2.7.2.1.1 Radioactive material shall be assigned to one of the UN numbers specified in table 2.7.2.1.1, in accordance with 2.7.2.4 and 2.7.2.5, taking into account the material characteristics determined in 2.7.2.3.

Table 2.7.2.1.1 – Assignment of UN numbers

UN numbers	Proper shipping name ^a and description
Excepted packages (1.5.1.5)	
2908	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – EMPTY PACKAGING
2909	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM
2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – LIMITED QUANTITY OF MATERIAL
2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – INSTRUMENTS or ARTICLES
3507	URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE less than 0.1 kg per package, non-fissile or fissile-excepted ^{b, c}
Low specific activity radioactive material (2.7.2.3.1)	
2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile-excepted ^b
3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), non-fissile or fissile-excepted ^b
3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), non-fissile or fissile-excepted ^b
3324	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE
3325	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), FISSILE
Surface contaminated objects (2.7.2.3.2)	
△ 2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I, SCO-II or SCO-III), non-fissile or fissile-excepted ^b
3326	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), FISSILE
Type A packages (2.7.2.4.4)	
2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non-fissile or fissile-excepted ^b
3327	RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE, non-special form
3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non-fissile or fissile-excepted ^b
3333	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE
Type B(U) package (2.7.2.4.6)	
2916	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, non-fissile or fissile-excepted ^b
3328	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE

UN numbers	Proper shipping name ^a and description
Type B(M) package (2.7.2.4.6)	
2917	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, non-fissile or fissile-excepted ^b
3329	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, FISSILE
Type C package (2.7.2.4.6)	
3323	RADIOACTIVE MATERIAL, TYPE C PACKAGE, non-fissile or fissile-excepted ^b
3330	RADIOACTIVE MATERIAL, TYPE C PACKAGE, FISSILE
Special arrangement (2.7.2.5)	
2919	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, non-fissile or fissile-excepted ^b
3331	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE
Uranium hexafluoride (2.7.2.4.5)	
2977	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE
2978	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted ^b
3507	URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE less than 0.1 kg per package, non-fissile or fissile-excepted ^{b, c}

^a The proper shipping name is found in the column “Proper shipping name and description” and is restricted to that part shown in capital letters. In the cases of UN Nos. 2909, 2911, 2913 and 3326, where alternative proper shipping names are separated by the word “or”, only the relevant proper shipping name shall be used.

^b The term “fissile-excepted” refers only to material excepted under 2.7.2.3.5.

^c For UN 3507, see also special provision 369 in chapter 3.3.

2.7.2.2 Determination of activity level

2.7.2.2.1 The following basic values for individual radionuclides are given in table 2.7.2.2.1:

- .1 A_1 and A_2 in TBq;
- .2 Activity concentration limits for exempt material in Bq/g; and
- .3 Activity limits for exempt consignments in Bq.

Table 2.7.2.2.1 – Basic radionuclides values for individual radionuclides

Radionuclide (atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Actinium (89)				
Ac-225 (a)	8×10^{-1}	6×10^{-3}	1×10^1	1×10^4
Ac-227 (a)	9×10^{-1}	9×10^{-5}	1×10^{-1}	1×10^3
Ac-228	6×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Silver (47)				
Ag-105	2×10^0	2×10^0	1×10^2	1×10^6
Ag-108m (a)	7×10^{-1}	7×10^{-1}	1×10^1 (b)	1×10^6 (b)
Ag-110m (a)	4×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Ag-111	2×10^0	6×10^{-1}	1×10^3	1×10^6
Aluminium (13)				
Al-26	1×10^{-1}	1×10^{-1}	1×10^1	1×10^5
Americium (95)				
Am-241	1×10^1	1×10^{-3}	1×10^0	1×10^4
Am-242m (a)	1×10^1	1×10^{-3}	1×10^0 (b)	1×10^4 (b)
Am-243 (a)	5×10^0	1×10^{-3}	1×10^0 (b)	1×10^3 (b)
Argon (18)				
Ar-37	4×10^1	4×10^1	1×10^6	1×10^8
Ar-39	4×10^1	2×10^1	1×10^7	1×10^4
Ar-41	3×10^{-1}	3×10^{-1}	1×10^2	1×10^9

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Arsenic (33)				
As-72	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
As-73	4×10^1	4×10^1	1×10^3	1×10^7
As-74	1×10^0	9×10^{-1}	1×10^1	1×10^6
As-76	3×10^{-1}	3×10^{-1}	1×10^2	1×10^5
As-77	2×10^1	7×10^{-1}	1×10^3	1×10^6
Astatine (85)				
At-211 (a)	2×10^1	5×10^{-1}	1×10^3	1×10^7
Gold (79)				
Au-193	7×10^0	2×10^0	1×10^2	1×10^7
Au-194	1×10^0	1×10^0	1×10^1	1×10^6
Au-195	1×10^1	6×10^0	1×10^2	1×10^7
Au-198	1×10^0	6×10^{-1}	1×10^2	1×10^6
Au-199	1×10^1	6×10^{-1}	1×10^2	1×10^6
Barium (56)				
Ba-131 (a)	2×10^0	2×10^0	1×10^2	1×10^6
Ba-133	3×10^0	3×10^0	1×10^2	1×10^6
Ba-133m	2×10^1	6×10^{-1}	1×10^2	1×10^6
Ba-135m	2×10^1	6×10^{-1}	1×10^2	1×10^6
Ba-140 (a)	5×10^{-1}	3×10^{-1}	1×10^1 (b)	1×10^5 (b)
Beryllium (4)				
Be-7	2×10^1	2×10^1	1×10^3	1×10^7
Be-10	4×10^1	6×10^{-1}	1×10^4	1×10^6
Bismuth (83)				
Bi-205	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Bi-206	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Bi-207	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Bi-210	1×10^0	6×10^{-1}	1×10^3	1×10^6
Bi-210m (a)	6×10^{-1}	2×10^{-2}	1×10^1	1×10^5
Bi-212 (a)	7×10^{-1}	6×10^{-1}	1×10^1 (b)	1×10^5 (b)
Berkelium (97)				
Bk-247	8×10^0	8×10^{-4}	1×10^0	1×10^4
Bk-249 (a)	4×10^1	3×10^{-1}	1×10^3	1×10^6
Bromine (35)				
Br-76	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Br-77	3×10^0	3×10^0	1×10^2	1×10^6
Br-82	4×10^{-1}	4×10^{-1}	1×10^1	1×10^6
Carbon (6)				
C-11	1×10^0	6×10^{-1}	1×10^1	1×10^6
C-14	4×10^1	3×10^0	1×10^4	1×10^7
Calcium (20)				
Ca-41	Unlimited	Unlimited	1×10^5	1×10^7
Ca-45	4×10^1	1×10^0	1×10^4	1×10^7
Ca-47 (a)	3×10^0	3×10^{-1}	1×10^1	1×10^6
Cadmium (48)				
Cd-109	3×10^1	2×10^0	1×10^4	1×10^6
Cd-113m	4×10^1	5×10^{-1}	1×10^3	1×10^6
Cd-115 (a)	3×10^0	4×10^{-1}	1×10^2	1×10^6
Cd-115m	5×10^{-1}	5×10^{-1}	1×10^3	1×10^6
Cerium (58)				
Ce-139	7×10^0	2×10^0	1×10^2	1×10^6
Ce-141	2×10^1	6×10^{-1}	1×10^2	1×10^7
Ce-143	9×10^{-1}	6×10^{-1}	1×10^2	1×10^6
Ce-144 (a)	2×10^{-1}	2×10^{-1}	1×10^2 (b)	1×10^5 (b)
Californium (98)				
Cf-248	4×10^1	6×10^{-3}	1×10^1	1×10^4
Cf-249	3×10^0	8×10^{-4}	1×10^0	1×10^3
Cf-250	2×10^1	2×10^{-3}	1×10^1	1×10^4

Radionuclide (atomic number)	A_1 (TBq)	A_2 (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Cf-251	7×10^0	7×10^{-4}	1×10^0	1×10^3
Cf-252	1×10^{-1}	3×10^{-3}	1×10^1	1×10^4
Cf-253 (a)	4×10^1	4×10^{-2}	1×10^2	1×10^5
Cf-254	1×10^{-3}	1×10^{-3}	1×10^0	1×10^3
Chlorine (17)				
Cl-36	1×10^1	6×10^{-1}	1×10^4	1×10^6
Cl-38	2×10^{-1}	2×10^{-1}	1×10^1	1×10^5
Curium (96)				
Cm-240	4×10^1	2×10^{-2}	1×10^2	1×10^5
Cm-241	2×10^0	1×10^0	1×10^2	1×10^6
Cm-242	4×10^1	1×10^{-2}	1×10^2	1×10^5
Cm-243	9×10^0	1×10^{-3}	1×10^0	1×10^4
Cm-244	2×10^1	2×10^{-3}	1×10^1	1×10^4
Cm-245	9×10^0	9×10^{-4}	1×10^0	1×10^3
Cm-246	9×10^0	9×10^{-4}	1×10^0	1×10^3
Cm-247 (a)	3×10^0	1×10^{-3}	1×10^0	1×10^4
Cm-248	2×10^{-2}	3×10^{-4}	1×10^0	1×10^3
Cobalt (27)				
Co-55	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Co-56	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Co-57	1×10^1	1×10^1	1×10^2	1×10^6
Co-58	1×10^0	1×10^0	1×10^1	1×10^6
Co-58m	4×10^1	4×10^1	1×10^4	1×10^7
Co-60	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Chromium (24)				
Cr-51	3×10^1	3×10^1	1×10^3	1×10^7
Caesium (55)				
Cs-129	4×10^0	4×10^0	1×10^2	1×10^5
Cs-131	3×10^1	3×10^1	1×10^3	1×10^6
Cs-132	1×10^0	1×10^0	1×10^1	1×10^5
Cs-134	7×10^{-1}	7×10^{-1}	1×10^1	1×10^4
Cs-134m	4×10^1	6×10^{-1}	1×10^3	1×10^5
Cs-135	4×10^1	1×10^0	1×10^4	1×10^7
Cs-136	5×10^{-1}	5×10^{-1}	1×10^1	1×10^5
Cs-137 (a)	2×10^0	6×10^{-1}	$1 \times 10^1 (b)$	$1 \times 10^4 (b)$
Copper (29)				
Cu-64	6×10^0	1×10^0	1×10^2	1×10^6
Cu-67	1×10^1	7×10^{-1}	1×10^2	1×10^6
Dysprosium (66)				
Dy-159	2×10^1	2×10^1	1×10^3	1×10^7
Dy-165	9×10^{-1}	6×10^{-1}	1×10^3	1×10^6
Dy-166 (a)	9×10^{-1}	3×10^{-1}	1×10^3	1×10^6
Erbium (68)				
Er-169	4×10^1	1×10^0	1×10^4	1×10^7
Er-171	8×10^{-1}	5×10^{-1}	1×10^2	1×10^6
Europium (63)				
Eu-147	2×10^0	2×10^0	1×10^2	1×10^6
Eu-148	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Eu-149	2×10^1	2×10^1	1×10^2	1×10^7
Eu-150 (short-lived)	2×10^0	7×10^{-1}	1×10^3	1×10^6
Eu-150 (long-lived)	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Eu-152	1×10^0	1×10^0	1×10^1	1×10^6
Eu-152m	8×10^{-1}	8×10^{-1}	1×10^2	1×10^6
Eu-154	9×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Eu-155	2×10^1	3×10^0	1×10^2	1×10^7
Eu-156	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Fluorine (9)				
F-18	1×10^0	6×10^{-1}	1×10^1	1×10^6

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Iron (26)				
Fe-52 (a)	3×10^{-1}	3×10^{-1}	1×10^1	1×10^6
Fe-55	4×10^1	4×10^1	1×10^4	1×10^6
Fe-59	9×10^{-1}	9×10^{-1}	1×10^1	1×10^6
Fe-60 (a)	4×10^1	2×10^{-1}	1×10^2	1×10^5
Gallium (31)				
Ga-67	7×10^0	3×10^0	1×10^2	1×10^6
Ga-68	5×10^{-1}	5×10^{-1}	1×10^1	1×10^5
Ga-72	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
Gadolinium (64)				
Gd-146 (a)	5×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Gd-148	2×10^1	2×10^{-3}	1×10^1	1×10^4
Gd-153	1×10^1	9×10^0	1×10^2	1×10^7
Gd-159	3×10^0	6×10^{-1}	1×10^3	1×10^6
Germanium (32)				
Ge-68 (a)	5×10^{-1}	5×10^{-1}	1×10^1	1×10^5
Ge-69	1×10^0	1×10^0	1×10^1	1×10^6
Ge-71	4×10^1	4×10^1	1×10^4	1×10^8
Ge-77	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
Hafnium (72)				
Hf-172 (a)	6×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Hf-175	3×10^0	3×10^0	1×10^2	1×10^6
Hf-181	2×10^0	5×10^{-1}	1×10^1	1×10^6
Hf-182	Unlimited	Unlimited	1×10^2	1×10^6
Mercury (80)				
Hg-194 (a)	1×10^0	1×10^0	1×10^1	1×10^6
Hg-195m (a)	3×10^0	7×10^{-1}	1×10^2	1×10^6
Hg-197	2×10^1	1×10^1	1×10^2	1×10^7
Hg-197m	1×10^1	4×10^{-1}	1×10^2	1×10^6
Hg-203	5×10^0	1×10^0	1×10^2	1×10^5
Holmium (67)				
Ho-166	4×10^{-1}	4×10^{-1}	1×10^3	1×10^5
Ho-166m	6×10^{-1}	5×10^{-1}	1×10^1	1×10^6
Iodine (53)				
I-123	6×10^0	3×10^0	1×10^2	1×10^7
I-124	1×10^0	1×10^0	1×10^1	1×10^6
I-125	2×10^1	3×10^0	1×10^3	1×10^6
I-126	2×10^0	1×10^0	1×10^2	1×10^6
I-129	Unlimited	Unlimited	1×10^2	1×10^5
I-131	3×10^0	7×10^{-1}	1×10^2	1×10^6
I-132	4×10^{-1}	4×10^{-1}	1×10^1	1×10^5
I-133	7×10^{-1}	6×10^{-1}	1×10^1	1×10^6
I-134	3×10^{-1}	3×10^{-1}	1×10^1	1×10^5
I-135 (a)	6×10^{-1}	6×10^{-1}	1×10^1	1×10^6
Indium (49)				
In-111	3×10^0	3×10^0	1×10^2	1×10^6
In-113m	4×10^0	2×10^0	1×10^2	1×10^6
In-114m (a)	1×10^1	5×10^{-1}	1×10^2	1×10^6
In-115m	7×10^0	1×10^0	1×10^2	1×10^6
Iridium (77)				
Ir-189 (a)	1×10^1	1×10^1	1×10^2	1×10^7
Ir-190	7×10^{-1}	7×10^{-1}	1×10^1	1×10^6
Ir-192	1×10^0 (c)	6×10^{-1}	1×10^1	1×10^4
Ir-193m	4×10^1	4×10^0	1×10^4	1×10^7
Ir-194	3×10^{-1}	3×10^{-1}	1×10^2	1×10^5
Potassium (19)				
K-40	9×10^{-1}	9×10^{-1}	1×10^2	1×10^6
K-42	2×10^{-1}	2×10^{-1}	1×10^2	1×10^6
K-43	7×10^{-1}	6×10^{-1}	1×10^1	1×10^6

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Krypton (36)				
Kr-79	4 × 10 ⁰	2 × 10 ⁰	1 × 10 ³	1 × 10 ⁵
Kr-81	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁷
Kr-85	1 × 10 ¹	1 × 10 ¹	1 × 10 ⁵	1 × 10 ⁴
Kr-85m	8 × 10 ⁰	3 × 10 ⁰	1 × 10 ³	1 × 10 ¹⁰
Kr-87	2 × 10 ⁻¹	2 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁹
Lanthanum (57)				
La-137	3 × 10 ¹	6 × 10 ⁰	1 × 10 ³	1 × 10 ⁷
La-140	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Lutetium (71)				
Lu-172	6 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Lu-173	8 × 10 ⁰	8 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Lu-174	9 × 10 ⁰	9 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Lu-174m	2 × 10 ¹	1 × 10 ¹	1 × 10 ²	1 × 10 ⁷
Lu-177	3 × 10 ¹	7 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Magnesium (12)				
Mg-28 (a)	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Manganese (25)				
Mn-52	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Mn-53	Unlimited	Unlimited	1 × 10 ⁴	1 × 10 ⁹
Mn-54	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Mn-56	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Molybdenum (42)				
Mo-93	4 × 10 ¹	2 × 10 ¹	1 × 10 ³	1 × 10 ⁸
Mo-99 (a)	1 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Nitrogen (7)				
N-13	9 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁹
Sodium (11)				
Na-22	5 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Na-24	2 × 10 ⁻¹	2 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Niobium (41)				
Nb-93m	4 × 10 ¹	3 × 10 ¹	1 × 10 ⁴	1 × 10 ⁷
Nb-94	7 × 10 ⁻¹	7 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Nb-95	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Nb-97	9 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Neodymium (60)				
Nd-147	6 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Nd-149	6 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Nickel (28)				
Ni-57	6 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Ni-59	Unlimited	Unlimited	1 × 10 ⁴	1 × 10 ⁸
Ni-63	4 × 10 ¹	3 × 10 ¹	1 × 10 ⁵	1 × 10 ⁸
Ni-65	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Neptunium (93)				
Np-235	4 × 10 ¹	4 × 10 ¹	1 × 10 ³	1 × 10 ⁷
Np-236 (short-lived)	2 × 10 ¹	2 × 10 ⁰	1 × 10 ³	1 × 10 ⁷
Np-236 (long-lived)	9 × 10 ⁰	2 × 10 ⁻²	1 × 10 ²	1 × 10 ⁵
Np-237	2 × 10 ¹	2 × 10 ⁻³	1 × 10 ⁰ (b)	1 × 10 ³ (b)
Np-239	7 × 10 ⁰	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁷
Osmium (76)				
Os-185	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Os-191	1 × 10 ¹	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Os-191m	4 × 10 ¹	3 × 10 ¹	1 × 10 ³	1 × 10 ⁷
Os-193	2 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Os-194 (a)	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Phosphorus (15)				
P-32	5 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁵
P-33	4 × 10 ¹	1 × 10 ⁰	1 × 10 ⁵	1 × 10 ⁸

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Protactinium (91)				
Pa-230 (a)	2 × 10 ⁰	7 × 10 ⁻²	1 × 10 ¹	1 × 10 ⁶
Pa-231	4 × 10 ⁰	4 × 10 ⁻⁴	1 × 10 ⁰	1 × 10 ³
Pa-233	5 × 10 ⁰	7 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁷
Lead (82)				
Pb-201	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Pb-202	4 × 10 ¹	2 × 10 ¹	1 × 10 ³	1 × 10 ⁶
Pb-203	4 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Pb-205	Unlimited	Unlimited	1 × 10 ⁴	1 × 10 ⁷
Pb-210 (a)	1 × 10 ⁰	5 × 10 ⁻²	1 × 10 ¹ (b)	1 × 10 ⁴ (b)
Pb-212 (a)	7 × 10 ⁻¹	2 × 10 ⁻¹	1 × 10 ¹ (b)	1 × 10 ⁵ (b)
Palladium (46)				
Pd-103 (a)	4 × 10 ¹	4 × 10 ¹	1 × 10 ³	1 × 10 ⁸
Pd-107	Unlimited	Unlimited	1 × 10 ⁵	1 × 10 ⁸
Pd-109	2 × 10 ⁰	5 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Promethium (61)				
Pm-143	3 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Pm-144	7 × 10 ⁻¹	7 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Pm-145	3 × 10 ¹	1 × 10 ¹	1 × 10 ³	1 × 10 ⁷
Pm-147	4 × 10 ¹	2 × 10 ⁰	1 × 10 ⁴	1 × 10 ⁷
Pm-148m (a)	8 × 10 ⁻¹	7 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Pm-149	2 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Pm-151	2 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Polonium (84)				
Po-210	4 × 10 ¹	2 × 10 ⁻²	1 × 10 ¹	1 × 10 ⁴
Praseodymium (59)				
Pr-142	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Pr-143	3 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ⁴	1 × 10 ⁶
Platinum (78)				
Pt-188 (a)	1 × 10 ⁰	8 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Pt-191	4 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Pt-193	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁷
Pt-193m	4 × 10 ¹	5 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Pt-195m	1 × 10 ¹	5 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Pt-197	2 × 10 ¹	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Pt-197m	1 × 10 ¹	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Plutonium (94)				
Pu-236	3 × 10 ¹	3 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
Pu-237	2 × 10 ¹	2 × 10 ¹	1 × 10 ³	1 × 10 ⁷
Pu-238	1 × 10 ¹	1 × 10 ⁻³	1 × 10 ⁰	1 × 10 ⁴
Pu-239	1 × 10 ¹	1 × 10 ⁻³	1 × 10 ⁰	1 × 10 ⁴
Pu-240	1 × 10 ¹	1 × 10 ⁻³	1 × 10 ⁰	1 × 10 ³
Pu-241 (a)	4 × 10 ¹	6 × 10 ⁻²	1 × 10 ²	1 × 10 ⁵
Pu-242	1 × 10 ¹	1 × 10 ⁻³	1 × 10 ⁰	1 × 10 ⁴
Pu-244 (a)	4 × 10 ⁻¹	1 × 10 ⁻³	1 × 10 ⁰	1 × 10 ⁴
Radium (88)				
Ra-223 (a)	4 × 10 ⁻¹	7 × 10 ⁻³	1 × 10 ² (b)	1 × 10 ⁵ (b)
Ra-224 (a)	4 × 10 ⁻¹	2 × 10 ⁻²	1 × 10 ¹ (b)	1 × 10 ⁵ (b)
Ra-225 (a)	2 × 10 ⁻¹	4 × 10 ⁻³	1 × 10 ²	1 × 10 ⁵
Ra-226 (a)	2 × 10 ⁻¹	3 × 10 ⁻³	1 × 10 ¹ (b)	1 × 10 ⁴ (b)
Ra-228 (a)	6 × 10 ⁻¹	2 × 10 ⁻²	1 × 10 ¹ (b)	1 × 10 ⁵ (b)
Rubidium (37)				
Rb-81	2 × 10 ⁰	8 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Rb-83 (a)	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Rb-84	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Rb-86	5 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Rb-87	Unlimited	Unlimited	1 × 10 ⁴	1 × 10 ⁷
Rb (nat)	Unlimited	Unlimited	1 × 10 ⁴	1 × 10 ⁷

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Rhenium (75)				
Re-184	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Re-184m	3 × 10 ⁰	1 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Re-186	2 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Re-187	Unlimited	Unlimited	1 × 10 ⁶	1 × 10 ⁹
Re-188	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Re-189 (a)	3 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Re (nat)	Unlimited	Unlimited	1 × 10 ⁶	1 × 10 ⁹
Rhodium (45)				
Rh-99	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Rh-101	4 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Rh-102	5 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Rh-102m	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Rh-103m	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁸
Rh-105	1 × 10 ¹	8 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁷
Radon (86)				
Rn-222 (a)	3 × 10 ⁻¹	4 × 10 ⁻³	1 × 10 ¹ (b)	1 × 10 ⁸ (b)
Ruthenium (44)				
Ru-97	5 × 10 ⁰	5 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Ru-103 (a)	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Ru-105	1 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Ru-106 (a)	2 × 10 ⁻¹	2 × 10 ⁻¹	1 × 10 ² (b)	1 × 10 ⁵ (b)
Sulphur (16)				
S-35	4 × 10 ¹	3 × 10 ⁰	1 × 10 ⁵	1 × 10 ⁸
Antimony (51)				
Sb-122	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁴
Sb-124	6 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Sb-125	2 × 10 ⁰	1 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Sb-126	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Scandium (21)				
Sc-44	5 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Sc-46	5 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Sc-47	1 × 10 ¹	7 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Sc-48	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Selenium (34)				
Se-75	3 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Se-79	4 × 10 ¹	2 × 10 ⁰	1 × 10 ⁴	1 × 10 ⁷
Silicon (14)				
Si-31	6 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Si-32	4 × 10 ¹	5 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Samarium (62)				
Sm-145	1 × 10 ¹	1 × 10 ¹	1 × 10 ²	1 × 10 ⁷
Sm-147	Unlimited	Unlimited	1 × 10 ¹	1 × 10 ⁴
Sm-151	4 × 10 ¹	1 × 10 ¹	1 × 10 ⁴	1 × 10 ⁸
Sm-153	9 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Tin (50)				
Sn-113 (a)	4 × 10 ⁰	2 × 10 ⁰	1 × 10 ³	1 × 10 ⁷
Sn-117m	7 × 10 ⁰	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Sn-119m	4 × 10 ¹	3 × 10 ¹	1 × 10 ³	1 × 10 ⁷
Sn-121m (a)	4 × 10 ¹	9 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Sn-123	8 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Sn-125	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Sn-126 (a)	6 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Strontium (38)				
Sr-82 (a)	2 × 10 ⁻¹	2 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Sr-83	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Sr-85	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Sr-85m	5 × 10 ⁰	5 × 10 ⁰	1 × 10 ²	1 × 10 ⁷

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Sr-87m	3 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Sr-89	6 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Sr-90 (a)	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ² (b)	1 × 10 ⁴ (b)
Sr-91 (a)	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Sr-92 (a)	1 × 10 ⁰	3 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Tritium (1)				
T (H-3)	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁶	1 × 10 ⁹
Tantalum (73)				
Ta-178 (long-lived)	1 × 10 ⁰	8 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Ta-179	3 × 10 ¹	3 × 10 ¹	1 × 10 ³	1 × 10 ⁷
Ta-182	9 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁴
Terbium (65)				
Tb-149	8 × 10 ⁻¹	8 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Tb-157	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁷
Tb-158	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Tb-160	1 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Tb-161	3 × 10 ¹	7 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Technetium (43)				
Tc-95m (a)	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Tc-96	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Tc-96m (a)	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Tc-97	Unlimited	Unlimited	1 × 10 ³	1 × 10 ⁸
Tc-97m	4 × 10 ¹	1 × 10 ⁰	1 × 10 ³	1 × 10 ⁷
Tc-98	8 × 10 ⁻¹	7 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Tc-99	4 × 10 ¹	9 × 10 ⁻¹	1 × 10 ⁴	1 × 10 ⁷
Tc-99m	1 × 10 ¹	4 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Tellurium (52)				
Te-121	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Te-121m	5 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Te-123m	8 × 10 ⁰	1 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Te-125m	2 × 10 ¹	9 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Te-127	2 × 10 ¹	7 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Te-127m (a)	2 × 10 ¹	5 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Te-129	7 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Te-129m (a)	8 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Te-131m (a)	7 × 10 ⁻¹	5 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Te-132 (a)	5 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁷
Thorium (90)				
Th-227	1 × 10 ¹	5 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
Th-228 (a)	5 × 10 ⁻¹	1 × 10 ⁻³	1 × 10 ⁰ (b)	1 × 10 ⁴ (b)
Th-229	5 × 10 ⁰	5 × 10 ⁻⁴	1 × 10 ⁰ (b)	1 × 10 ³ (b)
Th-230	1 × 10 ¹	1 × 10 ⁻³	1 × 10 ⁰	1 × 10 ⁴
Th-231	4 × 10 ¹	2 × 10 ⁻²	1 × 10 ³	1 × 10 ⁷
Th-232	Unlimited	Unlimited	1 × 10 ¹	1 × 10 ⁴
Th-234 (a)	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ³ (b)	1 × 10 ⁵ (b)
Th (nat)	Unlimited	Unlimited	1 × 10 ⁰ (b)	1 × 10 ³ (b)
Titanium (22)				
Ti-44 (a)	5 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
Thallium (81)				
Tl-200	9 × 10 ⁻¹	9 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Tl-201	1 × 10 ¹	4 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Tl-202	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Tl-204	1 × 10 ¹	7 × 10 ⁻¹	1 × 10 ⁴	1 × 10 ⁴
Thulium (69)				
Tm-167	7 × 10 ⁰	8 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Tm-170	3 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Tm-171	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁸

Radionuclide (atomic number)	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for an exempt consignment (Bq)
Uranium (92)				
U-230 (fast lung absorption) (a) (d)	4 × 10 ¹	1 × 10 ⁻¹	1 × 10 ¹ (b)	1 × 10 ⁵ (b)
U-230 (medium lung absorption) (a) (e)	4 × 10 ¹	4 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
U-230 (slow lung absorption) (a) (f)	3 × 10 ¹	3 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
U-232 (fast lung absorption) (d)	4 × 10 ¹	1 × 10 ⁻²	1 × 10 ⁰ (b)	1 × 10 ³ (b)
U-232 (medium lung absorption) (e)	4 × 10 ¹	7 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
U-232 (slow lung absorption) (f)	1 × 10 ¹	1 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
U-233 (fast lung absorption) (d)	4 × 10 ¹	9 × 10 ⁻²	1 × 10 ¹	1 × 10 ⁴
U-233 (medium lung absorption) (e)	4 × 10 ¹	2 × 10 ⁻²	1 × 10 ²	1 × 10 ⁵
U-233 (slow lung absorption) (f)	4 × 10 ¹	6 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁵
U-234 (fast lung absorption) (d)	4 × 10 ¹	9 × 10 ⁻²	1 × 10 ¹	1 × 10 ⁴
U-234 (medium lung absorption) (e)	4 × 10 ¹	2 × 10 ⁻²	1 × 10 ²	1 × 10 ⁵
U-234 (slow lung absorption) (f)	4 × 10 ¹	6 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁵
U-235 (all lung absorption types) (a) (d) (e) (f)	Unlimited	Unlimited	1 × 10 ¹ (b)	1 × 10 ⁴ (b)
U-236 (fast lung absorption) (d)	Unlimited	Unlimited	1 × 10 ¹	1 × 10 ⁴
U-236 (medium lung absorption) (e)	4 × 10 ¹	2 × 10 ⁻²	1 × 10 ²	1 × 10 ⁵
U-236 (slow lung absorption) (f)	4 × 10 ¹	6 × 10 ⁻³	1 × 10 ¹	1 × 10 ⁴
U-238 (all lung absorption types) (d) (e) (f)	Unlimited	Unlimited	1 × 10 ¹ (b)	1 × 10 ⁴ (b)
U (nat)	Unlimited	Unlimited	1 × 10 ⁰ (b)	1 × 10 ³ (b)
U (enriched to 20% or less) (g)	Unlimited	Unlimited	1 × 10 ⁰	1 × 10 ³
U (dep)	Unlimited	Unlimited	1 × 10 ⁰	1 × 10 ³
Vanadium (23)				
V-48	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁵
V-49	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁷
Tungsten (74)				
W-178 (a)	9 × 10 ⁰	5 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
W-181	3 × 10 ¹	3 × 10 ¹	1 × 10 ³	1 × 10 ⁷
W-185	4 × 10 ¹	8 × 10 ⁻¹	1 × 10 ⁴	1 × 10 ⁷
W-187	2 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
W-188 (a)	4 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Xenon (54)				
Xe-122 (a)	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁹
Xe-123	2 × 10 ⁰	7 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁹
Xe-127	4 × 10 ⁰	2 × 10 ⁰	1 × 10 ³	1 × 10 ⁵
Xe-131m	4 × 10 ¹	4 × 10 ¹	1 × 10 ⁴	1 × 10 ⁴
Xe-133	2 × 10 ¹	1 × 10 ¹	1 × 10 ³	1 × 10 ⁴
Xe-135	3 × 10 ⁰	2 × 10 ⁰	1 × 10 ³	1 × 10 ¹⁰
Yttrium (39)				
Y-87 (a)	1 × 10 ⁰	1 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Y-88	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Y-90	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁵
Y-91	6 × 10 ⁻¹	6 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁶
Y-91m	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Y-92	2 × 10 ⁻¹	2 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Y-93	3 × 10 ⁻¹	3 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁵
Ytterbium (70)				
Yb-169	4 × 10 ⁰	1 × 10 ⁰	1 × 10 ²	1 × 10 ⁷
Yb-175	3 × 10 ¹	9 × 10 ⁻¹	1 × 10 ³	1 × 10 ⁷
Zinc (30)				
Zn-65	2 × 10 ⁰	2 × 10 ⁰	1 × 10 ¹	1 × 10 ⁶
Zn-69	3 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ⁴	1 × 10 ⁶
Zn-69m (a)	3 × 10 ⁰	6 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁶
Zirconium (40)				
Zr-88	3 × 10 ⁰	3 × 10 ⁰	1 × 10 ²	1 × 10 ⁶
Zr-93	Unlimited	Unlimited	1 × 10 ³ (b)	1 × 10 ⁷ (b)
Zr-95 (a)	2 × 10 ⁰	8 × 10 ⁻¹	1 × 10 ¹	1 × 10 ⁶
Zr-97 (a)	4 × 10 ⁻¹	4 × 10 ⁻¹	1 × 10 ¹ (b)	1 × 10 ⁵ (b)

- (a) A_1 and/or A_2 values for these parent radionuclides include contributions from their progeny with half-lives less than 10 days, as listed in the following:

Mg-28	Al-28
Ar-42	K-42
Ca-47	Sc-47
Ti-44	Sc-44
Fe-52	Mn-52m
Fe-60	Co-60m
Zn-69m	Zn-69
Ge-68	Ga-68
Rb-83	Kr-83m
Sr-82	Rb-82
Sr-90	Y-90
Sr-91	Y-91m
Sr-92	Y-92
Y-87	Sr-87m
Zr-95	Nb-95m
Zr-97	Nb-97m, Nb-97
Mo-99	Tc-99m
Tc-95m	Tc-95
Tc-96m	Tc-96
Ru-103	Rh-103m
Ru-106	Rh-106
Pd-103	Rh-103m
Ag-108m	Ag-108
Ag-110m	Ag-110
Cd-115	In-115m
In-114m	In-114
Sn-113	In-113m
Sn-121m	Sn-121
Sn-126	Sb-126m
Te-118	Sb-118
Te-127m	Te-127
Te-129m	Te-129
Te-131m	Te-131
Te-132	I-132
I-135	Xe-135m
Xe-122	I-122
Cs-137	Ba-137m
Ba-131	Cs-131
Ba-140	La-140
Ce-144	Pr-144m, Pr-144
Pm-148m	Pm-148
Gd-146	Eu-146
Dy-166	Ho-166
Hf-172	Lu-172
W-178	Ta-178
W-188	Re-188
Re-189	Os-189m
Os-194	Ir-194
Ir-189	Os-189m
Pt-188	Ir-188
Hg-194	Au-194
Hg-195m	Hg-195
Pb-210	Bi-210

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Pb-212	Bi-212, Tl-208, Po-212
Bi-210m	Tl-206
Bi-212	Tl-208, Po-212
At-211	Po-211
Rn-222	Po-218, Pb-214, At-218, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Po-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212
Ra-225	Ac-225, Fr-221, At-217, Bi-213, Tl-209, Po-213, Pb-209
Ra-226	Rn-222, Po-218, Pb-214, At-218, Bi-214, Po-214
Ra-228	Ac-228
Ac-225	Fr-221, At-217, Bi-213, Tl-209, Po-213, Pb-209
Ac-227	Fr-223
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212
Th-234	Pa-234m, Pa-234
Pa-230	Ac-226, Th-226, Fr-222, Ra-222, Rn-218, Po-214
U-230	Th-226, Ra-222, Rn-218, Po-214
U-235	Th-231
Pu-241	U-237
Pu-244	U-240, Np-240m
Am-242m	Am-242, Np-238
Am-243	Np-239
Cm-247	Pu-243
Bk-249	Am-245
Cf-253	Cm-249

△ (b) Parent nuclides and their progeny included in secular equilibrium are listed in the following (the activity to be taken into account is that of the parent nuclide only):

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Ag-108m	Ag-108
Cs-137	Ba-137m
Ce-144	Pr-144
Ba-140	La-140
Bi-212	Tl-208 (0.36), Po-212 (0.64)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
△ Th (nat)*	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)
U-235	Th-231
U-238	Th-234, Pa-234m
△ U (nat)*	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210

* In the case of Th-natural, the parent nuclide is Th-232, in the case of U-natural the parent nuclide is U-238.

Np-237 Pa-233
 Am-242m Am-242
 Am-243 Np-239

- (c) The quantity may be determined from a measurement of the rate of decay or a measurement of the dose rate at a prescribed distance from the source.
- (d) These values apply only to compounds of uranium that take the chemical form of UF₆, UO₂F₂ and UO₂(NO₃)₂ in both normal and accident conditions of transport.
- (e) These values apply only to compounds of uranium that take the chemical form of UO₃, UF₄, UCl₄ and hexavalent compounds in both normal and accident conditions of transport.
- (f) These values apply to all compounds of uranium other than those specified in (d) and (e) above.
- (g) These values apply to unirradiated uranium only.

2.7.2.2.2 For individual radionuclides:

- △ .1 which are not listed in table 2.7.2.2.1, the determination of the basic radionuclide values referred to in 2.7.2.2.1 shall require multilateral approval. For these radionuclides, activity concentration limits for exempt material and activity limits for exempt consignments shall be calculated in accordance with the principles established in the *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014)*. It is permissible to use an A₂ value calculated using a dose coefficient for the appropriate lung absorption type as recommended by the International Commission on Radiological Protection, if the chemical forms of each radionuclide under both normal and accident conditions of transport are taken into consideration. Alternatively, the radionuclide values in table 2.7.2.2.2 may be used without obtaining competent authority approval;
- △ .2 In instruments or articles in which the radioactive material is enclosed or is included as a component part of the instrument or other manufactured article and which meet 2.7.2.4.1.3.3, alternative basic radionuclide values to those in table 2.7.2.2.1 for the activity limit for an exempt consignment are permitted and shall require multilateral approval. Such alternative activity limits for an exempt consignment shall be calculated in accordance with the principles set out in GSR Part 3.

Table 2.7.2.2.2 – Basic radionuclide values for unknown radionuclides or mixtures

Radioactive contents	A ₁ (TBq)	A ₂ (TBq)	Activity concentration limit for exempt material (Bq/g)	Activity limit for exempt consignments (Bq)
Only beta or gamma emitting nuclides are known to be present	0.1	0.02	1 × 10 ¹	1 × 10 ⁴
Alpha emitting nuclides but no neutron emitters are known to be present	0.2	9 × 10 ⁻⁵	1 × 10 ⁻¹	1 × 10 ³
Neutron emitting nuclides are known to be present or no relevant data are available	0.001	9 × 10 ⁻⁵	1 × 10 ⁻¹	1 × 10 ³

- △ 2.7.2.2.3 In the calculations of A₁ and A₂ for a radionuclide not in table 2.7.2.2.1, a single radioactive decay chain in which the radionuclides are present in their naturally occurring proportions, and in which no progeny nuclide has a half-life either longer than 10 days or longer than that of the parent nuclide, shall be considered as a single radionuclide; and the activity to be taken into account and the A₁ or A₂ value to be applied shall be those corresponding to the parent nuclide of that chain. In the case of radioactive decay chains in which any progeny nuclide has a half-life either longer than 10 days or greater than that of the parent nuclide, the parent and such progeny nuclides shall be considered as mixtures of different nuclides.

2.7.2.2.4 For mixtures of radionuclides, the basic radionuclide values referred to in 2.7.2.2.1 may be determined as follows:

$$X_m = \frac{1}{\sum_i \frac{f(i)}{X(i)}}$$

where:

- f(i) is the fraction of activity or activity concentration of radionuclide i in the mixture;
- X(i) is the appropriate value of A₁ or A₂, or the activity concentration limit for exempt material or the activity limit for an exempt consignment, as appropriate, for the radionuclide i; and
- X_m is the derived value of A₁ or A₂, or the activity concentration limit for exempt material or the activity limit for an exempt consignment in the case of a mixture.

2.7.2.2.5 When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest radionuclide value, as appropriate, for the radionuclides in each group may be used in applying the formulae in 2.7.2.2.4 and 2.7.2.4.4. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest radionuclide values for the alpha emitters or beta/gamma emitters, respectively.

2.7.2.2.6 For individual radionuclides or for mixtures of radionuclides for which relevant data are not available, the values shown in table 2.7.2.2.2 shall be used.

2.7.2.3 Determination of other material characteristics

2.7.2.3.1 *Low specific activity (LSA) material*

2.7.2.3.1.1 [Reserved]

2.7.2.3.1.2 LSA material shall be in one of three groups:

.1 LSA-I

- .1 uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides;
- .2 Natural uranium, depleted uranium, natural thorium or their compounds or mixtures, that are unirradiated and in solid or liquid form;
- .3 radioactive material for which the A_2 value is unlimited. Fissile material may be included only if excepted under 2.7.2.3.5; or
- .4 other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in 2.7.2.2.1 to 2.7.2.2.6. Fissile material may be included only if excepted under 2.7.2.3.5;

.2 LSA-II

- .1 water with tritium concentration up to 0.8 TBq/L;
- .2 other material in which the activity is distributed throughout and the estimated average specific activity does not exceed $10^{-4}A_2/g$ for solids and gases, and $10^{-5}A_2/g$ for liquids;

△ .3 LSA-III – Solids (e.g. consolidated wastes, activated materials), excluding powders, in which:

- .1 the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen and ceramic);

⊗

- △ .2 the estimated average specific activity of the solid, excluding any shielding material, does not exceed $2 \times 10^{-3}A_2/g$.

△ 2.7.2.3.1.3 Deleted.

2.7.2.3.1.4 Deleted

2.7.2.3.1.5 Deleted.

2.7.2.3.2 *Surface contaminated object (SCO)*

△ SCO is classified in one of three groups:

.1 SCO-I: A solid object on which:

- .1 the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 for beta and gamma emitters and low-toxicity alpha emitters, or 0.4 Bq/cm^2 for all other alpha emitters;
- .2 the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ for beta and gamma emitters and low-toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ for all other alpha emitters; and
- .3 the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed $4 \times 10^4 \text{ Bq/cm}^2$ for beta and gamma emitters and low-toxicity alpha emitters, or $4 \times 10^3 \text{ Bq/cm}^2$ for all other alpha emitters;

- 2
- .2 SCO-II: A solid object on which either the fixed or non-fixed contamination on the surface exceeds the applicable limits specified for SCO-I in 2.7.2.3.2.1 above and on which:
 - .1 the non-fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 400 Bq/cm² for beta and gamma emitters and low-toxicity alpha emitters, or 40 Bq/cm² for all other alpha emitters;
 - .2 the fixed contamination on the accessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8×10^5 Bq/cm² for beta and gamma emitters and low-toxicity alpha emitters, or 8×10^4 Bq/cm² for all other alpha emitters; and
 - .3 the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² (or the area of the surface if less than 300 cm²) does not exceed 8×10^5 Bq/cm² for beta and gamma emitters and low-toxicity alpha emitters, or 8×10^4 Bq/cm² for all other alpha emitters.
 - .3 SCO-III: A large solid object which, because of its size, cannot be transported in a type of package described in **this Code** and for which:
 - .1 all openings are sealed to prevent release of radioactive material during conditions defined in 4.1.9.2.4.5;
 - .2 the inside of the object is as dry as practicable;
 - .3 the non-fixed contamination on the external surfaces does not exceed the limits specified in 4.1.9.1.2; and
 - .4 the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm² does not exceed 8×10^5 Bq/cm² for beta and gamma emitters and low toxicity alpha emitters, or 8×10^4 Bq/cm² for all other alpha emitters.

2.7.2.3.3 Special form radioactive material

- 2.7.2.3.3.1 .1 Special form radioactive material shall have at least one dimension not less than 5 mm.
- .2 When a sealed capsule constitutes part of the special form radioactive material, the capsule shall be so manufactured that it can be opened only by destroying it.
- .3 The design for special form radioactive material requires unilateral approval.
- 2.7.2.3.3.2 Special form radioactive material shall be of such a nature or shall be so designed that, if it is subjected to the tests specified in 2.7.2.3.3.4 to 2.7.2.3.3.8, it shall meet the following requirements:
 - .1 It would not break or shatter under the impact, percussion and bending tests 2.7.2.3.3.5.1, 2.7.2.3.3.5.2, 2.7.2.3.3.5.3, and 2.7.2.3.3.6.1 as applicable;
 - .2 It would not melt or disperse in the applicable heat test 2.7.2.3.3.5.4 or 2.7.2.3.3.6.2 as applicable; and
 - .3 The activity in the water from the leaching tests specified in 2.7.2.3.3.7 and 2.7.2.3.3.8 would not exceed 2 kBq; or alternatively for sealed sources, the leakage rate for the volumetric leakage assessment test specified in ISO 9978:1992, *Radiation protection – Sealed radioactive sources – Leakage test methods*, would not exceed the applicable acceptance threshold acceptable to the competent authority.
- 2.7.2.3.3.3 Demonstration of compliance with the performance standards in 2.7.2.3.3.2 shall be in accordance with 6.4.12.1 and 6.4.12.2.
- 2.7.2.3.3.4 Specimens that comprise or simulate special form radioactive material shall be subjected to the impact test, the percussion test, the bending test, and the heat test specified in 2.7.2.3.3.5 or alternative tests as authorized in 2.7.2.3.3.6. A different specimen may be used for each of the tests. Following each test, a leaching assessment or volumetric leakage test shall be performed on the specimen by a method no less sensitive than the methods given in 2.7.2.3.3.7 for indispersible solid material or 2.7.2.3.3.8 for encapsulated material.
- 2.7.2.3.3.5 The relevant test methods are:
 - .1 *Impact test*: The specimen shall drop onto the target from a height of 9 m. The target shall be as defined in 6.4.14;
 - △ .2 *Percussion test*: The specimen shall be placed on a sheet of lead which is supported by a smooth solid surface and struck by the flat face of a mild steel bar so as to cause an impact equivalent to that resulting from a free drop of 1.4 kg from a height of 1 m. The lower part of the bar shall be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm. The lead, of hardness number 3.5 to 4.5 on the Vickers scale and not more than 25 mm thick, shall cover an area greater than that covered by the specimen. A fresh surface of lead shall be used for each impact. The bar shall strike the specimen so as to cause maximum damage;
 - .3 *Bending test*: The test shall apply only to long, slender sources with both a minimum length of 10 cm and a length to minimum width ratio of not less than 10. The specimen shall be rigidly clamped in a horizontal position so that one half of its length protrudes from the face of the clamp. The orientation of the specimen shall be such that the specimen will suffer maximum damage when its free end is struck by the flat face of a steel bar. The bar shall strike the specimen so as to cause an impact equivalent to that

- △ resulting from a free vertical drop of 1.4 kg from a height of 1 m. The lower part of the bar shall be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm;
- .4 *Heat test:* The specimen shall be heated in air to a temperature of 800°C and held at that temperature for a period of 10 minutes and shall then be allowed to cool.
- 2.7.2.3.3.6 Specimens that comprise or simulate radioactive material enclosed in a sealed capsule may be excepted from:
- .1 The tests prescribed in 2.7.2.3.3.5.1 and 2.7.2.3.3.5.2 provided that the specimens are alternatively subjected to the impact test prescribed in ISO 2919:2012, *Radiation Protection – Sealed Radioactive Sources – General requirements and classification:*
- .1 the class 4 impact test if the mass of the special form radioactive material is less than 200 g; and
- .2 the class 5 impact test if the mass of the special form radioactive material is equal to or more than 200 g but is less than 500 g.
- .2 The test prescribed in 2.7.2.3.3.5.4 provided they are alternatively subjected to the class 6 temperature test specified in ISO 2919:2012, *Radiation protection – Sealed radioactive sources – General requirements and classification.*
- 2.7.2.3.3.7 For specimens which comprise or simulate indispersible solid material, a leaching assessment shall be performed as follows:
- .1 The specimen shall be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the 7-day test period the free volume of the unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6 to 8 and a maximum conductivity of 1 mS/m at 20°C;
- △ .2 The water and the specimen shall then be heated to a temperature of (50 ± 5) °C and maintained at this temperature for 4 hours;
- .3 The activity of the water shall then be determined;
- .4 The specimen shall then be kept for at least 7 days in still air at not less than 30°C and relative humidity not less than 90%;
- △ .5 The specimen shall then be immersed in water of the same specification as in 2.7.2.3.3.7.1 above and the water and the specimen heated to (50 ± 5) °C and maintained at this temperature for 4 hours;
- .6 The activity of the water shall then be determined.
- 2.7.2.3.3.8 For specimens which comprise or simulate radioactive material enclosed in a sealed capsule, either a leaching assessment or a volumetric leakage assessment shall be performed as follows:
- .1 The leaching assessment shall consist of the following steps:
- .1 the specimen shall be immersed in water at ambient temperature. The water shall have an initial pH of 6 to 8 with a maximum conductivity of 1 mS/m at 20°C;
- △ .2 the water and specimen shall then be heated to a temperature of (50 ± 5) °C and maintained at this temperature for 4 hours;
- .3 the activity of the water shall then be determined;
- .4 the specimen shall then be kept for at least 7 days in still air at not less than 30°C and relative humidity of not less than 90%;
- .5 the process in .1, .2 and .3 shall be repeated.
- .2 The alternative volumetric leakage assessment shall comprise any of the tests prescribed in ISO 9978:1992, *Radiation protection – Sealed radioactive sources – Leakage test methods*, provided that they are acceptable to the competent authority.
- 2.7.2.3.4 **Low dispersible material**
- 2.7.2.3.4.1 The design for low dispersible radioactive material shall require multilateral approval. Low dispersible radioactive material shall be such that the total amount of this radioactive material in a package, taking into account the provisions of 6.4.8.14, shall meet the following provisions:
- △ .1 The dose rate at 3 m from the unshielded radioactive material does not exceed 10 mSv/h;
- .2 If subjected to the tests specified in 6.4.20.3 and 6.4.20.4, the airborne release in gaseous and particulate forms of up to 100 µm aerodynamic equivalent diameter would not exceed $100A_2$. A separate specimen may be used for each test; and
- .3 If subjected to the test specified in 2.7.2.3.4.3, the activity in the water would not exceed $100A_2$. In the application of this test, the damaging effects of the tests specified in 2.7.2.3.4.1.2 above shall be taken into account.

2.7.2.3.4.2 Low dispersible material shall be tested as follows:

A specimen that comprises or simulates low dispersible radioactive material shall be subjected to the enhanced thermal test specified in 6.4.20.3 and the impact test specified in 6.4.20.4. A different specimen may be used for each of the tests. Following each test, the specimen shall be subjected to the leach test specified in 2.7.2.3.1.4. After each test it shall be determined if the applicable provisions of 2.7.2.3.4.1 have been met.

2.7.2.3.4.3 A solid material sample representing the entire contents of the package shall be immersed for seven days in water at ambient temperature. The volume of water to be used in the test shall be sufficient to ensure that at the end of the seven-day test period the free volume of unabsorbed and unreacted water remaining shall be at least 10% of the volume of the solid test sample itself. The water shall have an initial pH of 6 to 8 and a maximum conductivity of 1 mS/m at 20°C. The total activity of the free volume of water shall be measured following the seven-day immersion of the test sample.

2.7.2.3.4.4 Demonstration of compliance with the performance standards in 2.7.2.3.4.1, 2.7.2.3.4.2 and 2.7.2.3.4.3 shall be in accordance with 6.4.12.1 and 6.4.12.2.

2.7.2.3.5 *Fissile material*

Fissile material and packages containing fissile material shall be classified under the relevant entry as “FISSILE” in accordance with table 2.7.2.1.1 unless excepted by one of the provisions of subparagraphs .1 to .6 below and transported subject to the requirements of 5.1.5.5. All provisions apply only to material in packages that meets the requirements of 6.4.7.2 unless unpackaged material is specifically allowed in the provision.

- .1 uranium enriched in uranium-235 to a maximum of 1% by mass, and with a total plutonium and uranium-233 content not exceeding 1% of the mass of uranium-235, provided that the fissile nuclides are distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it shall not form a lattice arrangement;
- .2 liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2% by mass, with a total plutonium and uranium-233 content not exceeding 0.002% of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2;
- .3 uranium with a maximum uranium enrichment of 5% by mass uranium-235 provided:
 - .1 there is no more than 3.5 g of uranium-235 per package;
 - .2 the total plutonium and uranium-233 content does not exceed 1% of the mass of uranium-235 per package;
 - .3 transport of the package is subject to the consignment limit provided in 5.1.5.5.3;
- .4 fissile nuclides with a total mass not greater than 2 g per package provided the package is transported subject to the consignment limit provided in 5.1.5.5.4;
- △ .5 fissile nuclides with a total mass not greater than 45 g either packaged or unpackaged subject to the requirements of 5.1.5.5.5;
- .6 a fissile material that meets the requirements of 5.1.5.5.2, 2.7.2.3.6 and 5.1.5.2.1.

△ 2.7.2.3.6 Fissile material excepted from classification as “FISSILE” under 2.7.2.3.5.6 shall be subcritical without the need for accumulation control under the following conditions:

- .1 the conditions of 6.4.11.1 (a);
- .2 the conditions consistent with the assessment provisions stated in 6.4.11.12 (b) and 6.4.11.13 (b) for packages; and
- .3 the conditions specified in 6.4.11.11 (a), if transported by air.

2.7.2.4 Classification of packages or unpacked material

The quantity of radioactive material in a package shall not exceed the relevant limits for the package type as specified below.

2.7.2.4.1 *Classification as excepted package*

2.7.2.4.1.1 A package may be classified as an excepted package if it meets one of the following conditions:

- .1 it is an empty package having contained radioactive material;
- .2 it contains instruments or articles not exceeding the activity limits specified in columns (2) and (3) of table 2.7.2.4.1.2;
- .3 it contains articles manufactured of natural uranium, depleted uranium or natural thorium;
- .4 it contains radioactive material not exceeding the activity limits specified in column (4) of table 2.7.2.4.1.2; or
- .5 it contains less than 0.1 kg of uranium hexafluoride not exceeding the activity limits specified in column (4) of table 2.7.2.4.1.2.

2.7.2.4.1.2 A package containing radioactive material may be classified as an excepted package provided that the dose rate at any point on its external surface does not exceed 5 µSv/h.

Table 2.7.2.4.1.2 – Activity limits for excepted packages

Physical state of contents	Instruments or article		Material package limits ^a
	Item limits ^a	Package limits ^a	
(1)	(2)	(3)	(4)
Solids			
special form	$10^{-2} A_1$	A_1	$10^{-3} A_1$
other form	$10^{-2} A_2$	A_2	$10^{-3} A_2$
Liquids	$10^{-3} A_2$	$10^{-1} A_2$	$10^{-4} A_2$
Gases			
tritium	$2 \times 10^{-2} A_2$	$2 \times 10^{-1} A_2$	$2 \times 10^{-2} A_2$
special form	$10^{-3} A_1$	$10^{-2} A_1$	$10^{-3} A_1$
other forms	$10^{-3} A_2$	$10^{-2} A_2$	$10^{-3} A_2$

^a For mixtures of radionuclides, see 2.7.2.2.4 to 2.7.2.2.6.

2.7.2.4.1.3 Radioactive material which is enclosed in or is included as a component part of an instrument or other manufactured article may be classified under UN 2911, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – INSTRUMENTS or ARTICLES provided that:

- .1 the dose rate at 10 cm from any point on the external surface of any unpackaged instrument or article is not greater than 0.1 mSv/h; and
- .2 each instrument or manufactured article bears the mark “RADIOACTIVE” on its external surface except for the following:
 - .1 radioluminescent time-pieces or devices;
 - .2 consumer products that either have received regulatory approval in accordance with 1.5.1.4.5 or do not individually exceed the activity limit for an exempt consignment in table 2.7.2.2.1 (column 5), provided such products are transported in a package that bears the mark “RADIOACTIVE” on its internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package;
 - .3 other instruments or articles too small to bear the mark “RADIOACTIVE”, provided that they are transported in a package that bears the mark “RADIOACTIVE” on its internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; and
- .3 the active material is completely enclosed by non-active components (a device performing the sole function of containing radioactive material shall not be considered to be an instrument or manufactured article);
- .4 the limits specified in columns 2 and 3 of table 2.7.2.4.1.2 are met for each individual item and each package, respectively;
- .5 reserved; and
- .6 if the package contains fissile material, one of the provisions of sub-paragraphs .1 to .6 of 2.7.2.3.5 applies.

2.7.2.4.1.4 Radioactive material in forms other than as specified in 2.7.2.4.1.3 and with an activity not exceeding the limits specified in column 4 of table 2.7.2.4.1.2, may be classified under UN 2910, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – LIMITED QUANTITY OF MATERIAL provided that:

- △ .1 the package retains its radioactive contents under routine conditions of transport;
- .2 the package bears the mark “RADIOACTIVE” on either:
 - .1 an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; or
 - △ .2 the outside of the package, where it is impractical to mark an internal surface; and
- .3 if the package contains fissile material, one of the provisions of sub-paragraphs .1 to .6 of 2.7.2.3.5 applies.

2.7.2.4.1.5 Uranium hexafluoride not exceeding the limits specified in column 4 of table 2.7.2.4.1.2 may be classified under UN 3507 URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, less than 0.1 kg per package, non-fissile or fissile-excepted, provided that:

- .1 the mass of uranium hexafluoride in the package is less than 0.1 kg; and
- .2 the conditions of 2.7.2.4.5.1 and 2.7.2.4.1.4.1 and 2.7.2.4.1.4.2 are met.

2.7.2.4.1.6 Articles manufactured of natural uranium, depleted uranium or natural thorium and articles in which the sole radioactive material is unirradiated natural uranium, unirradiated depleted uranium or unirradiated natural thorium may be classified under UN 2909, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM, provided that the outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some other substantial material.

2.7.2.4.1.7 An empty packaging which had previously contained radioactive material may be classified under UN 2908, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – EMPTY PACKAGING, provided that:

- .1 it is in a well-maintained condition and securely closed;
- .2 the outer surface of any uranium or thorium in its structure is covered with an inactive sheath made of metal or some other substantial material;
- .3 the level of internal non-fixed contamination, when averaged over any 300 cm², does not exceed:
 - .1 400 Bq/cm² for beta and gamma emitters and low-toxicity alpha emitters; and
 - △ .2 40 Bq/cm² for all other alpha emitters;
- △ .4 any labels which may have been displayed on it in conformity with 5.2.2.1.12.1 are no longer visible; and
- .5 if the packaging has contained fissile material, one of the provisions of sub-paragraphs .1 to .6 of 2.7.2.3.5 or one of the provisions for exclusion in 2.7.1.3 applies.

2.7.2.4.2 *Classification as Low specific activity (LSA) material*

Radioactive material may only be classified as LSA material if the definition of LSA in 2.7.1.3 and the conditions of 2.7.2.3.1, 4.1.9.2 and 7.1.4.5.1 are met.

2.7.2.4.3 *Classification as Surface contaminated object (SCO)*

Radioactive material may be classified as SCO if the definition of SCO in 2.7.1.3 and the conditions of 2.7.2.3.2, 4.1.9.2 and 7.1.4.5.1 are met.

2.7.2.4.4 *Classification as Type A package*

Packages containing radioactive material may be classified as Type A packages provided that the following conditions are met:

Type A packages shall not contain activities greater than either of the following:

- .1 for special form radioactive material – A_1 ;
- .2 for all other radioactive material – A_2 .

For mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a Type A package:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)} \leq 1$$

where:

- $B(i)$ is the activity of radionuclide i as special form radioactive material;
- $A_1(i)$ is the A_1 value for radionuclide i ;
- $C(j)$ is the activity of radionuclide j as other than special form radioactive material;
- $A_2(j)$ is the A_2 value for radionuclide j .

2.7.2.4.5 *Classification of uranium hexafluoride*

2.7.2.4.5.1 Uranium hexafluoride shall only be assigned to:

- .1 UN 2977, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE;
- .2 UN 2978, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted; or
- .3 UN 3507, URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE less than 0.1 kg per package, non-fissile or fissile-excepted.

2.7.2.4.5.2 The contents of a package containing uranium hexafluoride shall comply with the following requirements:

- .1 for UN Nos. 2977 and 2978, the mass of uranium hexafluoride shall not be different from that allowed for the package design, and for UN 3507, the mass of uranium hexafluoride shall be less than 0.1 kg;
- .2 the mass of uranium hexafluoride shall not be greater than a value that would lead to an ullage smaller than 5% at the maximum temperature of the package as specified for the plant systems where the package shall be used; and

- .3 the uranium hexafluoride shall be in solid form and the internal pressure shall not be above atmospheric pressure when presented for transport.

2.7.2.4.6 *Classification as Type B(U), Type B(M) or Type C packages*

2.7.2.4.6.1 Packages not otherwise classified in 2.7.2.4 (2.7.2.4.1 to 2.7.2.4.5) shall be classified in accordance with the competent authority certificate of approval for the package issued by the country of origin of design.

2.7.2.4.6.2 The contents of a Type B(U), Type B(M) or Type C package shall be as specified in the certificate of approval.

2.7.2.5 **Special arrangements**

Radioactive material shall be classified as transported under special arrangement when it is intended to be transported in accordance with 1.5.4.

