

Appendix Clearance Level for Radioactive Waste

Table I. Single-radionuclide: the radionuclide concentration should be less than the relevant value on one of the column

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
H-3	1.E+9	1.E+2	1.E+6
Be-7	1.E+7	1.E+1	1.E+3
C-14	1.E+7	1.E+0	1.E+4
F-18	1.E+6	1.E+1	1.E+1
Na-22	1.E+6	1.E-1	1.E+1
Na-24	1.E+5	1.E+0	1.E+1
Si-31	1.E+6	1.E+3	1.E+3
P-32	1.E+5	1.E+3	1.E+3
P-33	1.E+8	1.E+3	1.E+5
S-35	1.E+8	1.E+2	1.E+5
Cl-36	1.E+6	1.E+0	1.E+4
Cl-38	1.E+5	1.E+1	1.E+1
K-40	1.E+6	1.E+1	1.E+2
K-42	1.E+6	1.E+2	1.E+2
K-43	1.E+6	1.E+1	1.E+1
Ca-45	1.E+7	1.E+2	1.E+4
Ca-47	1.E+6	1.E+1	1.E+1
Sc-46	1.E+6	1.E-1	1.E+1
Sc-47	1.E+6	1.E+2	1.E+2
Sc-48	1.E+5	1.E+0	1.E+1
V-48	1.E+5	1.E+0	1.E+1
Cr-51	1.E+7	1.E+2	1.E+3
Mn-51	1.E+5	1.E+1	1.E+1
Mn-52	1.E+5	1.E+0	1.E+1
Mn-52m	1.E+5	1.E+1	1.E+1

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Mn-53	1.E+9	1.E+2	1.E+4
Mn-54	1.E+6	1.E-1	1.E+1
Mn-56	1.E+5	1.E+1	1.E+1
Fe-52	1.E+6	1.E+1	1.E+1
Fe-55	1.E+6	1.E+3	1.E+4
Fe-59	1.E+6	1.E+0	1.E+1
Co-55	1.E+6	1.E+1	1.E+1
Co-56	1.E+5	1.E-1	1.E+1
Co-57	1.E+6	1.E+0	1.E+2
Co-58	1.E+6	1.E+0	1.E+1
Co-58m	1.E+7	1.E+4	1.E+4
Co-60	1.E+5	1.E-1	1.E+1
Co-60m	1.E+6	1.E+3	1.E+3
Co-61	1.E+6	1.E+2	1.E+2
Co-62m	1.E+5	1.E+1	1.E+1
Ni-59	1.E+8	1.E+2	1.E+4
Ni-63	1.E+8	1.E+2	1.E+5
Ni-65	1.E+6	1.E+1	1.E+1
Cu-64	1.E+6	1.E+2	1.E+2
Zn-65	1.E+6	1.E-1	1.E+1
Zn-69	1.E+6	1.E+3	1.E+4
Zn-69m	1.E+6	1.E+1	1.E+2
Ga-72	1.E+5	1.E+1	1.E+1
Ge-71	1.E+8	1.E+4	1.E+4
As-73	1.E+7	1.E+3	1.E+3

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
As-74	1.E+6	1.E+1	1.E+1
As-76	1.E+5	1.E+1	1.E+2
As-77	1.E+6	1.E+3	1.E+3
Se-75	1.E+6	1.E+0	1.E+2
Br-82	1.E+6	1.E+0	1.E+1
Rb-86	1.E+5	1.E+2	1.E+2
Sr-85	1.E+6	1.E+0	1.E+2
Sr-85m	1.E+7	1.E+2	1.E+2
Sr-87m	1.E+6	1.E+2	1.E+2
Sr-89	1.E+6	1.E+3	1.E+3
Sr-90	1.E+4	1.E+0	1.E+2
Sr-91	1.E+5	1.E+1	1.E+1
Sr-92	1.E+6	1.E+1	1.E+1
Y-90	1.E+5	1.E+3	1.E+3
Y-91	1.E+6	1.E+2	1.E+3
Y-91m	1.E+6	1.E+2	1.E+2
Y-92	1.E+5	1.E+2	1.E+2
Y-93	1.E+5	1.E+2	1.E+2
Zr-93	1.E+7	1.E+1	1.E+3
Zr-95	1.E+6	1.E+0	1.E+1
Zr-97	1.E+5	1.E+1	1.E+1
Nb-93m	1.E+7	1.E+1	1.E+4
Nb-94	1.E+6	1.E-1	1.E+1
Nb-95	1.E+6	1.E+0	1.E+1
Nb-97	1.E+6	1.E+1	1.E+1
Nb-98	1.E+5	1.E+1	1.E+1
Mo-90	1.E+6	1.E+1	1.E+1

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Mo-93	1.E+8	1.E+1	1.E+3
Mo-99	1.E+6	1.E+1	1.E+2
Mo-101	1.E+6	1.E+1	1.E+1
Tc-96	1.E+6	1.E+0	1.E+1
Tc-96m	1.E+7	1.E+3	1.E+3
Tc-97	1.E+8	1.E+1	1.E+3
Tc-97m	1.E+7	1.E+2	1.E+3
Tc-99	1.E+7	1.E+0	1.E+4
Tc-99m	1.E+7	1.E+2	1.E+2
Ru-97	1.E+7	1.E+1	1.E+2
Ru-103	1.E+6	1.E+0	1.E+2
Ru-105	1.E+6	1.E+1	1.E+1
Ru-106	1.E+5	1.E-1	1.E+2
Rh-103m	1.E+8	1.E+4	1.E+4
Rh-105	1.E+7	1.E+2	1.E+2
Pd-103	1.E+8	1.E+3	1.E+3
Pd-109	1.E+6	1.E+2	1.E+3
Ag-105	1.E+6	1.E+0	1.E+2
Ag-110m	1.E+6	1.E-1	1.E+1
Ag-111	1.E+6	1.E+2	1.E+3
Cd-109	1.E+6	1.E+0	1.E+4
Cd-115	1.E+6	1.E+1	1.E+2
Cd-115m	1.E+6	1.E+2	1.E+3
In-111	1.E+6	1.E+1	1.E+2
In-113m	1.E+6	1.E+2	1.E+2
In-114m	1.E+6	1.E+1	1.E+2
In-115m	1.E+6	1.E+2	1.E+2

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Sn-113	1.E+7	1.E+0	1.E+3
Sn-125	1.E+5	1.E+1	1.E+2
Sb-122	1.E+4	1.E+1	1.E+2
Sb-124	1.E+6	1.E+0	1.E+1
Sb-125	1.E+6	1.E-1	1.E+2
Te-123m	1.E+7	1.E+0	1.E+2
Te-125m	1.E+7	1.E+3	1.E+3
Te-127	1.E+6	1.E+3	1.E+3
Te-127m	1.E+7	1.E+1	1.E+3
Te-129	1.E+6	1.E+2	1.E+2
Te-129m	1.E+6	1.E+1	1.E+3
Te-131	1.E+5	1.E+2	1.E+2
Te-131m	1.E+6	1.E+1	1.E+1
Te-132	1.E+7	1.E+0	1.E+2
Te-133	1.E+5	1.E+1	1.E+1
Te-133m	1.E+5	1.E+1	1.E+1
Te-134	1.E+6	1.E+1	1.E+1
I-123	1.E+7	1.E+2	1.E+2
I-125	1.E+6	1.E+2	1.E+3
I-126	1.E+6	1.E+1	1.E+2
I-129	1.E+5	1.E-1	1.E+2
I-130	1.E+6	1.E+1	1.E+1
I-131	1.E+6	1.E+1	1.E+2
I-132	1.E+5	1.E+1	1.E+1
I-133	1.E+6	1.E+1	1.E+1
I-134	1.E+5	1.E+1	1.E+1
I-135	1.E+6	1.E+1	1.E+1

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Cs-129	1.E+5	1.E+1	1.E+2
Cs-131	1.E+6	1.E+3	1.E+3
Cs-132	1.E+5	1.E+1	1.E+1
Cs-134	1.E+4	1.E-1	1.E+1
Cs-134m	1.E+5	1.E+3	1.E+3
Cs-135	1.E+7	1.E+2	1.E+4
Cs-136	1.E+5	1.E+0	1.E+1
Cs-137	1.E+4	1.E-1	1.E+1
Cs-138	1.E+4	1.E+1	1.E+1
Ba-131	1.E+6	1.E+1	1.E+2
Ba-140	1.E+5	1.E+0	1.E+1
La-140	1.E+5	1.E+0	1.E+1
Ce-139	1.E+6	1.E+0	1.E+2
Ce-141	1.E+7	1.E+2	1.E+2
Ce-143	1.E+6	1.E+1	1.E+2
Ce-144	1.E+5	1.E+1	1.E+2
Pr-142	1.E+5	1.E+2	1.E+2
Pr-143	1.E+6	1.E+3	1.E+4
Nd-147	1.E+6	1.E+2	1.E+2
Nd-149	1.E+6	1.E+2	1.E+2
Pm-147	1.E+7	1.E+3	1.E+4
Pm-149	1.E+6	1.E+3	1.E+3
Sm-151	1.E+8	1.E+3	1.E+4
Sm-153	1.E+6	1.E+2	1.E+2
Eu-152	1.E+6	1.E-1	1.E+1
Eu-152m	1.E+6	1.E+2	1.E+2
Eu-154	1.E+6	1.E-1	1.E+1

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Eu-155	1.E+7	1.E+0	1.E+2
Gd-153	1.E+7	1.E+1	1.E+2
Gd-159	1.E+6	1.E+2	1.E+3
Tb-160	1.E+6	1.E+0	1.E+1
Dy-165	1.E+6	1.E+3	1.E+3
Dy-166	1.E+6	1.E+2	1.E+3
Ho-166	1.E+5	1.E+2	1.E+3
Er-169	1.E+7	1.E+3	1.E+4
Er-171	1.E+6	1.E+2	1.E+2
Tm-170	1.E+6	1.E+2	1.E+3
Tm-171	1.E+8	1.E+3	1.E+4
Yb-175	1.E+7	1.E+2	1.E+3
Lu-177	1.E+7	1.E+2	1.E+3
Hf-181	1.E+6	1.E+0	1.E+1
Ta-182	1.E+4	1.E-1	1.E+1
W-181	1.E+7	1.E+1	1.E+3
W-185	1.E+7	1.E+3	1.E+4
W-187	1.E+6	1.E+1	1.E+2
Re-186	1.E+6	1.E+3	1.E+3
Re-188	1.E+5	1.E+2	1.E+2
Os-185	1.E+6	1.E+0	1.E+1
Os-191	1.E+7	1.E+2	1.E+2
Os-191m	1.E+7	1.E+3	1.E+3
Os-193	1.E+6	1.E+2	1.E+2
Ir-190	1.E+6	1.E+0	1.E+1
Ir-192	1.E+4	1.E+0	1.E+1
Ir-194	1.E+5	1.E+2	1.E+2

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Pt-191	1.E+6	1.E+1	1.E+2
Pt-193m	1.E+7	1.E+3	1.E+3
Pt-197	1.E+6	1.E+3	1.E+3
Pt-197m	1.E+6	1.E+2	1.E+2
Au-198	1.E+6	1.E+1	1.E+2
Au-199	1.E+6	1.E+2	1.E+2
Hg-197	1.E+7	1.E+2	1.E+2
Hg-197m	1.E+6	1.E+2	1.E+2
Hg-203	1.E+5	1.E+1	1.E+2
Tl-200	1.E+6	1.E+1	1.E+1
Tl-201	1.E+6	1.E+2	1.E+2
T-202	1.E+6	1.E+1	1.E+2
Tl-204	1.E+4	1.E+0	1.E+4
Pb-203	1.E+6	1.E+1	1.E+2
Bi-206	1.E+5	1.E+0	1.E+1
Bi-207	1.E+6	1.E-1	1.E+1
Po-203	1.E+6	1.E+1	1.E+1
Po-205	1.E+6	1.E+1	1.E+1
Po-207	1.E+6	1.E+1	1.E+1
At-211	1.E+7	1.E+3	1.E+3
Ra-225	1.E+5	1.E+1	1.E+2
Ra-227	1.E+6	1.E+2	1.E+2
Th-226	1.E+7	1.E+3	1.E+3
Th-229	1.E+3	1.E-1	1.E+0
Th-232	1.E+4	1.E+0	1.E+1
Pa-230	1.E+6	1.E+1	1.E+1
Pa-233	1.E+7	1.E+1	1.E+2

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
U-230	1.E+5	1.E+1	1.E+1
U-231	1.E+7	1.E+2	1.E+2
U-232	1.E+3	1.E-1	1.E+0
U-233	1.E+4	1.E+0	1.E+1
U-235	1.E+4	1.E+0	1.E+1
U-236	1.E+4	1.E+1	1.E+1
U-237	1.E+6	1.E+2	1.E+2
U-238	1.E+4	1.E+0	1.E+1
U-239	1.E+6	1.E+2	1.E+2
U-240	1.E+7	1.E+2	1.E+3
Np-237	1.E+3	1.E+0	1.E+0
Np-239	1.E+7	1.E+2	1.E+2
Np-240	1.E+6	1.E+1	1.E+1
Pu-234	1.E+7	1.E+2	1.E+2
Pu-235	1.E+7	1.E+2	1.E+2
Pu-236	1.E+4	1.E+0	1.E+1
Pu-237	1.E+7	1.E+2	1.E+3
Pu-238	1.E+4	1.E-1	1.E+0
Pu-239	1.E+4	1.E-1	1.E+0
Pu-240	1.E+3	1.E-1	1.E+0
Pu-241	1.E+5	1.E+1	1.E+2
Pu-242	1.E+4	1.E-1	1.E+0
Pu-243	1.E+7	1.E+3	1.E+3
Pu-244	1.E+4	1.E-1	1.E+0
Am-241	1.E+4	1.E-1	1.E+0
Am-242	1.E+6	1.E+3	1.E+3
Am-242m	1.E+4	1.E-1	1.E+0

Clearance level Nuclide	Annual release activity (Bq)	Specific activity (annual release waste amount ≥ 1 t) (Bq/g)	Specific activity (annual release waste amount < 1 t) (Bq/g)
Am-243	1.E+3	1.E-1	1.E+0
Cm-242	1.E+5	1.E+1	1.E+2
Cm-243	1.E+4	1.E+0	1.E+0
Cm-244	1.E+4	1.E+0	1.E+1
Cm-245	1.E+3	1.E-1	1.E+0
Cm-246	1.E+3	1.E-1	1.E+0
Cm-247	1.E+4	1.E-1	1.E+0
Cm-248	1.E+3	1.E-1	1.E+0
Bk-249	1.E+6	1.E+2	1.E+3
Cf-246	1.E+6	1.E+3	1.E+3
Cf-248	1.E+4	1.E+0	1.E+1
Cf-249	1.E+3	1.E-1	1.E+0
Cf-250	1.E+4	1.E+0	1.E+1
Cf-251	1.E+3	1.E-1	1.E+0
Cf-252	1.E+4	1.E+0	1.E+1
Cf-253	1.E+5	1.E+2	1.E+2
Cf-254	1.E+3	1.E+0	1.E+0
Es-253	1.E+5	1.E+2	1.E+2
Es-254	1.E+4	1.E-1	1.E+1
Es-254m	1.E+6	1.E+1	1.E+2
Fm-254	1.E+7	1.E+4	1.E+4
Fm-255	1.E+6	1.E+2	1.E+3
All Others	1.E+3	1.E-1	1.E-1

II. Multi-radionulides: To determine if a mixture of radionuclides is below the limit a simple summation formula can be used

$$\sum_{i=1}^n \frac{C_i}{C_{i,o}} \leq 1$$

where

C_i : is the activity or specific activity of radionuclide i,

$C_{i,o}$: is the activity or specific activity limit of radionuclide i in Table I,

n: is the number of radionuclides in the mixture.

