

deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of a significant condition adverse to quality, the measures must assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken must be documented and reported to appropriate levels of management.

§ 71.135 Quality assurance records.

The licensee, certificate holder, and applicant for a Certificate of Compliance shall maintain sufficient written records to describe the activities affecting quality. These records must include changes to the quality assurance program as required by § 71.106, the instructions, procedures, and drawings required by § 71.111 to prescribe quality assurance activities, and closely related specifications such as required qualifications of personnel, procedures, and equipment. The records must include the instructions or procedures that establish a records retention program that is consistent with applicable regulations and designates factors such as duration, location, and assigned responsibility. The licensee, certificate holder, and applicant for a Certificate of Compliance shall retain these records for 3 years beyond the date when the licensee, certificate holder, and applicant for a Certificate of Compliance last engage in the activity for which the quality assurance program was developed. If any portion of the quality assurance program, written procedures or instructions is superseded, the licensee, certificate holder, and applicant for a Certificate of Compliance shall retain the superseded material for 3 years after it is superseded.

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§ 71.137 Audits.

The licensee, certificate holder, and applicant for a CoC shall carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program. The audits

must be performed in accordance with written procedures or checklists by appropriately trained personnel not having direct responsibilities in the areas being audited. Audited results must be documented and reviewed by management having responsibility in the area audited. Followup action, including reaudit of deficient areas, must be taken where indicated.

APPENDIX A TO PART 71— DETERMINATION OF A_1 AND A_2

I. Values of A_1 and A_2 for individual radionuclides, which are the bases for many activity limits elsewhere in these regulations, are given in Table A-1. The curie (Ci) values specified are obtained by converting from the Terabecquerel (TBq) value. The Terabecquerel values are the regulatory standard. The curie values are for information only and are not intended to be the regulatory standard. Where values of A_1 and A_2 are unlimited, it is for radiation control purposes only. For nuclear criticality safety, some materials are subject to controls placed on fissile material.

II. a. For individual radionuclides whose identities are known, but which are not listed in Table A-1, the A_1 and A_2 values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior Commission approval of the A_1 and A_2 values for radionuclides not listed in Table A-1, before shipping the material.

b. For individual radionuclides whose identities are known, but which are not listed in Table A-2, the exempt material activity concentration and exempt consignment activity values contained in Table A-3 may be used. Otherwise, the licensee shall obtain prior Commission approval of the exempt material activity concentration and exempt consignment activity values for radionuclides not listed in Table A-2, before shipping the material.

c. The licensee shall submit requests for prior approval, described under paragraphs II.a. and II.b. of this Appendix, to the Commission, in accordance with § 71.1 of this part.

III. In the calculations of A_1 and A_2 for a radionuclide not in Table A-1, a single radioactive decay chain, in which radionuclides are present in their naturally occurring proportions, and in which no daughter radionuclide has a half-life either longer than 10 days, or longer than that of the parent radionuclide, shall be considered as a single radionuclide, and the activity to be taken into account, and the A_1 and A_2 value to be applied, shall be those corresponding to the parent radionuclide of that chain. In the case of radioactive decay chains in which any daughter radionuclide has a half-life either longer

Pt. 71, App. A

10 CFR Ch. I (1–1–24 Edition)

than 10 days, or greater than that of the parent radionuclide, the parent and those daughter radionuclides shall be considered as mixtures of different radionuclides.

IV. For mixtures of radionuclides whose identities and respective activities are known, the following conditions apply:

a. For special form radioactive material, the maximum quantity transported in a Type A package is as follows:

$$\sum_i \frac{B(i)}{A_1(i)} \leq 1$$

where B(i) is the activity of radionuclide i in special form, and A₁(i) is the A₁ value for radionuclide i.

b. For normal form radioactive material, the maximum quantity transported in a Type A package is as follows:

$$\sum_i \frac{B(i)}{A_2(i)} \leq 1$$

where B(i) is the activity of radionuclide i in normal form, and A₂(i) is the A₂ value for radionuclide i.

c. If the package contains both special and normal form radioactive material, the activity that may be transported in a Type A package is as follows:

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

where B(i) is the activity of radionuclide i as special form radioactive material, A₁(i) is the A₁ value for radionuclide i, C(j) is the activity of radionuclide j as normal form radio-

active material, and A₂(j) is the A₂ value for radionuclide j.

d. Alternatively, the A₁ value for mixtures of special form material may be determined as follows:

$$A_1 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_1(i)}}$$

where f(i) is the fraction of activity for radionuclide i in the mixture and A₁(i) is the appropriate A₁ value for radionuclide i.

e. Alternatively, the A₂ value for mixtures of normal form material may be determined as follows:

$$A_2 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where $f(i)$ is the fraction of activity for radionuclide i in the mixture and $A_2(i)$ is the appropriate A_2 value for radionuclide i .

f. The exempt activity concentration for mixtures of nuclides may be determined as follows:

$$\text{Exempt activity concentration for mixture} = \frac{1}{\sum_i \frac{f(i)}{[A](i)}}$$

where $f(i)$ is the fraction of activity concentration of radionuclide i in the mixture and $[A](i)$ is the activity concentration for exempt material containing radionuclide i .

g. The activity limit for an exempt consignment for mixtures of radionuclides may be determined as follows:

$$\text{Exempt consignment activity limit for mixture} = \frac{1}{\sum_i \frac{f(i)}{A(i)}}$$

where $f(i)$ is the fraction of activity of radionuclide i in the mixture and $A(i)$ is the activity limit for exempt consignments for radionuclide i .

V.a. 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 A_1 or A_2 value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraph IV. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest A_1 or A_2 values for the alpha emitters and beta/gamma emitters.

b. 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 $[A]$ (activity concentration for exempt material) or A (activity limit for exempt consignment) value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraph IV of this appendix. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest $[A]$ or A values for the alpha emitters and beta/gamma emitters, respectively.

TABLE A-1— A_1 AND A_2 VALUES FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	A_1 (TBq)	A_1 (Ci) ^b	A_2 (TBq)	A_2 (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
Ac-225 (a)	Actinium (89)	8.0×10^{-1}	2.2×10^1	6.0×10^{-3}	1.6×10^{-1}	2.1×10^3	5.8×10^4
Ac-227 (a) .....	.....	9.0×10^{-1}	2.4×10^1	9.0×10^{-5}	2.4×10^{-3}	2.7	7.2×10^1
Ac-228 .....	.....	6.0×10^{-1}	1.6×10^1	5.0×10^{-1}	1.4×10^1	8.4×10^4	2.2×10^6
Ag-105	Silver (47)	2.0	5.4×10^1	2.0	5.4×10^1	1.1×10^3	3.0×10^4
Ag-108m (a) .....	.....	7.0×10^{-1}	1.9×10^1	7.0×10^{-1}	1.9×10^1	9.7×10^{-1}	2.6×10^1
Ag-110m (a) .....	.....	4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	1.8×10^2	4.7×10^3
Ag-111 .....	.....	2.0	5.4×10^1	6.0×10^{-1}	1.6×10^1	5.8×10^3	1.6×10^5
Al-26	Aluminum (13)	1.0×10^{-1}	2.7	1.0×10^{-1}	2.7	7.0×10^{-4}	1.9×10^{-2}
Am-241	Americium (95)	1.0×10^1	2.7×10^2	1.0×10^{-3}	2.7×10^{-2}	1.3×10^{-1}	3.4
Am-242m (a) .....	.....	1.0×10^1	2.7×10^2	1.0×10^{-3}	2.7×10^{-2}	3.6×10^{-1}	1.0×10^1

TABLE A–1—A₁ AND A₂ VALUES FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
Am-243 (a)	.....	5.0	1.4×10^2	1.0×10^{-3}	2.7×10^{-2}	7.4×10^{-3}	2.0×10^{-1}
Ar-37	Argon (18)	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	3.7×10^3	9.9×10^4
Ar-39	.....	4.0×10^1	1.1×10^3	2.0×10^1	5.4×10^2	1.3	3.4×10^1
Ar-41	.....	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.5×10^6	4.2×10^7
As-72	Arsenic (33)	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	6.2×10^4	1.7×10^6
As-73	.....	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	8.2×10^2	2.2×10^4
As-74	.....	1.0	2.7×10^1	9.0×10^{-1}	2.4×10^1	3.7×10^3	9.9×10^4
As-76	.....	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	5.8×10^4	1.6×10^6
As-77	.....	2.0×10^1	5.4×10^2	7.0×10^{-1}	1.9×10^1	3.9×10^4	1.0×10^6
At-211 (a)	Astatine (85)	2.0×10^1	5.4×10^2	5.0×10^{-1}	1.4×10^1	7.6×10^4	2.1×10^6
Au-193	Gold (79)	7.0	1.9×10^2	2.0	5.4×10^1	3.4×10^4	9.2×10^5
Au-194	.....	1.0	2.7×10^1	1.0	2.7×10^1	1.5×10^4	4.1×10^5
Au-195	.....	1.0×10^1	2.7×10^2	6.0	1.6×10^2	1.4×10^2	3.7×10^3
Au-198	.....	1.0	2.7×10^1	6.0×10^{-1}	1.6×10^1	9.0×10^3	2.4×10^5
Au-199	.....	1.0×10^1	2.7×10^2	6.0×10^{-1}	1.6×10^1	7.7×10^3	2.1×10^5
Ba-131 (a)	Barium (56)	2.0	5.4×10^1	2.0	5.4×10^1	3.1×10^3	8.4×10^4
Ba-133	.....	3.0	8.1×10^1	3.0	8.1×10^1	9.4	2.6×10^2
Ba-133m	.....	2.0×10^1	5.4×10^2	6.0×10^{-1}	1.6×10^1	2.2×10^4	6.1×10^5
Ba-140 (a)	.....	5.0×10^{-1}	1.4×10^1	3.0×10^{-1}	8.1	2.7×10^3	7.3×10^4
Be-7	Beryllium (4)	2.0×10^1	5.4×10^2	2.0×10^1	5.4×10^2	1.3×10^4	3.5×10^5
Be-10	.....	4.0×10^1	1.1×10^3	6.0×10^{-1}	1.6×10^1	8.3×10^{-4}	2.2×10^{-2}
Bi-205	Bismuth (83)	7.0×10^{-1}	1.9×10^1	7.0×10^{-1}	1.9×10^1	1.5×10^3	4.2×10^4
Bi-206	.....	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	3.8×10^3	1.0×10^5
Bi-207	.....	7.0×10^{-1}	1.9×10^1	7.0×10^{-1}	1.9×10^1	1.9	5.2×10^1
Bi-210	.....	1.0	2.7×10^1	6.0×10^{-1}	1.6×10^1	4.6×10^3	1.2×10^5
Bi-210m (a)	.....	6.0×10^{-1}	1.6×10^1	2.0×10^{-2}	5.4×10^{-1}	2.1×10^{-5}	5.7×10^{-4}
Bi-212 (a)	.....	7.0×10^{-1}	1.9×10^1	6.0×10^{-1}	1.6×10^1	5.4×10^5	1.5×10^7
Bk-247	Berkelium (97)	8.0	2.2×10^2	8.0×10^{-4}	2.2×10^{-2}	3.8×10^{-2}	1.0
Bk-249 (a)	.....	4.0×10^1	1.1×10^3	3.0×10^{-1}	8.1	6.1×10^1	1.6×10^3
Br-76	Bromine (35)	4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	9.4×10^4	2.5×10^6
Br-77	.....	3.0	8.1×10^1	3.0	8.1×10^1	2.6×10^4	7.1×10^5
Br-82	.....	4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	4.0×10^4	1.1×10^6
C-11	Carbon (6)	1.0	2.7×10^1	6.0×10^{-1}	1.6×10^1	3.1×10^7	8.4×10^8
C-14	.....	4.0×10^1	1.1×10^3	3.0	8.1×10^1	1.6×10^{-1}	4.5
Ca-41	Calcium (20)	Unlimited	Unlimited	Unlimited	Unlimited	3.1×10^{-3}	8.5×10^{-2}
Ca-45	.....	4.0×10^1	1.1×10^3	1.0	2.7×10^1	6.6×10^2	1.8×10^4
Ca-47 (a)	.....	3.0	8.1×10^1	3.0×10^{-1}	8.1	2.3×10^4	6.1×10^5
Cd-109	Cadmium (48)	3.0×10^1	8.1×10^2	2.0	5.4×10^1	9.6×10^1	2.6×10^3
Cd-113m	.....	4.0×10^1	1.1×10^3	5.0×10^{-1}	1.4×10^1	8.3	2.2×10^2
Cd-115 (a)	.....	3.0	8.1×10^1	4.0×10^{-1}	1.1×10^1	1.9×10^4	5.1×10^5
Cd-115m	.....	5.0×10^{-1}	1.4×10^1	5.0×10^{-1}	1.4×10^1	9.4×10^2	2.5×10^4
Ce-139	Cerium (58)	7.0	1.9×10^2	2.0	5.4×10^1	2.5×10^2	6.8×10^3
Ce-141	.....	2.0×10^1	5.4×10^2	6.0×10^{-1}	1.6×10^1	1.1×10^3	2.8×10^4
Ce-143	.....	9.0×10^{-1}	2.4×10^1	6.0×10^{-1}	1.6×10^1	2.5×10^4	6.6×10^5
Ce-144 (a)	.....	2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	1.2×10^2	3.2×10^3
Cf-248	Californium (98)	4.0×10^1	1.1×10^3	6.0×10^{-3}	1.6×10^{-1}	5.8×10^1	1.6×10^3
Cf-249	.....	3.0	8.1×10^1	8.0×10^{-4}	2.2×10^{-2}	1.5×10^{-1}	4.1
Cf-250	.....	2.0×10^1	5.4×10^2	2.0×10^{-3}	5.4×10^{-2}	4.0	1.1×10^2
Cf-251	.....	7.0	1.9×10^2	7.0×10^{-4}	1.9×10^{-2}	5.9×10^{-2}	1.6
Cf-252	.....	1.0×10^{-1}	2.7	3.0×10^{-3}	8.1×10^{-2}	2.0×10^1	5.4×10^2
Cf-253 (a)	.....	4.0×10^1	1.1×10^3	4.0×10^{-2}	1.1	1.1×10^3	2.9×10^4
Cf-254	.....	1.0×10^{-3}	2.7×10^{-2}	1.0×10^{-3}	2.7×10^{-2}	3.1×10^2	8.5×10^3
Cl-36	Chlorine (17)	1.0×10^1	2.7×10^2	6.0×10^{-1}	1.6×10^1	1.2×10^{-3}	3.3×10^{-2}
Cl-38	.....	2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	4.9×10^6	1.3×10^8
Cm-240	Curium (96)	4.0×10^1	1.1×10^3	2.0×10^{-2}	5.4×10^{-1}	7.5×10^2	2.0×10^4
Cm-241	.....	2.0	5.4×10^1	1.0	2.7×10^1	6.1×10^2	1.7×10^4
Cm-242	.....	4.0×10^1	1.1×10^3	1.0×10^{-2}	2.7×10^{-1}	1.2×10^2	3.3×10^3
Cm-243	.....	9.0	2.4×10^2	1.0×10^{-3}	2.7×10^{-2}	1.9×10^{-3}	5.2×10^1
Cm-244	.....	2.0×10^1	5.4×10^2	2.0×10^{-3}	5.4×10^{-2}	3.0	8.1×10^1
Cm-245	.....	9.0	2.4×10^2	9.0×10^{-4}	2.4×10^{-2}	6.4×10^{-3}	1.7×10^{-1}
Cm-246	.....	9.0	2.4×10^2	9.0×10^{-4}	2.4×10^{-2}	1.1×10^{-2}	3.1×10^{-1}
Cm-247 (a)	.....	3.0	8.1×10^1	1.0×10^{-3}	2.7×10^{-2}	3.4×10^{-6}	9.3×10^{-5}
Cm-248	.....	2.0×10^{-2}	5.4×10^{-1}	3.0×10^{-4}	8.1×10^{-3}	1.6×10^{-4}	4.2×10^{-3}
Co-55	Cobalt (27)	5.0×10^{-1}	1.4×10^1	5.0×10^{-1}	1.4×10^1	1.1×10^5	3.1×10^6
Co-56	.....	3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.1×10^3	3.0×10^4
Co-57	.....	1.0×10^1	2.7×10^2	1.0×10^1	2.7×10^2	3.1×10^2	8.4×10^3
Co-58	.....	1.0	2.7×10^1	1.0	2.7×10^1	1.2×10^3	3.2×10^4
Co-58m	.....	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	2.2×10^5	5.9×10^6
Co-60	.....	4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	4.2×10^1	1.1×10^3
Cr-51	Chromium (24)	3.0×10^1	8.1×10^2	3.0×10^1	8.1×10^2	3.4×10^3	9.2×10^4

TABLE A-1—A₁ AND A₂ VALUES FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
Cs-129	Cesium (55)	4.0	1.1 × 10 ²	4.0	1.1 × 10 ²	2.8 × 10 ⁴	7.6 × 10 ⁵
Cs-131		3.0 × 10 ¹	8.1 × 10 ²	3.0 × 10 ¹	8.1 × 10 ²	3.8 × 10 ³	1.0 × 10 ⁵
Cs-132		1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	5.7 × 10 ³	1.5 × 10 ⁵
Cs-134		7.0 × 10 ⁻¹	1.9 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	4.8 × 10 ¹	1.3 × 10 ³
Cs-134m		4.0 × 10 ¹	1.1 × 10 ³	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.0 × 10 ⁵	8.0 × 10 ⁶
Cs-135		4.0 × 10 ¹	1.1 × 10 ³	1.0	2.7 × 10 ¹	4.3 × 10 ⁻⁵	1.2 × 10 ⁻³
Cs-136		5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	2.7 × 10 ³	7.3 × 10 ⁴
Cs-137 (a)		2.0	5.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.2	8.7 × 10 ¹
Cu-64	Copper (29)	6.0	1.6 × 10 ²	1.0	2.7 × 10 ¹	1.4 × 10 ⁵	3.9 × 10 ⁶
Cu-67		1.0 × 10 ¹	2.7 × 10 ²	7.0 × 10 ⁻¹	1.9 × 10 ¹	2.8 × 10 ⁴	7.6 × 10 ⁵
Dy-159	Dysprosium (66)	2.0 × 10 ¹	5.4 × 10 ²	2.0 × 10 ¹	5.4 × 10 ²	2.1 × 10 ²	5.7 × 10 ³
Dy-165		9.0 × 10 ⁻¹	2.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.0 × 10 ⁵	8.2 × 10 ⁶
Dy-166 (a)		9.0 × 10 ⁻¹	2.4 × 10 ¹	3.0 × 10 ⁻¹	8.1	8.6 × 10 ³	2.3 × 10 ⁵
Er-169	Erbium (68)	4.0 × 10 ¹	1.1 × 10 ³	1.0	2.7 × 10 ¹	3.1 × 10 ³	8.3 × 10 ⁴
Er-171		8.0 × 10 ⁻¹	2.2 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	9.0 × 10 ⁴	2.4 × 10 ⁶
Eu-147	Europium (63)	2.0	5.4 × 10 ¹	2.0	5.4 × 10 ¹	1.4 × 10 ³	3.7 × 10 ⁴
Eu-148		5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	6.0 × 10 ²	1.6 × 10 ⁴
Eu-149		2.0 × 10 ¹	5.4 × 10 ²	2.0 × 10 ¹	5.4 × 10 ²	3.5 × 10 ²	9.4 × 10 ³
Eu-150 (short lived)		2.0	5.4 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	6.1 × 10 ⁴	1.6 × 10 ⁶
Eu-150 (long lived)		7.0 × 10 ⁻¹	1.9 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	6.1 × 10 ⁴	1.6 × 10 ⁶
Eu-152		1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	6.5	1.8 × 10 ²
Eu-152m		8.0 × 10 ⁻¹	2.2 × 10 ¹	8.0 × 10 ⁻¹	2.2 × 10 ¹	8.2 × 10 ⁴	2.2 × 10 ⁶
Eu-154		9.0 × 10 ⁻¹	2.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	9.8	2.6 × 10 ²
Eu-155		2.0 × 10 ¹	5.4 × 10 ²	3.0	8.1 × 10 ¹	1.8 × 10 ¹	4.9 × 10 ²
Eu-156		7.0 × 10 ⁻¹	1.9 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	2.0 × 10 ³	5.5 × 10 ⁴
F-18	Fluorine (9)	1.0	2.7 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.5 × 10 ⁶	9.5 × 10 ⁷
Fe-52 (a)	Iron (26)	3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	2.7 × 10 ⁵	7.3 × 10 ⁶
Fe-55		4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	8.8 × 10 ¹	2.4 × 10 ³
Fe-59		9.0 × 10 ⁻¹	2.4 × 10 ¹	9.0 × 10 ⁻¹	2.4 × 10 ¹	1.8 × 10 ³	5.0 × 10 ⁴
Fe-60 (a)		4.0 × 10 ¹	1.1 × 10 ³	2.0 × 10 ⁻¹	5.4	7.4 × 10 ⁻⁴	2.0 × 10 ⁻²
Ga-67	Gallium (31)	7.0	1.9 × 10 ²	3.0	8.1 × 10 ¹	2.2 × 10 ⁴	6.0 × 10 ⁵
Ga-68		5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	1.5 × 10 ⁶	4.1 × 10 ⁷
Ga-72		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	1.1 × 10 ⁵	3.1 × 10 ⁶
Gd-146 (a)	Gadolinium (64)	5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	6.9 × 10 ²	1.9 × 10 ⁴
Gd-148		2.0 × 10 ¹	5.4 × 10 ²	2.0 × 10 ⁻³	5.4 × 10 ⁻²	1.2	3.2 × 10 ¹
Gd-153		1.0 × 10 ¹	2.7 × 10 ²	9.0	2.4 × 10 ²	1.3 × 10 ²	3.5 × 10 ³
Gd-159		3.0	8.1 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.9 × 10 ⁴	1.1 × 10 ⁶
Ge-68 (a)	Germanium (32)	5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	2.6 × 10 ²	7.1 × 10 ³
Ge-71		4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	5.8 × 10 ³	1.6 × 10 ⁵
Ge-77		3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	1.3 × 10 ⁵	3.6 × 10 ⁶
Hf-172 (a)	Hafnium (72)	6.0 × 10 ⁻¹	1.6 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	4.1 × 10 ¹	1.1 × 10 ³
Hf-175		3.0	8.1 × 10 ¹	3.0	8.1 × 10 ¹	3.9 × 10 ²	1.1 × 10 ⁴
Hf-181		2.0	5.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	6.3 × 10 ²	1.7 × 10 ⁴
Hf-182		Unlimited	Unlimited	Unlimited	Unlimited	8.1 × 10 ⁻⁶	2.2 × 10 ⁻⁴
Hg-194	Mercury (80)	1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	1.3 × 10 ⁻¹	3.5
Hg-195m (a)		3.0	8.1 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	1.5 × 10 ⁴	4.0 × 10 ⁵
Hg-197		2.0 × 10 ¹	5.4 × 10 ²	1.0 × 10 ¹	2.7 × 10 ²	9.2 × 10 ³	2.5 × 10 ⁵
Hg-197m		1.0 × 10 ¹	2.7 × 10 ²	4.0 × 10 ⁻¹	1.1 × 10 ¹	2.5 × 10 ⁴	6.7 × 10 ⁵
Hg-203		5.0	1.4 × 10 ²	1.0	2.7 × 10 ¹	5.1 × 10 ²	1.4 × 10 ⁴
Ho-166	Holmium (67)	4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	2.6 × 10 ⁴	7.0 × 10 ⁵
Ho-166m		6.0 × 10 ⁻¹	1.6 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	6.6 × 10 ⁻²	1.8
I-123	Iodine (53)	6.0	1.6 × 10 ²	3.0	8.1 × 10 ¹	7.1 × 10 ⁴	1.9 × 10 ⁶
I-124		1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	9.3 × 10 ³	2.5 × 10 ⁵
I-125		2.0 × 10 ¹	5.4 × 10 ²	3.0	8.1 × 10 ¹	6.4 × 10 ²	1.7 × 10 ⁴
I-126		2.0	5.4 × 10 ¹	1.0	2.7 × 10 ¹	2.9 × 10 ³	8.0 × 10 ⁴
I-129		Unlimited	Unlimited	Unlimited	Unlimited	6.5 × 10 ⁻⁶	1.8 × 10 ⁻⁴
I-131		3.0	8.1 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	4.6 × 10 ³	1.2 × 10 ⁵
I-132		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	3.8 × 10 ⁵	1.0 × 10 ⁷
I-133		7.0 × 10 ⁻¹	1.9 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	4.2 × 10 ⁴	1.1 × 10 ⁶
I-134		3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	9.9 × 10 ⁵	2.7 × 10 ⁷
I-135 (a)		6.0 × 10 ⁻¹	1.6 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	1.3 × 10 ⁵	3.5 × 10 ⁶
In-111	Indium (49)	3.0	8.1 × 10 ¹	3.0	8.1 × 10 ¹	1.5 × 10 ⁴	4.2 × 10 ⁵
In-113m		4.0	1.1 × 10 ²	2.0	5.4 × 10 ¹	6.2 × 10 ⁵	1.7 × 10 ⁷
In-114m (a)		1.0 × 10 ¹	2.7 × 10 ²	5.0 × 10 ⁻¹	1.4 × 10 ¹	8.6 × 10 ²	2.3 × 10 ⁴
In-115m		7.0	1.9 × 10 ²	1.0	2.7 × 10 ¹	2.2 × 10 ⁵	6.1 × 10 ⁶
Ir-189 (a)	Iridium (77)	1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ¹	2.7 × 10 ²	1.9 × 10 ³	5.2 × 10 ⁴
Ir-190		7.0 × 10 ⁻¹	1.9 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	2.3 × 10 ³	6.2 × 10 ⁴
Ir-192		°1.0	°2.7 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.4 × 10 ²	9.2 × 10 ³
Ir-194		3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	3.1 × 10 ⁴	8.4 × 10 ⁵
K-40	Potassium (19)	9.0 × 10 ⁻¹	2.4 × 10 ¹	9.0 × 10 ⁻¹	2.4 × 10 ¹	2.4 × 10 ⁻⁷	6.4 × 10 ⁻⁶

TABLE A–1—A₁ AND A₂ VALUES FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
K-42		2.0 × 10 ⁻¹	5.4	2.0 × 10 ⁻¹	5.4	2.2 × 10 ⁵	6.0 × 10 ⁶
K-43		7.0 × 10 ⁻¹	1.9 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	1.2 × 10 ⁵	3.3 × 10 ⁶
Kr-79	Krypton (36)	4.0	1.1 × 10 ²	2.0	5.4 × 10 ¹	4.2 × 10 ⁴	1.1 × 10 ⁶
Kr-81		4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	7.8 × 10 ⁻⁴	2.1 × 10 ⁻²
Kr-85		1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ¹	2.7 × 10 ²	1.5 × 10 ¹	3.9 × 10 ²
Kr-85m		8.0	2.2 × 10 ²	3.0	8.1 × 10 ¹	3.0 × 10 ⁵	8.2 × 10 ⁶
Kr-87		2.0 × 10 ⁻¹	5.4	2.0 × 10 ⁻¹	5.4	1.0 × 10 ⁶	2.8 × 10 ⁷
La-137	Lanthanum (57)	3.0 × 10 ¹	8.1 × 10 ²	6.0	1.6 × 10 ²	1.6 × 10 ⁻³	4.4 × 10 ⁻²
La-140		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	2.1 × 10 ⁴	5.6 × 10 ⁵
Lu-172	Lutetium (71)	6.0 × 10 ⁻¹	1.6 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	4.2 × 10 ³	1.1 × 10 ⁵
Lu-173		8.0	2.2 × 10 ²	8.0	2.2 × 10 ²	5.6 × 10 ¹	1.5 × 10 ³
Lu-174		9.0	2.4 × 10 ²	9.0	2.4 × 10 ²	2.3 × 10 ¹	6.2 × 10 ²
Lu-174m		2.0 × 10 ¹	5.4 × 10 ²	1.0 × 10 ¹	2.7 × 10 ²	2.0 × 10 ²	5.3 × 10 ³
Lu-177		3.0 × 10 ¹	8.1 × 10 ²	7.0 × 10 ⁻¹	1.9 × 10 ¹	4.1 × 10 ³	1.1 × 10 ⁵
Mg-28 (a)	Magnesium (12)	3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	2.0 × 10 ⁵	5.4 × 10 ⁶
Mn-52	Manganese (25)	3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	1.6 × 10 ⁴	4.4 × 10 ⁵
Mn-53		Unlimited	Unlimited	Unlimited	Unlimited	6.8 × 10 ⁻⁵	1.8 × 10 ⁻³
Mn-54		1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	2.9 × 10 ²	7.7 × 10 ³
Mn-56		3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	8.0 × 10 ⁵	2.2 × 10 ⁷
Mo-93	Molybdenum (42)	4.0 × 10 ¹	1.1 × 10 ³	2.0 × 10 ¹	5.4 × 10 ²	4.1 × 10 ⁻²	1.1
Mo-99 ^{a,h}		1.0	2.7 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	1.8 × 10 ⁴	4.8 × 10 ⁵
N-13	Nitrogen (7)	9.0 × 10 ⁻¹	2.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	5.4 × 10 ⁷	1.5 × 10 ⁹
Na-22	Sodium (11)	5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	2.3 × 10 ²	6.3 × 10 ³
Na-24		2.0 × 10 ⁻¹	5.4	2.0 × 10 ⁻¹	5.4	3.2 × 10 ⁵	8.7 × 10 ⁶
Nb-93m	Niobium (41)	4.0 × 10 ¹	1.1 × 10 ³	3.0 × 10 ¹	8.1 × 10 ²	8.8	2.4 × 10 ²
Nb-94		7.0 × 10 ⁻¹	1.9 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	6.9 × 10 ⁻³	1.9 × 10 ⁻¹
Nb-95		1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	1.5 × 10 ³	3.9 × 10 ⁴
Nb-97		9.0 × 10 ⁻¹	2.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	9.9 × 10 ⁵	2.7 × 10 ⁷
Nd-147	Neodymium (60)	6.0	1.6 × 10 ²	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.0 × 10 ³	8.1 × 10 ⁴
Nd-149		6.0 × 10 ⁻¹	1.6 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	4.5 × 10 ⁵	1.2 × 10 ⁷
Ni-59	Nickel (28)	Unlimited	Unlimited	Unlimited	Unlimited	3.0 × 10 ⁻³	8.0 × 10 ⁻²
Ni-63		4.0 × 10 ¹	1.1 × 10 ³	3.0 × 10 ¹	8.1 × 10 ²	2.1	5.7 × 10 ¹
Ni-65		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	7.1 × 10 ⁵	1.9 × 10 ⁷
Np-235	Neptunium (93)	4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	5.2 × 10 ¹	1.4 × 10 ³
Np-236 (short-lived)		2.0 × 10 ¹	5.4 × 10 ²	2.0	5.4 × 10 ¹	4.7 × 10 ⁻⁴	1.3 × 10 ⁻²
Np-236 (long-lived)		9.0 × 10 ⁰	2.4 × 10 ²	2.0 × 10 ⁻²	5.4 × 10 ⁻¹	4.7 × 10 ⁻⁴	1.3 × 10 ⁻²
Np-237		2.0 × 10 ¹	5.4 × 10 ²	2.0 × 10 ⁻³	5.4 × 10 ⁻²	2.6 × 10 ⁻⁵	7.1 × 10 ⁻⁴
Np-239		7.0	1.9 × 10 ²	4.0 × 10 ⁻¹	1.1 × 10 ¹	8.6 × 10 ³	2.3 × 10 ⁵
Os-185	Osmium (76)	1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	2.8 × 10 ²	7.5 × 10 ³
Os-191		1.0 × 10 ¹	2.7 × 10 ²	2.0	5.4 × 10 ¹	1.6 × 10 ³	4.4 × 10 ⁴
Os-191m		4.0 × 10 ¹	1.1 × 10 ³	3.0 × 10 ¹	8.1 × 10 ²	4.6 × 10 ⁴	1.3 × 10 ⁶
Os-193		2.0	5.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	2.0 × 10 ⁴	5.3 × 10 ⁵
Os-194 (a)		3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	1.1 × 10 ¹	3.1 × 10 ²
P-32	Phosphorus (15)	5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	1.1 × 10 ⁴	2.9 × 10 ⁵
P-33		4.0 × 10 ¹	1.1 × 10 ³	1.0	2.7 × 10 ¹	5.8 × 10 ³	1.6 × 10 ⁵
Pa-230 (a)	Protactinium (91)	2.0	5.4 × 10 ¹	7.0 × 10 ⁻²	1.9	1.2 × 10 ³	3.3 × 10 ⁴
Pa-231		4.0	1.1 × 10 ²	4.0 × 10 ⁻⁴	1.1 × 10 ⁻²	1.7 × 10 ⁻³	4.7 × 10 ⁻²
Pa-233		5.0	1.4 × 10 ²	7.0 × 10 ⁻¹	1.9 × 10 ¹	7.7 × 10 ²	2.1 × 10 ⁴
Pb-201	Lead (82)	1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	6.2 × 10 ⁴	1.7 × 10 ⁶
Pb-202		4.0 × 10 ¹	1.1 × 10 ³	2.0 × 10 ¹	5.4 × 10 ²	1.2 × 10 ⁻⁴	3.4 × 10 ⁻³
Pb-203		4.0	1.1 × 10 ²	3.0	8.1 × 10 ¹	1.1 × 10 ⁴	3.0 × 10 ⁵
Pb-205		Unlimited	Unlimited	Unlimited	Unlimited	4.5 × 10 ⁻⁶	1.2 × 10 ⁻⁴
Pb-210 (a)		1.0	2.7 × 10 ¹	5.0 × 10 ⁻²	1.4	2.8	7.6 × 10 ¹
Pb-212 (a)		7.0 × 10 ⁻¹	1.9 × 10 ¹	2.0 × 10 ⁻¹	5.4	5.1 × 10 ⁴	1.4 × 10 ⁶
Pd-103 (a)	Palladium (46)	4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	2.8 × 10 ³	7.5 × 10 ⁴
Pd-107		Unlimited	Unlimited	Unlimited	Unlimited	1.9 × 10 ⁻⁵	5.1 × 10 ⁻⁴
Pd-109		2.0	5.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	7.9 × 10 ⁴	2.1 × 10 ⁶
Pm-143	Promethium (61)	3.0	8.1 × 10 ¹	3.0	8.1 × 10 ¹	1.3 × 10 ²	3.4 × 10 ³
Pm-144		7.0 × 10 ⁻¹	1.9 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	9.2 × 10 ¹	2.5 × 10 ³
Pm-145		3.0 × 10 ¹	8.1 × 10 ²	1.0 × 10 ¹	2.7 × 10 ²	5.2	1.4 × 10 ²
Pm-147		4.0 × 10 ¹	1.1 × 10 ³	2.0	5.4 × 10 ¹	3.4 × 10 ¹	9.3 × 10 ²
Pm-148m (a)		8.0 × 10 ⁻¹	2.2 × 10 ¹	7.0 × 10 ⁻¹	1.9 × 10 ¹	7.9 × 10 ²	2.1 × 10 ⁴
Pm-149		2.0	5.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	1.5 × 10 ⁴	4.0 × 10 ⁵
Pm-151		2.0	5.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	2.7 × 10 ⁴	7.3 × 10 ⁵
Po-210	Polonium (84)	4.0 × 10 ¹	1.1 × 10 ³	2.0 × 10 ⁻²	5.4 × 10 ⁻¹	1.7 × 10 ²	4.5 × 10 ³
Pr-142	Praseodymium (59)	4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	4.3 × 10 ⁴	1.2 × 10 ⁶
Pr-143		3.0	8.1 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	2.5 × 10 ³	6.7 × 10 ⁴
Pt-188 (a)	Platinum (78)	1.0	2.7 × 10 ¹	8.0 × 10 ⁻¹	2.2 × 10 ¹	2.5 × 10 ³	6.8 × 10 ⁴
Pt-191		4.0	1.1 × 10 ²	3.0	8.1 × 10 ¹	8.7 × 10 ³	2.4 × 10 ⁵
Pt-193		4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	1.4	3.7 × 10 ¹

TABLE A-1—A₁ AND A₂ VALUES FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
Pt-193m		4.0 × 10 ¹	1.1 × 10 ³	5.0 × 10 ⁻¹	1.4 × 10 ¹	5.8 × 10 ³	1.6 × 10 ⁵
Pt-195m		1.0 × 10 ¹	2.7 × 10 ²	5.0 × 10 ⁻¹	1.4 × 10 ¹	6.2 × 10 ³	1.7 × 10 ⁵
Pt-197		2.0 × 10 ¹	5.4 × 10 ²	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.2 × 10 ⁴	8.7 × 10 ⁵
Pt-197m		1.0 × 10 ¹	2.7 × 10 ²	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.7 × 10 ⁵	1.0 × 10 ⁷
Pu-236	Plutonium (94)	3.0 × 10 ¹	8.1 × 10 ²	3.0 × 10 ⁻³	8.1 × 10 ⁻²	2.0 × 10 ¹	5.3 × 10 ²
Pu-237		2.0 × 10 ¹	5.4 × 10 ²	2.0 × 10 ¹	5.4 × 10 ²	4.5 × 10 ²	1.2 × 10 ⁴
Pu-238		1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ⁻³	2.7 × 10 ⁻²	6.3 × 10 ⁻¹	1.7 × 10 ¹
Pu-239		1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ⁻³	2.7 × 10 ⁻²	2.3 × 10 ⁻³	6.2 × 10 ⁻²
Pu-240		1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ⁻³	2.7 × 10 ⁻²	8.4 × 10 ⁻³	2.3 × 10 ⁻¹
Pu-241 (a)		4.0 × 10 ¹	1.1 × 10 ³	6.0 × 10 ⁻²	1.6	3.8	1.0 × 10 ²
Pu-242		1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ⁻³	2.7 × 10 ⁻²	1.5 × 10 ⁻⁴	3.9 × 10 ⁻³
Pu-244 (a)		4.0 × 10 ⁻¹	1.1 × 10 ¹	1.0 × 10 ⁻³	2.7 × 10 ⁻²	6.7 × 10 ⁻⁷	1.8 × 10 ⁻⁵
Ra-223 (a)	Radium (88)	4.0 × 10 ⁻¹	1.1 × 10 ¹	7.0 × 10 ⁻³	1.9 × 10 ⁻¹	1.9 × 10 ³	5.1 × 10 ⁴
Ra-224 (a)		4.0 × 10 ⁻¹	1.1 × 10 ¹	2.0 × 10 ⁻²	5.4 × 10 ⁻¹	5.9 × 10 ³	1.6 × 10 ⁵
Ra-225 (a)		2.0 × 10 ⁻¹	5.4	4.0 × 10 ⁻³	1.1 × 10 ⁻¹	1.5 × 10 ³	3.9 × 10 ⁴
Ra-226 (a)		2.0 × 10 ⁻¹	5.4	3.0 × 10 ⁻³	8.1 × 10 ⁻²	3.7 × 10 ⁻²	1.0
Ra-228 (a)		6.0 × 10 ⁻¹	1.6 × 10 ¹	2.0 × 10 ⁻²	5.4 × 10 ⁻¹	1.0 × 10 ¹	2.7 × 10 ²
Rb-81	Rubidium (37)	2.0	5.4 × 10 ¹	8.0 × 10 ⁻¹	2.2 × 10 ¹	3.1 × 10 ⁵	8.4 × 10 ⁶
Rb-83 (a)		2.0	5.4 × 10 ¹	2.0	5.4 × 10 ¹	6.8 × 10 ²	1.8 × 10 ⁴
Rb-84		1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	1.8 × 10 ³	4.7 × 10 ⁴
Rb-86		5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	3.0 × 10 ³	8.1 × 10 ⁴
Rb-87		Unlimited	Unlimited	Unlimited	Unlimited	3.2 × 10 ⁻⁹	8.6 × 10 ⁻⁸
Rb(nat)		Unlimited	Unlimited	Unlimited	Unlimited	6.7 × 10 ⁶	1.8 × 10 ⁸
Re-184	Rhenium (75)	1.0	2.7 × 10 ¹	1.0	2.7 × 10 ¹	6.9 × 10 ²	1.9 × 10 ⁴
Re-184m		3.0	8.1 × 10 ¹	1.0	2.7 × 10 ¹	1.6 × 10 ²	4.3 × 10 ³
Re-186		2.0	5.4 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	6.9 × 10 ³	1.9 × 10 ⁵
Re-187		Unlimited	Unlimited	Unlimited	Unlimited	1.4 × 10 ⁻⁹	3.8 × 10 ⁻⁸
Re-188		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	3.6 × 10 ⁴	9.8 × 10 ⁵
Re-189 (a)		3.0	8.1 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	2.5 × 10 ⁴	6.8 × 10 ⁵
Re(nat)		Unlimited	Unlimited	Unlimited	Unlimited	0.0	2.4 × 10 ⁻⁸
Rh-99	Rhodium (45)	2.0	5.4 × 10 ¹	2.0	5.4 × 10 ¹	3.0 × 10 ³	8.2 × 10 ⁴
Rh-101		4.0	1.1 × 10 ²	3.0	8.1 × 10 ¹	4.1 × 10 ¹	1.1 × 10 ³
Rh-102		5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	4.5 × 10 ¹	1.2 × 10 ³
Rh-102m		2.0	5.4 × 10 ¹	2.0	5.4 × 10 ¹	2.3 × 10 ²	6.2 × 10 ³
Rh-103m		4.0 × 10 ¹	1.1 × 10 ³	4.0 × 10 ¹	1.1 × 10 ³	1.2 × 10 ⁶	3.3 × 10 ⁷
Rh-105		1.0 × 10 ¹	2.7 × 10 ²	8.0 × 10 ⁻¹	2.2 × 10 ¹	3.1 × 10 ⁴	8.4 × 10 ⁵
Rn-222 (a)	Radon (86)	3.0 × 10 ⁻¹	8.1	4.0 × 10 ⁻³	1.1 × 10 ⁻¹	5.7 × 10 ³	1.5 × 10 ⁵
Ru-97	Ruthenium (44)	5.0	1.4 × 10 ²	5.0	1.4 × 10 ²	1.7 × 10 ⁴	4.6 × 10 ⁵
Ru-103 (a)		2.0	5.4 × 10 ¹	2.0	5.4 × 10 ¹	1.2 × 10 ³	3.2 × 10 ⁴
Ru-105		1.0	2.7 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	2.5 × 10 ⁵	6.7 × 10 ⁶
Ru-106 (a)		2.0 × 10 ⁻¹	5.4	2.0 × 10 ⁻¹	5.4	1.2 × 10 ²	3.3 × 10 ³
S-35	Sulphur (16)	4.0 × 10 ¹	1.1 × 10 ³	3.0	8.1 × 10 ¹	1.6 × 10 ³	4.3 × 10 ⁴
Sb-122	Antimony (51)	4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	1.5 × 10 ⁴	4.0 × 10 ⁵
Sb-124		6.0 × 10 ⁻¹	1.6 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	6.5 × 10 ²	1.7 × 10 ⁴
Sb-125		2.0	5.4 × 10 ¹	1.0	2.7 × 10 ¹	3.9 × 10 ¹	1.0 × 10 ³
Sb-126		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	3.1 × 10 ³	8.4 × 10 ⁴
Sc-44	Scandium (21)	5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	6.7 × 10 ⁵	1.8 × 10 ⁷
Sc-46		5.0 × 10 ⁻¹	1.4 × 10 ¹	5.0 × 10 ⁻¹	1.4 × 10 ¹	1.3 × 10 ³	3.4 × 10 ⁴
Sc-47		1.0 × 10 ¹	2.7 × 10 ²	7.0 × 10 ⁻¹	1.9 × 10 ¹	3.1 × 10 ⁴	8.3 × 10 ⁵
Sc-48		3.0 × 10 ⁻¹	8.1	3.0 × 10 ⁻¹	8.1	5.5 × 10 ⁴	1.5 × 10 ⁶
Se-75	Selenium (34)	3.0	8.1 × 10 ¹	3.0	8.1 × 10 ¹	5.4 × 10 ²	1.5 × 10 ⁴
Se-79		4.0 × 10 ¹	1.1 × 10 ³	2.0	5.4 × 10 ¹	2.6 × 10 ⁻³	7.0 × 10 ⁻²
Si-31	Silicon (14)	6.0 × 10 ⁻¹	1.6 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	1.4 × 10 ⁶	3.9 × 10 ⁷
Si-32		4.0 × 10 ¹	1.1 × 10 ³	5.0 × 10 ⁻¹	1.4 × 10 ¹	3.9	1.1 × 10 ²
Sm-145	Samarium (62)	1.0 × 10 ¹	2.7 × 10 ²	1.0 × 10 ¹	2.7 × 10 ²	9.8 × 10 ¹	2.6 × 10 ³
Sm-147		Unlimited	Unlimited	Unlimited	Unlimited	8.5 × 10 ⁻¹⁰	2.3 × 10 ⁻⁸
Sm-151		4.0 × 10 ¹	1.1 × 10 ³	1.0 × 10 ¹	2.7 × 10 ²	9.7 × 10 ⁻¹	2.6 × 10 ¹
Sm-153		9.0	2.4 × 10 ²	6.0 × 10 ⁻¹	1.6 × 10 ¹	1.6 × 10 ⁴	4.4 × 10 ⁵
Sn-113 (a)	Tin (50)	4.0	1.1 × 10 ²	2.0	5.4 × 10 ¹	3.7 × 10 ²	1.0 × 10 ⁴
Sn-117m		7.0	1.9 × 10 ²	4.0 × 10 ⁻¹	1.1 × 10 ¹	3.0 × 10 ³	8.2 × 10 ⁴
Sn-119m		4.0 × 10 ¹	1.1 × 10 ³	3.0 × 10 ¹	8.1 × 10 ²	1.4 × 10 ²	3.7 × 10 ³
Sn-121m (a)		4.0 × 10 ¹	1.1 × 10 ³	9.0 × 10 ⁻¹	2.4 × 10 ¹	2.0	5.4 × 10 ¹
Sn-123		8.0 × 10 ⁻¹	2.2 × 10 ¹	6.0 × 10 ⁻¹	1.6 × 10 ¹	3.0 × 10 ²	8.2 × 10 ³
Sn-125		4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	4.0 × 10 ³	1.1 × 10 ⁵
Sn-126 (a)		6.0 × 10 ⁻¹	1.6 × 10 ¹	4.0 × 10 ⁻¹	1.1 × 10 ¹	1.0 × 10 ⁻³	2.8 × 10 ⁻²
Sr-82 (a)	Strontium (38)	2.0 × 10 ⁻¹	5.4	2.0 × 10 ⁻¹	5.4	2.3 × 10 ³	6.2 × 10 ⁴
Sr-85		2.0	5.4 × 10 ¹	2.0	5.4 × 10 ¹	8.8 × 10 ²	2.4 × 10 ⁴
Sr-85m		5.0	1.4 × 10 ²	5.0	1.4 × 10 ²	1.2 × 10 ⁶	3.3 × 10 ⁷
Sr-87m		3.0	8.1 × 10 ¹	3.0	8.1 × 10 ¹	4.8 × 10 ⁵	1.3 × 10 ⁷

TABLE A–1—A₁ AND A₂ VALUES FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
Sr-89		6.0×10^{-1}	1.6×10^1	6.0×10^{-1}	1.6×10^1	1.1×10^3	2.9×10^4
Sr-90 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	5.1	1.4×10^2
Sr-91 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.3×10^5	3.6×10^6
Sr-92 (a)		1.0	2.7×10^1	3.0×10^{-1}	8.1	4.7×10^5	1.3×10^7
T(H-3)	Tritium (1)	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	3.6×10^2	9.7×10^3
Ta-178 (long-lived)	Tantalum (73)	1.0	2.7×10^1	8.0×10^{-1}	2.2×10^1	4.2×10^6	1.1×10^8
Ta-179		3.0×10^1	8.1×10^2	3.0×10^1	8.1×10^2	4.1×10^1	1.1×10^3
Ta-182		9.0×10^{-1}	2.4×10^1	5.0×10^{-1}	1.4×10^1	2.3×10^2	6.2×10^3
Tb-157	Terbium (65)	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	5.6×10^{-1}	1.5×10^1
Tb-158		1.0	2.7×10^1	1.0	2.7×10^1	5.6×10^{-1}	1.5×10^1
Tb-160		1.0	2.7×10^1	6.0×10^{-1}	1.6×10^1	4.2×10^2	1.1×10^4
Tc-95m (a)	Technetium (43)	2.0	5.4×10^1	2.0	5.4×10^1	8.3×10^2	2.2×10^4
Tc-96		4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	1.2×10^4	3.2×10^5
Tc-96m (a)		4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	1.4×10^6	3.8×10^7
Tc-97		Unlimited	Unlimited	Unlimited	Unlimited	5.2×10^{-5}	1.4×10^{-3}
Tc-97m		4.0×10^1	1.1×10^3	1.0	2.7×10^1	5.6×10^2	1.5×10^4
Tc-98		8.0×10^{-1}	2.2×10^1	7.0×10^{-1}	1.9×10^1	3.2×10^{-5}	8.7×10^{-4}
Tc-99		4.0×10^1	1.1×10^3	9.0×10^{-1}	2.4×10^1	6.3×10^{-4}	1.7×10^{-2}
Tc-99m		1.0×10^1	2.7×10^2	4.0	1.1×10^2	1.9×10^5	5.3×10^6
Te-121	Tellurium (52)	2.0	5.4×10^1	2.0	5.4×10^1	2.4×10^3	6.4×10^4
Te-121m		5.0	1.4×10^2	3.0	8.1×10^1	2.6×10^2	7.0×10^3
Te-123m		8.0	2.2×10^2	1.0	2.7×10^1	3.3×10^2	8.9×10^3
Te-125m		2.0×10^1	5.4×10^2	9.0×10^{-1}	2.4×10^1	6.7×10^2	1.8×10^4
Te-127		2.0×10^1	5.4×10^2	7.0×10^{-1}	1.9×10^1	9.8×10^4	2.6×10^6
Te-127m (a)		2.0×10^1	5.4×10^2	5.0×10^{-1}	1.4×10^1	3.5×10^2	9.4×10^3
Te-129		7.0×10^{-1}	1.9×10^1	6.0×10^{-1}	1.6×10^1	7.7×10^5	2.1×10^7
Te-129m (a)		8.0×10^{-1}	2.2×10^1	4.0×10^{-1}	1.1×10^1	1.1×10^3	3.0×10^4
Te-131m (a)		7.0×10^{-1}	1.9×10^1	5.0×10^{-1}	1.4×10^1	3.0×10^4	8.0×10^5
Te-132 (a)		5.0×10^{-1}	1.4×10^1	4.0×10^{-1}	1.1×10^1	1.1×10^4	3.0×10^5
Th-227	Thorium (90)	1.0×10^1	2.7×10^2	5.0×10^{-3}	1.4×10^{-1}	1.1×10^3	3.1×10^4
Th-228 (a)		5.0×10^{-1}	1.4×10^1	1.0×10^{-3}	2.7×10^{-2}	3.0×10^1	8.2×10^2
Th-229		5.0	1.4×10^2	5.0×10^{-4}	1.4×10^{-2}	7.9×10^{-3}	2.1×10^{-1}
Th-230		1.0×10^1	2.7×10^2	1.0×10^{-3}	2.7×10^{-2}	7.6×10^{-4}	2.1×10^{-2}
Th-231		4.0×10^1	1.1×10^3	2.0×10^{-2}	5.4×10^{-1}	2.0×10^4	5.3×10^5
Th-232		Unlimited	Unlimited	Unlimited	Unlimited	4.0×10^{-9}	1.1×10^{-7}
Th-234 (a)		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	8.6×10^2	2.3×10^4
Th(nat)		Unlimited	Unlimited	Unlimited	Unlimited	8.1×10^{-9}	2.2×10^{-7}
Ti-44 (a)	Titanium (22)	5.0×10^{-1}	1.4×10^1	4.0×10^{-1}	1.1×10^1	6.4	1.7×10^2
Tl-200	Thallium (81)	9.0×10^{-1}	2.4×10^1	9.0×10^{-1}	2.4×10^1	2.2×10^4	6.0×10^5
Tl-201		1.0×10^1	2.7×10^2	4.0	1.1×10^2	7.9×10^3	2.1×10^5
Tl-202		2.0	5.4×10^1	2.0	5.4×10^1	2.0×10^3	5.3×10^4
Tl-204		1.0×10^1	2.7×10^2	7.0×10^{-1}	1.9×10^1	1.7×10^1	4.6×10^2
Tm-167	Thulium (69)	7.0	1.9×10^2	8.0×10^{-1}	2.2×10^1	3.1×10^3	8.5×10^4
Tm-170		3.0	8.1×10^1	6.0×10^{-1}	1.6×10^1	2.2×10^2	6.0×10^3
Tm-171		4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3
U-230 (fast lung absorption) (a)(d).	Uranium (92)	4.0×10^1	1.1×10^3	1.0×10^{-1}	2.7	1.0×10^3	2.7×10^4
U-230 (medium lung absorption) (a)(e).		4.0×10^1	1.1×10^3	4.0×10^{-3}	1.1×10^{-1}	1.0×10^3	2.7×10^4
U-230 (slow lung absorption) (a)(f).		3.0×10^1	8.1×10^2	3.0×10^{-3}	8.1×10^{-2}	1.0×10^3	2.7×10^4
U-232 (fast lung absorption) (d).		4.0×10^1	1.1×10^3	1.0×10^{-2}	2.7×10^{-1}	8.3×10^{-1}	2.2×10^1
U-232 (medium lung absorption) (e).		4.0×10^1	1.1×10^3	7.0×10^{-3}	1.9×10^{-1}	8.3×10^{-1}	2.2×10^1
U-232 (slow lung absorption) (f).		1.0×10^1	2.7×10^2	1.0×10^{-3}	2.7×10^{-2}	8.3×10^{-1}	2.2×10^1
U-233 (fast lung absorption) (d).		4.0×10^1	1.1×10^3	9.0×10^{-2}	2.4	3.6×10^{-4}	9.7×10^{-3}
U-233 (medium lung absorption) (e).		4.0×10^1	1.1×10^3	2.0×10^{-2}	5.4×10^{-1}	3.6×10^{-4}	9.7×10^{-3}
U-233 (slow lung absorption) (f).		4.0×10^1	1.1×10^3	6.0×10^{-3}	1.6×10^{-1}	3.6×10^{-4}	9.7×10^{-3}
U-234 (fast lung absorption) (d).		4.0×10^1	1.1×10^3	9.0×10^{-2}	2.4	2.3×10^{-4}	6.2×10^{-3}
U-234 (medium lung absorption) (e).		4.0×10^1	1.1×10^3	2.0×10^{-2}	5.4×10^{-1}	2.3×10^{-4}	6.2×10^{-3}
U-234 (slow lung absorption) (f).		4.0×10^1	1.1×10^3	6.0×10^{-3}	1.6×10^{-1}	2.3×10^{-4}	6.2×10^{-3}

TABLE A-1—A₁ AND A₂ VALUES FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	A ₁ (TBq)	A ₁ (Ci) ^b	A ₂ (TBq)	A ₂ (Ci) ^b	Specific activity	
						(TBq/g)	(Ci/g)
U-235 (all lung absorption types) (a),(d),(e),(f).		Unlimited	Unlimited	Unlimited	Unlimited	8.0×10^{-8}	2.2×10^{-6}
U-236 (fast lung absorption) (d).		Unlimited	Unlimited	Unlimited	Unlimited	2.4×10^{-6}	6.5×10^{-5}
U-236 (medium lung absorption) (e).		4.0×10^1	1.1×10^3	2.0×10^{-2}	5.4×10^{-1}	2.4×10^{-6}	6.5×10^{-5}
U-236 (slow lung absorption) (f).		4.0×10^1	1.1×10^3	6.0×10^{-3}	1.6×10^{-1}	2.4×10^{-6}	6.5×10^{-5}
U-238 (all lung absorption types) (d),(e),(f).		Unlimited	Unlimited	Unlimited	Unlimited	1.2×10^{-8}	3.4×10^{-7}
U (nat)		Unlimited	Unlimited	Unlimited	Unlimited	2.6×10^{-8}	7.1×10^{-7}
U (enriched to 20% or less)(g).		Unlimited	Unlimited	Unlimited	Unlimited	See Table A-4	See Table A-4
U (dep)		Unlimited	Unlimited	Unlimited	Unlimited	See Table A-4	See Table A-4
V-48	Vanadium (23)	4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	6.3×10^3	1.7×10^5
V-49		4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	3.0×10^2	8.1×10^3
W-178 (a)	Tungsten (74)	9.0	2.4×10^2	5.0	1.4×10^2	1.3×10^3	3.4×10^4
W-181		3.0×10^1	8.1×10^2	3.0×10^1	8.1×10^2	2.2×10^2	6.0×10^3
W-185		4.0×10^1	1.1×10^3	8.0×10^{-1}	2.2×10^1	3.5×10^2	9.4×10^3
W-187		2.0	5.4×10^1	6.0×10^{-1}	1.6×10^1	2.6×10^4	7.0×10^5
W-188 (a)		4.0×10^{-1}	1.1×10^1	3.0×10^{-1}	8.1	3.7×10^2	1.0×10^4
Xe-122 (a)	Xenon (54)	4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	4.8×10^4	1.3×10^6
Xe-123		2.0	5.4×10^1	7.0×10^{-1}	1.9×10^1	4.4×10^5	1.2×10^7
Xe-127		4.0	1.1×10^2	2.0	5.4×10^1	1.0×10^3	2.8×10^4
Xe-131m		4.0×10^1	1.1×10^3	4.0×10^1	1.1×10^3	3.1×10^3	8.4×10^4
Xe-133		2.0×10^1	5.4×10^2	1.0×10^1	2.7×10^2	6.9×10^3	1.9×10^5
Xe-135		3.0	8.1×10^1	2.0	5.4×10^1	9.5×10^4	2.6×10^6
Y-87 (a)	Yttrium (39)	1.0	2.7×10^1	1.0	2.7×10^1	1.7×10^4	4.5×10^5
Y-88		4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	5.2×10^2	1.4×10^4
Y-90		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	2.0×10^4	5.4×10^5
Y-91		6.0×10^{-1}	1.6×10^1	6.0×10^{-1}	1.6×10^1	9.1×10^2	2.5×10^4
Y-91m		2.0	5.4×10^1	2.0	5.4×10^1	1.5×10^5	4.2×10^7
Y-92		2.0×10^{-1}	5.4	2.0×10^{-1}	5.4	3.6×10^5	9.6×10^6
Y-93		3.0×10^{-1}	8.1	3.0×10^{-1}	8.1	1.2×10^5	3.3×10^6
Yb-169	Ytterbium (70)	4.0	1.1×10^2	1.0	2.7×10^1	8.9×10^2	2.4×10^4
Yb-175		3.0×10^1	8.1×10^2	9.0×10^{-1}	2.4×10^1	6.6×10^3	1.8×10^5
Zn-65	Zinc (30)	2.0	5.4×10^1	2.0	5.4×10^1	3.0×10^2	8.2×10^3
Zn-69		3.0	8.1×10^1	6.0×10^{-1}	1.6×10^1	1.8×10^5	4.9×10^7
Zn-69m (a)		3.0	8.1×10^1	6.0×10^{-1}	1.6×10^1	1.2×10^5	3.3×10^6
Zr-88	Zirconium (40)	3.0	8.1×10^1	3.0	8.1×10^1	6.6×10^2	1.8×10^4
Zr-93		Unlimited	Unlimited	Unlimited	Unlimited	9.3×10^{-5}	2.5×10^{-3}
Zr-95 (a)		2.0	5.4×10^1	8.0×10^{-1}	2.2×10^1	7.9×10^2	2.1×10^4
Zr-97 (a)		4.0×10^{-1}	1.1×10^1	4.0×10^{-1}	1.1×10^1	7.1×10^4	1.9×10^6

^a A₁ and/or A₂ values include contributions from daughter nuclides with half-lives less than 10 days, as listed in the following:

Mg-28	Al-28
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

Pt. 71, App. A

10 CFR Ch. I (1–1–24 Edition)

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-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
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

^bThe values of A₁ and A₂ in Curies (Ci) are approximate and for information only; the regulatory standard units are Terabecquerels (TBq) (see Appendix A to Part 71—Determination of A₁ and A₂, Section I).

^cThe activity of Ir-192 in special form may be determined from a measurement of the rate of decay or a measurement of the radiation level at a prescribed distance from the source.

Nuclear Regulatory Commission

Pt. 71, App. A

^dThese 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.
^eThese 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.
^fThese values apply to all compounds of uranium other than those specified in notes (d) and (e) of this table.
^gThese values apply to unirradiated uranium only.
^hA₂ = 0.74 TBq (20 Ci) for Mo-99 for domestic use.

TABLE A-2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Ac-225	Actinium (89)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Ac-227		1.0 × 10 ⁻¹	2.7 × 10 ⁻¹²	1.0 × 10 ³	2.7 × 10 ⁻⁸
Ac-228		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ag-105	Silver (47)	1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ag-108m (b)		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ag-110m		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ag-111		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Al-26	Aluminum (13)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Am-241	Americium (95)	1.0	2.7 × 10 ⁻¹¹	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Am-242m (b)		1.0	2.7 × 10 ⁻¹¹	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Am-243 (b)		1.0	2.7 × 10 ⁻¹¹	1.0 × 10 ³	2.7 × 10 ⁻⁸
Ar-37	Argon (18)	1.0 × 10 ⁶	2.7 × 10 ⁻⁵	1.0 × 10 ⁸	2.7 × 10 ⁻³
Ar-39		1.0 × 10 ⁷	2.7 × 10 ⁻⁴	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Ar-41		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁹	2.7 × 10 ⁻²
As-72	Arsenic (33)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
As-73		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
As-74		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
As-76		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
As-77		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
At-211	Astatine (85)	1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Au-193	Gold (79)	1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Au-194		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Au-195		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Au-198		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Au-199		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ba-131	Barium (56)	1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ba-133		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ba-133m		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ba-140 (b)		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Be-7	Beryllium (4)	1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Be-10		1.0 × 10 ⁴	2.7 × 10 ⁻⁷	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Bi-205	Bismuth (83)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Bi-206		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Bi-207		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Bi-210		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Bi-210m		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Bi-212 (b)		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Bk-247	Berkelium (97)	1.0	2.7 × 10 ⁻¹¹	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Bk-249		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Br-76	Bromine (35)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Br-77		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Br-82		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
C-11	Carbon (6)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
C-14		1.0 × 10 ⁴	2.7 × 10 ⁻⁷	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Ca-41	Calcium (20)	1.0 × 10 ⁵	2.7 × 10 ⁻⁶	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Ca-45		1.0 × 10 ⁴	2.7 × 10 ⁻⁷	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Ca-47		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Cd-109	Cadmium (48)	1.0 × 10 ⁴	2.7 × 10 ⁻⁷	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Cd-113m		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Cd-115		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Cd-115m		1.0 × 10 ³	2.7 × 10 ⁻⁸	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ce-139	Cerium (58)	1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ce-141		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁷	2.7 × 10 ⁻⁴
Ce-143		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁶	2.7 × 10 ⁻⁵
Ce-144 (b)		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁵	2.7 × 10 ⁻⁶
Cf-248	Californium (98)	1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Cf-249		1.0	2.7 × 10 ⁻¹¹	1.0 × 10 ³	2.7 × 10 ⁻⁸
Cf-250		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Cf-251		1.0	2.7 × 10 ⁻¹¹	1.0 × 10 ³	2.7 × 10 ⁻⁸
Cf-252		1.0 × 10 ¹	2.7 × 10 ⁻¹⁰	1.0 × 10 ⁴	2.7 × 10 ⁻⁷
Cf-253		1.0 × 10 ²	2.7 × 10 ⁻⁹	1.0 × 10 ⁵	2.7 × 10 ⁻⁶

TABLE A-2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Cf-254 .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Cl-36	Chlorine (17)	1.0×10^4	2.7×10^{-7}	1.0×10^6	2.7×10^{-5}
Cl-38 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Cm-240	Curium (96)	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Cm-241 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Cm-242 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Cm-243 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Cm-244 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Cm-245 .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Cm-246 .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Cm-247 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Cm-248 .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Co-55	Cobalt (27)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Co-56 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Co-57 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Co-58 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Co-58m .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Co-60 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Cr-51	Chromium (24)	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Cs-129	Cesium (55)	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Cs-131 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Cs-132 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Cs-134 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Cs-134m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
Cs-135 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Cs-136 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Cs-137 (b) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Cu-64	Copper (29)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Cu-67 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Dy-159	Dysprosium (66)	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Dy-165 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Dy-166 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Er-169	Erbium (68)	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Er-171 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Eu-147	Europium (63)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Eu-148 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Eu-149 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Eu-150 (short lived) .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Eu-150 (long lived) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Eu-152 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Eu-152m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Eu-154 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Eu-155 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Eu-156 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
F-18	Fluorine (9)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Fe-52	Iron (26)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Fe-55 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^6	2.7×10^{-5}
Fe-59 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Fe-60 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Ga-67	Gallium (31)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Ga-68 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Ga-72 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Gd-146	Gadolinium (64)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Gd-148 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Gd-153 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Gd-159 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Ge-68	Germanium (32)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Ge-71 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^8	2.7×10^{-3}
Ge-77 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Hf-172	Hafnium (72)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Hf-175 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Hf-181 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Hf-182 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Hg-194	Mercury (80)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Hg-195m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Hg-197 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}

TABLE A-2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Hg-197m		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Hg-203		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Ho-166	Holmium (67)	1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
Ho-166m		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
I-123	Iodine (53)	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
I-124		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
I-125		1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
I-126		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
I-129		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
I-131		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
I-132		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
I-133		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
I-134		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
I-135		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
In-111	Indium (49)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
In-113m		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
In-114m		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
In-115m		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Ir-189	Iridium (77)	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Ir-190		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Ir-192		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Ir-194		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
K-40	Potassium (19)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
K-42		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
K-43		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Kr-79	Krypton (36)	1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
Kr-81		1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Kr-85		1.0×10^5	2.7×10^{-6}	1.0×10^4	2.7×10^{-7}
Kr-85m		1.0×10^3	2.7×10^{-8}	1.0×10^{10}	2.7×10^{-1}
Kr-87		1.0×10^2	2.7×10^{-9}	1.0×10^9	2.7×10^{-2}
La-137	Lanthanum (57)	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
La-140		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Lu-172	Lutetium (71)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Lu-173		1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Lu-174		1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Lu-174m		1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Lu-177		1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Mg-28	Magnesium (12)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Mn-52	Manganese (25)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Mn-53		1.0×10^4	2.7×10^{-7}	1.0×10^9	2.7×10^{-2}
Mn-54		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Mn-56		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Mo-93	Molybdenum (42)	1.0×10^3	2.7×10^{-8}	1.0×10^8	2.7×10^{-3}
Mo-99		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
N-13	Nitrogen (7)	1.0×10^2	2.7×10^{-9}	1.0×10^9	2.7×10^{-2}
Na-22	Sodium (11)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Na-24		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Nb-93m	Niobium (41)	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Nb-94		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Nb-95		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Nb-97		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Nd-147	Neodymium (60)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Nd-149		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Ni-59	Nickel (28)	1.0×10^4	2.7×10^{-7}	1.0×10^8	2.7×10^{-3}
Ni-63		1.0×10^5	2.7×10^{-6}	1.0×10^8	2.7×10^{-3}
Ni-65		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Np-235	Neptunium (93)	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Np-236 (short-lived)		1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Np-236 (long-lived)		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Np-237 (b)		1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Np-239		1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Os-185	Osmium (76)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Os-191		1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Os-191m		1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Os-193		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Os-194		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}

TABLE A–2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
P-32	Phosphorus (15)	1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
P-33 .....	.....	1.0×10^5	2.7×10^{-6}	1.0×10^8	2.7×10^{-3}
Pa-230	Protactinium (91)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Pa-231 .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Pa-233 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Pb-201	Lead (82)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Pb-202 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Pb-203 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Pb-205 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Pb-210 (b) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Pb-212 (b) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Pd-103	Palladium (46)	1.0×10^3	2.7×10^{-8}	1.0×10^8	2.7×10^{-3}
Pd-107 .....	.....	1.0×10^5	2.7×10^{-6}	1.0×10^8	2.7×10^{-3}
Pd-109 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Pm-143	Promethium (61)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Pm-144 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Pm-145 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Pm-147 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Pm-148m .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Pm-149 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Pm-151 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Po-210	Polonium (84)	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Pr-142	Praseodymium (59)	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Pr-143 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^6	2.7×10^{-5}
Pt-188	Platinum (78)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Pt-191 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Pt-193 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Pt-193m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Pt-195m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Pt-197 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Pt-197m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Pu-236	Plutonium (94)	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Pu-237 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Pu-238 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Pu-239 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Pu-240 .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Pu-241 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Pu-242 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Pu-244 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Ra-223 (b)	Radium (88)	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Ra-224 (b) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Ra-225 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Ra-226 (b) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Ra-228 (b) .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Rb-81	Rubidium (37)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Rb-83 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Rb-84 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Rb-86 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Rb-87 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Rb(nat) .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Re-184	Rhenium (75)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Re-184m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Re-186 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Re-187 .....	.....	1.0×10^6	2.7×10^{-5}	1.0×10^9	2.7×10^{-2}
Re-188 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Re-189 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Re(nat) .....	.....	1.0×10^6	2.7×10^{-5}	1.0×10^9	2.7×10^{-2}
Rh-99	Rhodium (45)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Rh-101 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Rh-102 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Rh-102m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Rh-103m .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^8	2.7×10^{-3}
Rh-105 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Rn-222 (b)	Radon (86)	1.0×10^1	2.7×10^{-10}	1.0×10^8	2.7×10^{-3}
Ru-97	Ruthenium (44)	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Ru-103 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Ru-105 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Ru-106 (b) .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}

TABLE A-2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
S-35	Sulphur (16)	1.0×10^5	2.7×10^{-6}	1.0×10^8	2.7×10^{-3}
Sb-122	Antimony (51)	1.0×10^2	2.7×10^{-9}	1.0×10^4	2.7×10^{-7}
Sb-124 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Sb-125 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Sb-126 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Sc-44	Scandium (21)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Sc-46 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Sc-47 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Sc-48 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Se-75	Selenium (34)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Se-79 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Si-31	Silicon (14)	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Si-32 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Sm-145	Samarium (62)	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Sm-147 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Sm-151 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^8	2.7×10^{-3}
Sm-153 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Sn-113	Tin (50)	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Sn-117m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Sn-119m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Sn-121m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Sn-123 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Sn-125 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Sn-126 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Sr-82	Strontium (38)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Sr-85 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Sr-85m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Sr-87m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Sr-89 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Sr-90 (b) .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^4	2.7×10^{-7}
Sr-91 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Sr-92 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
T(H-3)	Tritium (1)	1.0×10^6	2.7×10^{-5}	1.0×10^9	2.7×10^{-2}
Ta-178 (long-lived)	Tantalum (73)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Ta-179 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Ta-182 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Tb-157	Terbium (65)	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Tb-158 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Tb-160 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Tc-95m	Technetium (43)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Tc-96 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Tc-96m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Tc-97 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^8	2.7×10^{-3}
Tc-97m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Tc-98 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Tc-99 .....	.....	1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
Tc-99m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Te-121	Tellurium (52)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Te-121m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Te-123m .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Te-125m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Te-127 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Te-127m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Te-129 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Te-129m .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Te-131m .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Te-132 .....	.....	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Th-227	Thorium (90)	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Th-228 (b) .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Th-229 (b) .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Th-230 .....	.....	1.0	2.7×10^{-11}	1.0×10^4	2.7×10^{-7}
Th-231 .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Th-232 .....	.....	1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
Th-234 (b) .....	.....	1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
Th (nat) (b) .....	.....	1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
Ti-44	Titanium (22)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
Tl-200	Thallium (81)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}

TABLE A–2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
Tl-201		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Tl-202		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Tl-204		1.0×10^4	2.7×10^{-7}	1.0×10^4	2.7×10^{-7}
Tm-167	Thulium (69)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Tm-170		1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Tm-171		1.0×10^4	2.7×10^{-7}	1.0×10^8	2.7×10^{-3}
U-230 (fast lung absorption) (b),(d).	Uranium (92)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
U-230 (medium lung absorption) (e).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-230 (slow lung absorption) (f).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-232 (fast lung absorption) (b),(d).		1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
U-232 (medium lung absorption) (e).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-232 (slow lung absorption) (f).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-233 (fast lung absorption) (d).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-233 (medium lung absorption) (e).		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
U-233 (slow lung absorption) (f).		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
U-234 (fast lung absorption) (d).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-234 (medium lung absorption) (e).		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
U-234 (slow lung absorption) (f).		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
U-235 (all lung absorption types) (b),(d),(e),(f).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-236 (fast lung absorption) (d).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-236 (medium lung absorption) (e).		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
U-236 (slow lung absorption) (f).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U-238 (all lung absorption types) (b),(d),(e),(f).		1.0×10^1	2.7×10^{-10}	1.0×10^4	2.7×10^{-7}
U (nat) (b)		1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
U (enriched to 20% or less) (g).		1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
U (dep)		1.0	2.7×10^{-11}	1.0×10^3	2.7×10^{-8}
V-48	Vanadium (23)	1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}
V-49		1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
W-178	Tungsten (74)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
W-181		1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}

TABLE A-2—EXEMPT MATERIAL ACTIVITY CONCENTRATIONS AND EXEMPT CONSIGNMENT ACTIVITY LIMITS FOR RADIONUCLIDES—Continued

Symbol of radionuclide	Element and atomic number	Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limit for exempt consignment (Bq)	Activity limit for exempt consignment (Ci)
W-185		1.0×10^4	2.7×10^{-7}	1.0×10^7	2.7×10^{-4}
W-187		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
W-188		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Xe-122	Xenon (54)	1.0×10^2	2.7×10^{-9}	1.0×10^9	2.7×10^{-2}
Xe-123		1.0×10^2	2.7×10^{-9}	1.0×10^9	2.7×10^{-2}
Xe-127		1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
Xe-131m		1.0×10^4	2.7×10^{-7}	1.0×10^4	2.7×10^{-7}
Xe-133		1.0×10^3	2.7×10^{-8}	1.0×10^4	2.7×10^{-7}
Xe-135		1.0×10^3	2.7×10^{-8}	1.0×10^{10}	2.7×10^{-1}
Y-87	Yttrium (39)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Y-88		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Y-90		1.0×10^3	2.7×10^{-8}	1.0×10^5	2.7×10^{-6}
Y-91		1.0×10^3	2.7×10^{-8}	1.0×10^6	2.7×10^{-5}
Y-91m		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Y-92		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Y-93		1.0×10^2	2.7×10^{-9}	1.0×10^5	2.7×10^{-6}
Yb-169	Ytterbium (70)	1.0×10^2	2.7×10^{-9}	1.0×10^7	2.7×10^{-4}
Yb-175		1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Zn-65	Zinc (30)	1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Zn-69		1.0×10^4	2.7×10^{-7}	1.0×10^6	2.7×10^{-5}
Zn-69m		1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Zr-88	Zirconium (40)	1.0×10^2	2.7×10^{-9}	1.0×10^6	2.7×10^{-5}
Zr-93 (b)		1.0×10^3	2.7×10^{-8}	1.0×10^7	2.7×10^{-4}
Zr-95		1.0×10^1	2.7×10^{-10}	1.0×10^6	2.7×10^{-5}
Zr-97 (b)		1.0×10^1	2.7×10^{-10}	1.0×10^5	2.7×10^{-6}

^a [Reserved]^b Parent nuclides and their progeny included in secular equilibrium are listed as follows:

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

^c [Reserved]^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.

*These values apply only to compounds of uranium that take the chemical form of UO_3 , UF_4 , UCl_4 and hexavalent compounds in both normal and accident conditions of transport.

†These values apply to all compounds of uranium other than those specified in notes (d) and (e) of this table.

‡These values apply to unirradiated uranium only.

TABLE A-3—GENERAL VALUES FOR A_1 AND A_2

Contents	A_1		A_2		Activity concentration for exempt material (Bq/g)	Activity concentration for exempt material (Ci/g)	Activity limits for exempt consignments (Bq)	Activity limits for exempt consignments (Ci)
	(TBq)	(Ci)	(TBq)	(Ci)				
Only beta or gamma emitting radionuclides are known to be present.	1×10^{-1}	2.7×10^0	2×10^{-2}	5.4×10^{-1}	1×10^1	2.7×10^{-10}	1×10^4	2.7×10^{-7}
Alpha emitting nuclides, but no neutron emitters, are known to be present (a).	2×10^{-1}	5.4×10^0	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^3	2.7×10^{-8}
Neutron emitting nuclides are known to be present or no relevant data are available.	1×10^{-3}	2.7×10^{-2}	9×10^{-5}	2.4×10^{-3}	1×10^{-1}	2.7×10^{-12}	1×10^3	2.7×10^{-8}

(a) If beta or gamma emitting nuclides are known to be present, the A_1 value of 0.1 TBq (2.7 Ci) should be used.

TABLE A-4—ACTIVITY-MASS RELATIONSHIPS FOR URANIUM

Uranium Enrichment ¹ wt % U-235 present	Specific Activity	
	TBq/g	Ci/g
0.45	1.8×10^{-8}	5.0×10^{-7}
0.72	2.6×10^{-8}	7.1×10^{-7}
1	2.8×10^{-8}	7.6×10^{-7}
1.5	3.7×10^{-8}	1.0×10^{-6}
5	1.0×10^{-7}	2.7×10^{-6}
10	1.8×10^{-7}	4.8×10^{-6}
20	3.7×10^{-7}	1.0×10^{-5}
35	7.4×10^{-7}	2.0×10^{-5}
50	9.3×10^{-7}	2.5×10^{-5}
90	2.2×10^{-6}	5.8×10^{-5}
93	2.6×10^{-6}	7.0×10^{-5}
95	3.4×10^{-6}	9.1×10^{-5}

¹ The figures for uranium include representative values for the activity of the uranium-234 that is concentrated during the enrichment process.

[69 FR 3800, Jan. 26, 2004; 69 FR 58039, Sept. 29, 2004, as amended at 77 FR 39908, July 6, 2012; 80 FR 34014, June 12, 2015; 85 FR 65663, Oct. 16, 2020]

PART 72—LICENSING REQUIREMENTS FOR THE INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL, HIGH-LEVEL RADIOACTIVE WASTE, AND REACTOR-RELATED GREATER THAN CLASS C WASTE

Subpart A—General Provisions

Sec.

- 72.1 Purpose.
- 72.2 Scope.
- 72.3 Definitions.
- 72.4 Communications.
- 72.5 Interpretations.
- 72.6 License required; types of licenses.
- 72.7 Specific exemptions.
- 72.8 Denial of licensing by Agreement States.
- 72.9 Information collection requirements: OMB approval.
- 72.10 Employee protection.
- 72.11 Completeness and accuracy of information.
- 72.12 Deliberate misconduct.
- 72.13 Applicability.