

CODE OF FEDERAL
REGULATIONS

10 CFR
Part 71, Appendix A

Nuclear Regulatory Commission

Pt. 71, App. A

§ 71.129 Inspection, test, and operating status.

(a) The licensee, certificate holder, and applicant for a CoC shall establish measures to indicate, by the use of markings such as stamps, tags, labels, routing cards, or other suitable means, the status of inspections and tests performed upon individual items of the packaging. These measures must provide for the identification of items that have satisfactorily passed required inspections and tests, where necessary to preclude inadvertent bypassing of the inspections and tests.

(b) The licensee shall establish measures to identify the operating status of components of the packaging, such as tagging valves and switches, to prevent inadvertent operation.

§ 71.131 Nonconforming materials, parts, or components.

The licensee, certificate holder, and applicant for a CoC shall establish measures to control materials, parts, or components that do not conform to the licensee's requirements to prevent their inadvertent use or installation. These measures must include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Nonconforming items must be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures.

§ 71.133 Corrective action.

The licensee, certificate holder, and applicant for a CoC shall establish measures to assure that conditions adverse to quality, such as deficiencies, 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 CoC shall maintain sufficient written records to describe the activities affecting quality. The records must include the instructions, procedures, and drawings required by § 71.111 to prescribe quality assurance activities and must include closely related specifications such as required qualifications of personnel, procedures, and equipment. The records must include the instructions or procedures which 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 CoC shall retain these records for 3 years beyond the date when the licensee, certificate holder, and applicant for a CoC last engage in the activity for which the quality assurance program was developed. If any portion of the written procedures or instructions is superseded, the licensee, certificate holder, and applicant for a CoC shall retain the superseded material for 3 years after it is superseded.

§ 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 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, and $A_1(i)$ is the A_1 value for radionuclide I.

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

$$\sum B(i)/A_2(i) \leq 1$$

where $B(i)$ is the activity of radionuclide i, and $A_2(i)$ is the A_2 value for radionuclide i.

c. Alternatively, the A_1 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 $A_1(i)$ is the appropriate A_1 value for radionuclide I.

d. Alternatively, the A_2 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.

e. 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 $[A]$ is the activity concentration for exempt material containing radionuclide I.

f. 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 is the activity limit for exempt consignments for radionuclide I.

V. 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 low-

est A₁ or A₂ 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 A₁ or A₂ values for the alpha emitters and beta/gamma emitters.

TABLE A-1—A₁ AND A₂ 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
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

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)
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 (h)		5.0×10 ⁻²	1.4	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 ⁻⁵	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
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	1.1×10 ⁻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)		7×10 ⁻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

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)
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 (a)	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 (c)		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
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-81	Krypton (36)	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) (i)		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

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)
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 ⁴
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
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

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)
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 ⁻¹	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
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	8.0×10 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

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)
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
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 ⁶	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 ⁶	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

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)
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

^aA₁ and/or A₂ values include contributions from daughter nuclides with half-lives less than 10 days.
^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). For radionuclide Bi-205, the specific activity is corrected to 1.5 × 10³ TBq/g. For radionuclide Cm-248, the specific activity is corrected to 1.6 × 10⁻⁴ TBq/g. For radionuclide Eu-150 (long lived), the A₁ value is corrected to 7.0 × 10⁻¹ TBq. For radionuclide Te-132(a), the specific activity is corrected to 3.0 × 10⁵ Ci/g.
^cThe quantity 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.
^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.
^hA₁ = 0.1 TBq (2.7 Ci) and A₂ = 0.001 TBq (0.027 Ci) for Cf-252 for domestic use.
ⁱA₂ = 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

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)
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
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

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)
Ga-72	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Gd-146	Gadolinium (64)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Gd-148	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁴	2.7x10 ⁻⁷
Gd-153	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Gd-159	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Ge-68	Germanium (32)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Ge-71	.....	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁸	2.7x10 ⁻³
Ge-77	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Hf-172	Hafnium (72)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Hf-175	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Hf-181	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Hf-182	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Hg-194	Mercury (80)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Hg-195m	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Hg-197	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Hg-197m	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Hg-203	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Ho-166	Holmium (67)	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁵	2.7x10 ⁻⁶
Ho-166m	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
I-123	Iodine (53)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
I-124	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
I-125	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
I-126	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
I-129	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
I-131	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
I-132	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
I-133	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
I-134	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
I-135	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
In-111	Indium (49)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
In-113m	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
In-114m	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
In-115m	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Ir-189	Iridium (77)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Ir-190	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Ir-192	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁴	2.7x10 ⁻⁷
Ir-194	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
K-40	Potassium (19)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
K-42	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
K-43	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Kr-81	Krypton (36)	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
Kr-85	.....	1.0x10 ⁵	2.7x10 ⁻⁶	1.0x10 ⁴	2.7x10 ⁻⁷
Kr-85m	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ¹⁰	2.7x10 ⁻¹
Kr-87	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁹	2.7x10 ⁻²
La-137	Lanthanum (57)	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
La-140	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Lu-172	Lutetium (71)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Lu-173	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Lu-174	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Lu-174m	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Lu-177	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Mg-28	Magnesium (12)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Mn-52	Manganese (25)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Mn-53	.....	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁹	2.7x10 ⁻²
Mn-54	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Mn-56	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Mo-93	Molybdenum (42)	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁸	2.7x10 ⁻³
Mo-99	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
N-13	Nitrogen (7)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁹	2.7x10 ⁻²
Na-22	Sodium (11)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Na-24	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Nb-93m	Niobium (41)	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
Nb-94	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Nb-95	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Nb-97	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Nd-147	Neodymium (60)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Nd-149	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Ni-59	Nickel (28)	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁸	2.7x10 ⁻³

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)
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
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

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)
Re-188		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Re-189		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Re(nat)		1.0x10 ⁶	2.7x10 ⁻⁵	1.0x10 ⁹	2.7x10 ⁻²
Rh-99	Rhodium (45)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Rh-101		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Rh-102		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Rh-102m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Rh-103m		1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁸	2.7x10 ⁻³
Rh-105		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Rn-222 (b)	Radon (86)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁸	2.7x10 ⁻³
Ru-97	Ruthenium (44)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Ru-103		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Ru-105		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Ru-106 (b)		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
S-35	Sulphur (16)	1.0x10 ⁵	2.7x10 ⁻⁶	1.0x10 ⁸	2.7x10 ⁻³
Sb-122	Antimony (51)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁴	2.7x10 ⁻⁷
Sb-124		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Sb-125		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Sb-126		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Sc-44	Scandium (21)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Sc-46		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Sc-47		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Sc-48		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Se-75	Selenium (34)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Se-79		1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
Si-31	Silicon (14)	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Si-32		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Sm-145	Samarium (62)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Sm-147		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁴	2.7x10 ⁻⁷
Sm-151		1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁸	2.7x10 ⁻³
Sm-153		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Sn-113	Tin (50)	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Sn-117m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Sn-119m		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Sn-121m		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Sn-123		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Sn-125		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Sn-126		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Sr-82	Strontium (38)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Sr-85		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Sr-85m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Sr-87m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Sr-89		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Sr-90 (b)		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁴	2.7x10 ⁻⁷
Sr-91		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
Sr-92		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
T(H-3)	Tritium (1)	1.0x10 ⁶	2.7x10 ⁻⁵	1.0x10 ⁹	2.7x10 ⁻²
Ta-178 (long-lived)	Tantalum (73)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Ta-179		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Ta-182		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁴	2.7x10 ⁻⁷
Tb-157	Terbium (65)	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
Tb-158		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Tb-160		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Tc-95m	Technetium (43)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Tc-96		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Tc-96m		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Tc-97		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁸	2.7x10 ⁻³
Tc-97m		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Tc-98		1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Tc-99		1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
Tc-99m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Te-121	Tellurium (52)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Te-121m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Te-123m		1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Te-125m		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Te-127		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Te-127m		1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻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)
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
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

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)
U-236 (slow lung absorption) (f).	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁴	2.7x10 ⁻⁷
U-238 (all lung absorption types) (b),(d),(e),(f).	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁴	2.7x10 ⁻⁷
U (nat) (b) .....	.....	1.0	2.7x10 ⁻¹¹	1.0x10 ³	2.7x10 ⁻⁸
U (enriched to 20% or less)(g).	.....	1.0	2.7x10 ⁻¹¹	1.0x10 ³	2.7x10 ⁻⁸
U (dep) .....	.....	1.0	2.7x10 ⁻¹¹	1.0x10 ³	2.7x10 ⁻⁸
V-48	Vanadium (23)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶
V-49 .....	.....	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
W-178	Tungsten (74)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
W-181 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
W-185 .....	.....	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁷	2.7x10 ⁻⁴
W-187 .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
W-188 .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Xe-122	Xenon (54)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁹	2.7x10 ⁻²
Xe-123 .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁹	2.7x10 ⁻²
Xe-127 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁵	2.7x10 ⁻⁶
Xe-131m .....	.....	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁴	2.7x10 ⁻⁷
Xe-133 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁴	2.7x10 ⁻⁷
Xe-135 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ¹⁰	2.7x10 ⁻¹
Y-87	Yttrium (39)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Y-88 .....	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Y-90 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁵	2.7x10 ⁻⁶
Y-91 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁶	2.7x10 ⁻⁵
Y-91m .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Y-92 .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Y-93 .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶
Yb-169	Ytterbium (70)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁷	2.7x10 ⁻⁴
Yb-175 .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Zn-65	Zinc (30)	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Zn-69 .....	.....	1.0x10 ⁴	2.7x10 ⁻⁷	1.0x10 ⁶	2.7x10 ⁻⁵
Zn-69m .....	.....	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Zr-88	Zirconium (40)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁶	2.7x10 ⁻⁵
Zr-93 (b) .....	.....	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ⁷	2.7x10 ⁻⁴
Zr-95 .....	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁶	2.7x10 ⁻⁵
Zr-97 (b) .....	.....	1.0x10 ¹	2.7x10 ⁻¹⁰	1.0x10 ⁵	2.7x10 ⁻⁶

^a [Reserved]

^b Parent nuclides and their progeny included in secular equilibrium are listed in the following:

- Sr-90 Y-90
- Zr-93 Nb-93m
- Zr-97 Nb-97
- Ru-106 Rh-106
- Cs-137 Ba-137m
- Ce-134 La-134
- 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-220 Po-216
- 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-226 Ra-222, Rn-218, Po-214
- 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
- U-240 Np-240m
- Np-237 Pa-233

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^c[Reserved]

^dThese values apply only to compounds of uranium that take the chemical form of UF_6 , UO_2F_2 and $UO_2(NO_3)_2$ in both normal and accident conditions of transport.

^eThese 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.

^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.

TABLE A-3—GENERAL VALUES FOR A₁ AND A₂

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}
Only alpha emitting radionuclides are known to be present.	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}
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}

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]

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

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