

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-188	Xenon (54)	1.0x10 ²	2.7x10 ⁻⁹	1.0x10 ⁵	2.7x10 ⁻⁶	
Xe-122		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	Yttrium (39)	1.0x10 ³	2.7x10 ⁻⁸	1.0x10 ¹⁰	2.7x10 ⁻¹	
Y-87		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-226, 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
- Am-242 mAm-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.

^e These values apply only to compounds of uranium that take the chemical form of UO₃, UF₄, UCl₄ and hexavalent compounds in both normal and accident conditions of transport.

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

^g These values apply to unirradiated uranium only.

[69 FR 3685, Jan. 26, 2004]

§ 173.441 Radiation level limitations and exclusive use provisions.

(a) Except as provided in paragraph (b) of this section, each package of Class 7 (radioactive) materials offered

for transportation must be designed and prepared for shipment, so that under conditions normally incident to transportation, the radiation level does not exceed 2 mSv/hour (200 mrem/hour) at any point on the external surface of

the package, and the transport index does not exceed 10.

(b) A package which exceeds the radiation level limits specified in paragraph (a) of this section must be transported by exclusive use shipment, and the radiation levels for such shipment may not exceed the following during transportation:

(1) 2 mSv/h (200 mrem/h) on the external surface of the package unless the following conditions are met, in which case the limit is 10 mSv/h (1000 mrem/h):

(i) The shipment is made in a closed transport vehicle;

(ii) The package is secured within the vehicle so that its position remains fixed during transportation; and

(iii) There are no loading or unloading operations between the beginning and end of the transportation;

(2) 2 mSv/h (200 mrem/h) at any point on the outer surfaces of the vehicle, including the top and underside of the vehicle; or in the case of a flat-bed style vehicle, at any point on the vertical planes projected from the outer edges of the vehicle, on the upper surface of the load or enclosure if used, and on the lower external surface of the vehicle;

(3) 0.1 mSv/h (10 mrem/h) at any point 2 m (6.6 feet) from the outer lateral surfaces of the vehicle (excluding the top and underside of the vehicle); or in the case of a flat-bed style vehicle, at any point 2 m (6.6 feet) from the vertical planes projected by the outer edges of the vehicle (excluding the top and underside of the vehicle); and

(4) 0.02 mSv/h (2mrem/h) in any normally occupied space, except that this provision does not apply to carriers if they operate under the provisions of a State or federally regulated radiation protection program and if personnel under their control who are in such an occupied space wear radiation dosimetry devices.

(c) For shipments made under the provisions of paragraph (b) of this section, the offeror shall provide specific written instructions for maintenance of the exclusive use shipment controls to the carrier. The instructions must be included with the shipping paper information. The instructions must be sufficient so that, when followed, they

will cause the carrier to avoid actions that will unnecessarily delay delivery or unnecessarily result in increased radiation levels or radiation exposures to transport workers or members of the general public.

(d) Conveyance limits on the sum of package transport indices are as follows:

(1) Except for shipments by cargo aircraft only or by seagoing vessel, the sum of transport indices for a non-exclusive use shipment may not exceed 50.

(2) Where a consignment is transported under exclusive use, there is no limit on the sum of the transport indices aboard a single conveyance. The conditions of paragraphs (b)(2), (b)(3), (b)(4) and (c) must be met.

(3) Provisions for shipments of Class 7 (radioactive) materials by air are described in §§175.700–175.705 of this subchapter.

(4) Provisions for shipment of Class 7 (radioactive) materials by vessel are described in §§176.700–176.720 of this subchapter.

(e) A package exceeding the maximum surface radiation level or maximum transport index prescribed in paragraph (a) of this section may not be transported by aircraft.

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended at 63 FR 48568, Sept. 10, 1998; 66 FR 45380, Aug. 28, 2001; 69 FR 3691, Jan. 26, 2004]

§ 173.442 Thermal limitations.

A package of Class 7 (radioactive) material must be designed, constructed, and loaded so that—

(a) The heat generated within the package by the radioactive contents will not, during conditions normally incident to transport, affect the integrity of the package; and

(b) The temperature of the accessible external surfaces of the loaded package will not, assuming still air in the shade at an ambient temperature of 38 °C (100 °F), exceed either—

(1) 50 °C (122 °F) in other than an exclusive use shipment; or

(2) 85 °C (185 °F) in an exclusive use shipment.