

4731.3140 EXEMPT CONCENTRATIONS.

Subpart 1. **Parent isotope.** Many radioisotopes disintegrate into isotopes that are also radioactive. In expressing the concentrations in subpart 3, the activity stated is that of the parent isotope and takes into account the daughters.

Subp. 2. **Combination of isotopes.** For purposes of part 4731.3025, where a combination of isotopes is involved, the limit for the combination should be derived as follows: determine for each isotope in the product the ratio between the concentration present in the product and the exempt concentration established in subpart 3 for the specific isotope when not in combination. The sum of the ratios may not exceed one.

$$\frac{\text{Concentration of isotope A in product}}{\text{Exempt concentration of isotope A}} + \frac{\text{Concentration of isotope B in product}}{\text{Exempt concentration of isotope B}} \leq 1$$

Subp. 3. Exempt concentrations.

Element (atomic number)	Isotope	Column I Gas concen- tration $\mu\text{Ci/ml}^1$	Column II Liquid and solid concen- tration $\mu\text{Ci/ml}^2$
Antimony (51)	Sb 122		3×10^{-4}
	Sb 124		2×10^{-4}
	Sb 125		1×10^{-3}
Argon (18)	A 37	1×10^{-3}	
	A 41	4×10^{-7}	
Arsenic (33)	As 73		5×10^{-3}
	As 74		5×10^{-4}
	As 76		2×10^{-4}
	As 77		8×10^{-4}
Barium (56)	Ba 131		2×10^{-3}
	Ba 140		3×10^{-4}

Beryllium (4)	Be 7		2×10^{-2}
Bismuth (83)	Bi 206		4×10^{-4}
Bromine (35)	Br 82	4×10^{-7}	3×10^{-3}
Cadmium (48)	Cd 109		2×10^{-3}
	Cd 115m		3×10^{-4}
	Cd 115		3×10^{-4}
Calcium (20)	Ca 45		9×10^{-5}
	Ca 47		5×10^{-4}
Carbon (6)	C 14	1×10^{-6}	8×10^{-3}
Cerium (58)	Ce 141		9×10^{-4}
	Ce 143		4×10^{-4}
	Ce 144		1×10^{-4}
Cesium (55)	Cs 131		2×10^{-2}
	Cs 134m		6×10^{-2}
	Cs 134		9×10^{-5}
Chlorine (17)	Cl 38	9×10^{-7}	4×10^{-3}
Chromium (24)	Cr 51		2×10^{-2}
Cobalt (27)	Co 57		5×10^{-3}
	Co 58		1×10^{-3}
	Co 60		5×10^{-4}
Copper (29)	Cu 64		3×10^{-3}
Dysprosium (66)	Dy 165		4×10^{-3}
	Dy 166		4×10^{-4}
Erbium (68)	Er 169		9×10^{-4}
	Er 171		1×10^{-3}
Europium (63)	Eu 152 (T/2=9.2 hrs)		6×10^{-4}
	Eu 155		2×10^{-3}
Fluorine (9)	F 18	2×10^{-6}	8×10^{-3}

Gadolinium (64)	Gd 153		2×10^{-3}
	Gd 159		8×10^{-4}
Gallium (31)	Ga 72		4×10^{-4}
Germanium (32)	Ge 71		2×10^{-2}
Gold (79)	Au 196		2×10^{-3}
	Au 198		5×10^{-4}
	Au 199		2×10^{-3}
Hafnium (72)	Hf 181		7×10^{-4}
Hydrogen (1)	H 3	5×10^{-6}	3×10^{-2}
Indium (49)	In 113m		1×10^{-2}
	In 114m		2×10^{-4}
Iodine (53)	I 126	3×10^{-9}	2×10^{-5}
	I 131	3×10^{-9}	2×10^{-5}
	I 132	8×10^{-8}	6×10^{-4}
	I 133	1×10^{-8}	7×10^{-5}
	I 134	2×10^{-7}	1×10^{-3}
Iridium (77)	Ir 190		2×10^{-3}
	Ir 192		4×10^{-4}
	Ir 194		3×10^{-4}
Iron (26)	Fe 55		8×10^{-3}
	Fe 59		6×10^{-4}
Krypton (36)	Kr 85m	1×10^{-6}	
	Kr 85	3×10^{-6}	
Lanthanum (57)	La 140		2×10^{-4}
Lead (82)	Pb 203		4×10^{-3}
Lutetium (71)	Lu 177		1×10^{-3}
Manganese (25)	Mn 52		3×10^{-4}
	Mn 54		1×10^{-3}

	Mn 56	1×10^{-3}
Mercury (80)	Hg 197m	2×10^{-3}
	Hg 197	3×10^{-3}
	Hg 203	2×10^{-4}
Molybdenum (42)	Mo 99	2×10^{-3}
Neodymium (60)	Nd 147	6×10^{-4}
	Nd 149	3×10^{-3}
Nickel (28)	Ni 65	1×10^{-3}
Niobium (Columbium) (41)	Nb 95	1×10^{-3}
	Nb 97	9×10^{-3}
Osmium (76)	Os 185	7×10^{-4}
	Os 191m	3×10^{-2}
	Os 191	2×10^{-3}
	Os 193	6×10^{-4}
Palladium (46)	Pd 103	3×10^{-3}
	Pd 109	9×10^{-4}
Phosphorus (15)	P 32	2×10^{-4}
Platinum (78)	Pt 191	1×10^{-3}
	Pt 193m	1×10^{-2}
	Pt 197m	1×10^{-2}
	Pt 197	1×10^{-3}
Potassium (19)	K 42	3×10^{-3}
Praseodymium (59)	Pr 142	3×10^{-4}
	Pr 143	5×10^{-4}
Promethium (61)	Pm 147	2×10^{-3}
	Pm 149	4×10^{-4}
Rhenium (75)	Re 183	6×10^{-3}
	Re 186	9×10^{-4}

	Re 188		6×10^{-4}
Rhodium (45)	Rh 103m		1×10^{-1}
	Rh 105		1×10^{-3}
Rubidium (37)	Rb 86		7×10^{-4}
Ruthenium (44)	Ru 97		4×10^{-4}
	Ru 103		8×10^{-4}
	Ru 105		1×10^{-3}
	Ru 106		1×10^{-4}
Samarium (62)	Sm 153		8×10^{-4}
Scandium (21)	Sc 46		4×10^{-4}
	Sc 47		9×10^{-4}
	Sc 48		3×10^{-4}
Selenium (34)	Se 75		3×10^{-3}
Silicon (14)	Si 31		9×10^{-3}
Silver (47)	Ag 105		1×10^{-3}
	Ag 110m		3×10^{-4}
	Ag 111		4×10^{-4}
Sodium (11)	Na 24		2×10^{-3}
Strontium (38)	Sr 85		1×10^{-3}
	Sr 89		1×10^{-4}
	Sr 91		7×10^{-4}
	Sr 92		7×10^{-4}
Sulfur (16)	S 35	9×10^{-8}	6×10^{-4}
Tantalum (73)	Ta 182		4×10^{-4}
Technetium (43)	Tc 96m		1×10^{-1}
	Tc 96		1×10^{-3}
Tellurium (52)	Te 125m		2×10^{-3}
	Te 125m		6×10^{-4}
	Te 127		3×10^{-3}

	Te 129m	3×10^{-4}
	Te 131m	6×10^{-4}
	Te 132	3×10^{-4}
Terbium (65)	Tb 160	4×10^{-4}
Thallium (81)	Tl 200	4×10^{-3}
	Tl 201	3×10^{-3}
	Tl 202	1×10^{-3}
	Tl 204	1×10^{-3}
Thulium (69)	Tm 170	5×10^{-4}
	Tm 171	5×10^{-3}
Tin (50)	Sn 113	9×10^{-4}
	Sn 125	2×10^{-4}
Tungsten (Wolfram) (74)	W 181	4×10^{-3}
	W 187	7×10^{-4}
Vanadium (23)	V 48	3×10^{-4}
Xenon (54)	Xe 131m	4×10^{-6}
	Xe 133	3×10^{-6}
	Xe 135	1×10^{-6}
Ytterbium (70)	Yb 175	1×10^{-3}
Yttrium (39)	Y 90	2×10^{-4}
	Y 91m	3×10^{-2}
	Y 91	3×10^{-4}
	Y 92	6×10^{-4}
	Y 93	3×10^{-4}
Zinc (30)	Zn 65	1×10^{-3}
	Zn 69m	7×10^{-4}
	Zn 69	2×10^{-2}
Zirconium (40)	Zr 95	6×10^{-4}

Zr 97

 2×10^{-4}

Beta- or gamma-
emitting radioactive
material not listed
above with half-life
less than three years

 1×10^{-10} 1×10^{-6}

¹Values are given only for those materials normally used as gases.

²μCi/gm for solids.

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