

## Chapter DHS 157

### APPENDIX A

Exempt Concentrations			
Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/
Antimony (51)	Sb-122		$3 \times 10^{-4}$
	Sb-124		$2 \times 10^{-4}$
	Sb-125		$1 \times 10^{-3}$
Argon (18)	Ar-37	$1 \times 10^{-3}$	
	Ar-41	$4 \times 10^{-7}$	
Arsenic (33)	As-73		$5 \times 10^{-3}$
	As-74		$5 \times 10^{-4}$
	As-76		$2 \times 10^{-4}$
	As-77		$8 \times 10^{-4}$
Barium (56)	Ba-131		$2 \times 10^{-3}$
	Ba-140		$3 \times 10^{-4}$
Beryllium (4)	Be-7		$2 \times 10^{-2}$
Bismuth (83)	Bi-206		$4 \times 10^{-4}$
Bromine (35)	Br-82	$4 \times 10^{-7}$	$3 \times 10^{-3}$
Cadmium (48)	Cd-109		$2 \times 10^{-3}$
	Cd-115m		$3 \times 10^{-4}$
	Cd-115		$3 \times 10^{-4}$
Calcium (20)	Ca-45		$9 \times 10^{-5}$
	Ca-47		$5 \times 10^{-4}$
Carbon (6)	C-14	$1 \times 10^{-6}$	$8 \times 10^{-3}$
Cerium (58)	Ce-141		$9 \times 10^{-4}$
	Ce-143		$4 \times 10^{-4}$
	Ce-144		$1 \times 10^{-4}$
Cesium (55)	Cs-131		$2 \times 10^{-2}$
	Cs-134m		$6 \times 10^{-2}$
	Cs-134		$9 \times 10^{-5}$
Chlorine (17)	Cl-38	$9 \times 10^{-7}$	$4 \times 10^{-3}$
Chromium (24)	Cr-51		$2 \times 10^{-2}$
Cobalt (27)	Co-57		$5 \times 10^{-3}$
	Co-58		$1 \times 10^{-3}$
	Co-60		$5 \times 10^{-4}$
Copper (29)	Cu-64		$3 \times 10^{-3}$
Dysprosium (66)	Dy-165		$4 \times 10^{-3}$
	Dy-166		$4 \times 10^{-4}$
Erbium (68)	Er-169		$9 \times 10^{-4}$
	Er-171		$1 \times 10^{-3}$
Europium (63)	Eu-152(9.2 h)		$6 \times 10^{-4}$
	Eu-155		$2 \times 10^{-3}$
Fluorine (9)	F-18	$2 \times 10^{-6}$	$8 \times 10^{-3}$
Gadolinium (64)	Gd-153		$2 \times 10^{-3}$
	Gd-159		$8 \times 10^{-4}$
Gallium (31)	Ga-72		$4 \times 10^{-4}$
Germanium (32)	Ge-71		$2 \times 10^{-2}$
Gold (79)	Au-196		$2 \times 10^{-3}$
	Au-198		$5 \times 10^{-4}$
	Au-199		$2 \times 10^{-3}$

1/ Values are given in Column I only for those materials normally used as gases.

2/ microcuries /g for solids

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/
Hafnium (72)	Hf-181		$7X10^{-4}$
Hydrogen (1)	H-3	$5X10^{-6}$	$3X10^{-2}$
Indium (49)	In-113m		$1X10^{-2}$
	In-114m		$2X10^{-4}$
Iodine (53)	I-126	$3X10^{-9}$	$2X10^{-5}$
	I-131	$3X10^{-9}$	$2X10^{-5}$
	I-132	$8X10^{-8}$	$6X10^{-4}$
	I-133	$1X10^{-8}$	$7X10^{-5}$
	I-134	$2X10^{-7}$	$1X10^{-3}$
Iridium (77)	Ir-190		$2X10^{-3}$
	Ir-192		$4X10^{-4}$
	Ir-194		$3X10^{-4}$
Iron (26)	Fe-55		$8X10^{-3}$
	Fe-59		$6X10^{-4}$
Krypton (36)	Kr-85m	$1X10^{-6}$	
	Kr-85	$3X10^{-6}$	
Lanthanum (57)	La-140		$2X10^{-4}$
Lead (82)	Pb-203		$4X10^{-3}$
Lutetium (71)	Lu-177		$1X10^{-3}$
Manganese (25)	Mn-52		$3X10^{-4}$
	Mn-54		$1X10^{-3}$
	Mn-56		$1X10^{-3}$
Mercury (80)	Hg-197m		$2X10^{-3}$
	Hg-197		$3X10^{-3}$
	Hg-203		$2X10^{-4}$
Molybdenum (42)	Mo-99		$2X10^{-3}$
Neodymium (60)	Nd-147		$6X10^{-4}$
	Nd-149		$3X10^{-3}$
Nickel (28)	Ni-65		$1X10^{-3}$
Niobium (Columbium) (41)	Nb-95		$1X10^{-3}$
	Nb-97		$9X10^{-3}$
Osmium (76)	Os-185		$7X10^{-4}$
	Os-191m		$3X10^{-2}$
	Os-191		$2X10^{-3}$
	Os-193		$6X10^{-4}$
Palladium (46)	Pd-103		$3X10^{-3}$
	Pd-109		$9X10^{-4}$
Phosphorus (15)	P-32		$2X10^{-4}$
Platinum (78)	Pt-191		$1X10^{-3}$
	Pt-193m		$1X10^{-2}$
	Pt-197m		$1X10^{-2}$
	Pt-197		$1X10^{-3}$
Potassium (19)	K-42		$3X10^{-3}$
Praseodymium (59)	Pr-142		$3X10^{-4}$
	Pr-143		$5X10^{-4}$
Promethium (61)	Pm-147		$2X10^{-3}$
	Pm-149		$4X10^{-4}$
Rhenium (75)	Re-183		$6X10^{-3}$
	Re-186		$9X10^{-4}$
Rhodium (45)	Rh-103m		$1X10^{-1}$
	Rh-105		$1X10^{-3}$
Rubidium (37)	Rb-86		$7X10^{-4}$

Published under s. 35.93, Stats. Updated on the first day of each month. Entire code is always current. The Register date on each page is the date the chapter was last published.

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/	
Ruthenium (44)	Ru-97		4X10 <sup>-4</sup>	
	Ru-103		8X10 <sup>-4</sup>	
	Ru-105		1X10 <sup>-3</sup>	
	Ru-106		1X10 <sup>-4</sup>	
Samarium (62)	Sm-153		8X10 <sup>-4</sup>	
Scandium (21)	Sc-46		4X10 <sup>-4</sup>	
	Sc-47		9X10 <sup>-4</sup>	
	Sc-48		3X10 <sup>-4</sup>	
Selenium (34)	Se-75		3X10 <sup>-3</sup>	
Silicon (14)	Si-31		9X10 <sup>-3</sup>	
Silver (47)	Ag-105		1X10 <sup>-3</sup>	
	Ag-110m		3X10 <sup>-4</sup>	
	Ag-111		4X10 <sup>-4</sup>	
	Na-24		2X10 <sup>-3</sup>	
Sodium (11)				
Strontium (38)	Sr-85		1X10 <sup>-4</sup>	
	Sr-89		1X10 <sup>-4</sup>	
	Sr-91		7X10 <sup>-4</sup>	
	Sr-92		7X10 <sup>-4</sup>	
Sulfur (16)	S-35	9X10 <sup>-8</sup>	6X10 <sup>-4</sup>	
Tantalum (73)	Ta-182		4X10 <sup>-4</sup>	
Technetium (43)	Tc-96m		1X10 <sup>-1</sup>	
	Tc-96		1X10 <sup>-3</sup>	
Tellurium (52)	Te-125m		2X10 <sup>-3</sup>	
	Te-127m		6X10 <sup>-4</sup>	
	Te-127		3X10 <sup>-3</sup>	
	Te-129m		3X10 <sup>-4</sup>	
	Te-131m		6X10 <sup>-4</sup>	
	Te-132		3X10 <sup>-4</sup>	
	Terbium (65)	Tb-160		4X10 <sup>-4</sup>
	Thallium (81)	Tl-200		4X10 <sup>-3</sup>
Tl-201			3X10 <sup>-3</sup>	
Tl-202			1X10 <sup>-3</sup>	
Tl-204			1X10 <sup>-3</sup>	
Tm-170			5X10 <sup>-4</sup>	
Thulium (69)	Tm-171		5X10 <sup>-3</sup>	
Tin (50)	Sn-113		9X10 <sup>-4</sup>	
	Sn-125		2X10 <sup>-4</sup>	
Tungsten (Wolfram) (74)	W-181		4X10 <sup>-3</sup>	
	W-187		7X10 <sup>-4</sup>	
Vanadium (23)	V-48		3X10 <sup>-4</sup>	
Xenon (54)	Xe-131m	4X10 <sup>-6</sup>		
	Xe-133	3X10 <sup>-6</sup>		
	Xe-135	1X10 <sup>-6</sup>		
Ytterbium (70)	Yb-175		1X10 <sup>-3</sup>	
1/ Values are given in Column I only for those materials normally used as gases.				
2/ microcuries /g for solids				
Yttrium (39)	Y-90		2X10 <sup>-4</sup>	
	Y-91m		3X10 <sup>-2</sup>	
	Y-91		3X10 <sup>-4</sup>	
	Y-92		6X10 <sup>-4</sup>	

Element (atomic number)	Radionuclide	Column I Gas concentration microcuries/ml 1/	Column II Liquid and solid concentration microcuries/ml 2/
Zinc (30)	Y-93		$3 \times 10^{-4}$
	Zn-65		$1 \times 10^{-3}$
	Zn-69m		$7 \times 10^{-4}$
Zirconium (40)	Zn-69		$2 \times 10^{-2}$
	Zr-95		$6 \times 10^{-4}$
	Zr-97		$2 \times 10^{-4}$

Beta- and gamma-emitting  
radioactive material not listed  
above with half-life  
of less than 3 years.

$1 \times 10^{-10}$

$1 \times 10^{-6}$

1/ Values are given in Column I only for those materials normally used as gases.

2/ microcuries /g for solids

**Note 1:** Many radionuclides transform into other radionuclides. In expressing the concentrations in Appendix A, the activity stated is that of the parent radionuclide and takes into account the radioactive decay products.

**Note 2:** For purposes of s. DHS 157.09 (2) where there is involved a combination of radionuclides, the limit for the combination should be derived as follows: Determine for each radionuclide in the product the ratio between the radioactivity concentration present in the product and the exempt radioactivity concentration established in Appendix A for the specific radionuclide when not in combination. The sum of such ratios may not exceed "1".

**Example:** 
$$\frac{\text{Concentration of Radionuclide A in Product}}{\text{Exempt concentration of Radionuclide A}} + \frac{\text{Concentration of Radionuclide B in Product}}{\text{Exempt concentration of Radionuclide B}} \leq 1$$

**Note 3:** To convert microcuries-/ml to SI units of megabecquerels per liter multiply the above values by 37.

**Example:** Zirconium (40) Zr-97 ( $2 \times 10^{-4}$  microcuries/ml multiplied by 37 is equivalent to  $74 \times 10^{-4}$  MBq/l).

2/ microcuries/g for solids.