Chapter DHS 157

APPENDIX A

Exempt Concentrations

Element (atomic number)	Radionuclide	Column I Gas concentration µCi/ml 1/	Column II Liquid and solid concentration µCi/ml 2/
Antimony (51)	Sb−122		$3X10^{-4}$
	Sb−124		$2X10^{-4}$
	Sb−125		$1X10^{-3}$
Argon (18)	Ar−37	$1X10^{-3}$	
	Ar−41	$4X10^{-7}$	
Arsenic (33)	As−73		$5X10^{-3}$
	As−74		$5X10^{-4}$
	As−76		$2X10^{-4}$
	As−77		$8X10^{-4}$
Barium (56)	Ba−131		$2X10^{-3}$
	Ba−140		$3X10^{-4}$
Beryllium (4)	Be−7		$2X10^{-2}$
Bismuth (83)	Bi−206		$4X10^{-4}$
Bromine (35)	Br−82	$4X10^{-7}$	$3X10^{-3}$
Cadmium (48)	Cd−109		$2X10^{-3}$
	Cd−115m		$3X10^{-4}$
	Cd−115		$3X10^{-4}$
Calcium (20)	Ca−45		$9X10^{-5}$
	Ca−47		$5X10^{-4}$
Carbon (6)	C−14	$1X10^{-6}$	$8X10^{-3}$
Cerium (58)	Ce−141		$9X10^{-4}$
	Ce−143		$4X10^{-4}$
	Ce−144		$1X10^{-4}$
Cesium (55)	Cs−131		$2X10^{-2}$
	Cs−134m		$6X10^{-2}$
	Cs−134		$9X10^{-5}$
Chlorine (17)	Cl−38	$9X10^{-7}$	$4X10^{-3}$
Chromium (24)	Cr−51		$2X10^{-2}$
Cobalt (27)	Co−57		$5X10^{-3}$
	Co−58		$1X10^{-3}$
	Co−60		$5X10^{-4}$
Copper (29)	Cu−64		$3X10^{-3}$
Dysprosium (66)	Dy−165		$4X10^{-3}$
	Dy−166		$4X10^{-4}$
Erbium (68)	Er−169		$9X10^{-4}$
	Er−171		$1X10^{-3}$
Europium (63)	Eu−152(9.2 h)		$6X10^{-4}$
	Eu−155		$2X10^{-3}$
Fluorine (9)	F−18	$2X10^{-6}$	$8X10^{-3}$

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

Element (atomic number)	Radionuclide	Column I Gas concentration µCi/ml 1/	Column II Liquid and solid concentration µCi/ml 2/
Gadolinium (64)	Gd−153		$2X10^{-3}$
	Gd−159		$8X10^{-4}$
Gallium (31)	Ga−72		$4X10^{-4}$
Germanium (32)	Ge−71		$2X10^{-2}$
Gold (79)	Au−196		$2X10^{-3}$
	Au−198		$5X10^{-4}$
	Au−199		$2X10^{-3}$
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		$1X10^{-2}$

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

Element (atomic number)	**Radionuclide**	**Column I Gas concentration µCi/ml 1/**	**Column II Liquid and solid concentration µCi/ml 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		$9X10^{-4}$
	Re–188		$6X10^{-4}$
Rhodium (45)	Rh–103m		$1X10^{-1}$
	Rh–105		$1X10^{-3}$
Rubidium (37)	Rb–86		$7X10^{-4}$
Ruthenium (44)	Ru–97		$4X10^{-3}$
	Ru–103		$8X10^{-4}$
	Ru–105		$1X10^{-3}$
	Ru–106		$1X10^{-4}$
Samarium (62)	Sm–153		$8X10^{-4}$
Scandium (21)	Sc–46		$4X10^{-4}$
	Sc–47		$9X10^{-4}$
	Sc–48		$3X10^{-4}$
Selenium (34)	Se–75		$3X10^{-3}$
Silicon (14)	Si–31		$9X10^{-3}$
Silver (47)	Ag–105		$1X10^{-3}$
	Ag–110m		$3X10^{-4}$
	Ag–111		$4X10^{-4}$
Sodium (11)	Na–24		$2X10^{-3}$
Strontium (38)	Sr–85		$1X10^{-3}$
	Sr–89		$1X10^{-4}$
	Sr–91		$7X10^{-4}$
	Sr–92		$7X10^{-4}$
Sulfur (16)	S–35	$9X10^{-8}$	$6X10^{-4}$
Tantalum (73)	Ta–182		$4X10^{-4}$
Technetium (43)	Tc–96m		$1X10^{-1}$
	Tc–96		$1X10^{-3}$
Tellurium (52)	Te–125m		$2X10^{-3}$
	Te–127m		$6X10^{-4}$
	Te–127		$3X10^{-3}$
	Te–129m		$3X10^{-4}$
	Te–131m		$6X10^{-4}$
	Te–132		$3X10^{-4}$
Terbium (65)	Tb–160		$4X10^{-4}$
Thallium (81)	Tl–200		$4X10^{-3}$
	Tl–201		$3X10^{-3}$

	Tl−202		$1X10^{-3}$
	Tl−204		$1X10^{-3}$
Thulium (69)	Tm−170		$5X10^{-4}$

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

Element (atomic number)	**Radionuclide**	**Column I Gas concentration µCi/ml 1/**	**Column II Liquid and solid concentration µCi/ml 2/**
	Tm−171		$5X10^{-3}$
Tin (50)	Sn−113		$9X10^{-4}$
	Sn−125		$2X10^{-4}$
Tungsten (Wolfram) (74)	W−181		$4X10^{-3}$
	W−187		$7X10^{-4}$
Vanadium (23)	V−48		$3X10^{-4}$
Xenon (54)	Xe−131m	$4X10^{-6}$	
	Xe−133	$3X10^{-6}$	
	Xe−135	$1X10^{-6}$	
Ytterbium (70)	Yb−175		$1X10^{-3}$
Yttrium (39)	Y−90		$2X10^{-4}$
	Y−91m		$3X10^{-2}$
	Y−91		$3X10^{-4}$
	Y−92		$6X10^{-4}$
	Y−93		$3X10^{-4}$
Zinc (30)	Zn−65		$1X10^{-3}$
	Zn−69m		$7X10^{-4}$
	Zn−69		$2X10^{-2}$
Zirconium (40)	Zr−95		$6X10^{-4}$
	Zr−97		$2X10^{-4}$
Beta− and gamma−emitting radioactive material not listed above with half−life of less than 3 years.		$1X10^{-10}$	$1X10^{-6}$

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 µCi/ml to SI units of megabecquerels per liter multiply the above values by 37.

Example: Zirconium (40) Zr−97 ($2x10^{-4}$ µCi/ml multiplied by 37 is equivalent to 74 x 10^{-4} MBq/l).
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2/ µCi/g for solids.