**Section 1000.APPENDIX A Concentrations in Air Above Natural Background**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element (atomic number) | Isotope1 |  | µCi/ml | | |
| Actinium (89) | AC 227 | S | 8 x 10-14 | | |
|  |  | I | 9 x 10-13 | | |
|  | AC 228 | S | 3 x 10-9 | | |
|  |  | I | 6 x 10-10 | | |
| Americium (95) | Am 241 | S | 2 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Am 242m | S | 2 x 10-13 | | |
|  |  | I | 9 x 10-12 | | |
|  | Am 242 | S | 1 x 10-9 | | |
|  |  | I | 2 x 10-9 | | |
|  | Am 243 | S | 2 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Am 244 | S | 1 x 10-7 | | |
|  |  | I | 8 x 10-7 | | |
| Antimony | Sb 122 | S | 6 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
|  | Sb 124 | S | 5 x 10-9 | | |
|  |  | I | 7 x 10-10 | | |
|  | Sb 125 | S | 2 x 10-8 | | |
|  |  | I | 9 x 10-10 | | |
| Argon (18) | A 37 | Sub2 | 1 x 10-4 | | |
|  | A 41 | Sub | 4 x 10-8 | | |
| Arsenic (33) | As 73 | S | 7 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | As 74 | S | 1 x 10-8 | | |
|  |  | I | 4 x 10-9 | | |
|  | As 76 | S | 4 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
|  | As 77 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
| Astatine (85) | At 211 | S | 2 x 10-10 | | |
|  |  | I | 1 x 10-9 | | |
| Barium (56) | Ba 131 | S | 4 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Ba 140 | S | 4 x 10-9 | | |
|  |  | I | 1 x 10-9 | | |
| Berkelium (97) | Bk 249 | S | 3 x 10-11 | | |
|  |  | I | 4 x 10-9 | | |
|  | Bk 250 | S | 5 x 10-9 | | |
|  |  | I | 4 x 10-8 | | |
| Berylium (4) | Be 7 | S | 2 x 10-7 | | |
|  |  | I | 4 x 10-8 | | |
| Bismuth (83) | Bi 206 | S | 6 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
|  | Bi 207 | S | 6 x 10-9 | | |
|  |  | I | 5 x 10-10 | | |
|  | Bi 210 | S | 2 x 10-10 | | |
|  |  | I | 2 x 10-10 | | |
|  | Bi 212 | S | 3 x 10-9 | | |
|  |  | I | 7 x 10-9 | | |
| Bromine (35) | Br 82 | S | 4 x 10-8 | | |
|  |  | I | 6 x 10-9 | | |
| Cadmium (48) | Cd 109 | S | 2 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
|  | Cd 115m | S | 1 x 10-9 | | |
|  |  | I | 1 x 10-9 | | |
|  | Cd 115 | S | 8 x 10-9 | |
|  |  | I | 6 x 10-9 | | |
| Calcium (20) | Ca 45 | S | 1 x 10-9 | |
|  |  | I | 4 x 10-9 | | |
|  | Ca 47 | S | 6 x 10-9 | |
|  |  | I | 6 x 10-9 | | |
| Californium (98) | Cf 249 | S | 5 x 10-14 | |
|  |  | I | 3 x 10-12 | | |
|  | Cf 250 | S | 2 x 10-13 | | |
|  |  | I | 3 x 10-12 | | |
|  | Cf 251 | S | 6 x 10-14 | | |
|  |  | I | 3 x 10-12 | | |
|  | Cf 252 | S | 2 x 10-13 | | |
|  |  | I | 1 x 10-12 | | |
|  | Cf 253 | S | 3 x 10-11 | | |
|  |  | I | 3 x 10-11 | | |
|  | Cf 254 | S | 2 x 10-13 | | |
|  |  | I | 2 x 10-13 | | |
| Carbon (6) | C 14 | S | 1 x 10-7 | | |
|  | (CO2) | Sub | 1 x 10-6 | | |
| Cerium (58) | Ce 141 | S | 2 x 10-8 | | |
|  |  | I | 5 x 10-9 | | |
|  | Ce 143 | S | 9 x 10-9 | | |
|  |  | I | 7 x 10-9 | | |
|  | Ce 144 | S | 3 x 10-10 | | |
|  |  | I | 2 x 10-10 | | |
| Cesium (55) | Cs 131 | S | 4 x 10-7 | | |
|  |  | I | 1 x 10-7 | | |
|  | Cs 134m | S | 1 x 10-6 | | |
|  |  | I | 2 x 10-7 | | |
|  | Cs 134 | S | 1 x 10-9 | | |
|  |  | I | 4 x 10-10 | | |
|  | Cs 135 | S | 2 x 10-8 | | |
|  |  | I | 3 x 10-9 | | |
|  | Cs 136 | S | 1 x 10-8 | | |
|  |  | I | 6 x 10-9 | | |
|  | Cs 137 | S | 2 x 10-9 | | |
|  |  | I | 5 x 10-10 | | |
| Chlorine (17) | Cl 36 | S | 1 x 10-8 | | |
|  |  | I | 8 x 10-10 | | |
|  | Cl 38 | S | 9 x 10-8 | | |
|  |  | I | 7 x 10-8 | | |
| Chromium (24) | Cr 51 | S | 4 x 10-7 | | |
|  |  | I | 8 x 10-8 | | |
| Cobalt (27) | Co 57 | S | 1 x 10-7 | | |
|  |  | I | 6 x 10-9 | | |
|  | Co 58m | S | 6 x 10-7 | | |
|  |  | I | 3 x 10-7 | | |
|  | Co 58 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-9 | | |
|  | Co 60 | S | 1 x 10-8 | | |
|  |  | I | 3 x 10-10 | | |
| Copper (29) | Cu 64 | S | 7 x 10-8 | | |
|  |  | I | 4 x 10-8 | | |
| Curium (96) | Cm 242 | S | 4 x 10-12 | | |
|  |  | I | 6 x 10-12 | | |
|  | Cm 243 | S | 2 x 10-13 | | |
|  |  | I | 3 x 10-12 | | |
|  | Cm 244 | S | 3 x 10-13 | | |
|  |  | I | 3 x 10-12 | | |
|  | Cm 245 | S | 2 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Cm 246 | S | 2 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Cm 247 | S | 2 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Cm 248 | S | 2 x 10-14 | | |
|  |  | I | 4 x 10-13 | | |
|  | Cm 249 | S | 4 x 10-7 | | |
|  |  | I | 4 x 10-7 | | |
| Dysprosium (66) | Dy 165 | S | 9 x 10-8 | | |
|  |  | I | 7 x 10-8 | | |
|  | Dy 166 | S | 8 x 10-9 | | |
|  |  | I | 7 x 10-9 | | |
| Einsteinium (99) | Es 253 | S | 3 x 10-11 | | |
|  |  | I | 2 x 10-11 | | |
|  | Es 254m | S | 2 x 10-10 | | |
|  |  | I | 2 x 10-10 | | |
|  | Es 254 | S | 6 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Es 255 | S | 2 x 10-11 | | |
|  |  | I | 1 x 10-11 | | |
| Erbium (68) | Er 169 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Er 171 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Europium (63) | Eu 152 | S | 1 x 10-8 | | |
|  | (T/2 = 9.2 hrs) | I | 1 x 10-8 | | |
|  | Eu 152 | S | 4 x 10-10 | | |
|  | (T/2 = 13 yrs) | I | 6 x 10-10 | | |
|  | Eu 154 | S | 1 x 10-10 | | |
|  |  | I | 2 x 10-10 | | |
|  | Eu 155 | S | 3 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
| Fermium (100) | Fm 254 | S | 2 x 10-9 | | |
|  |  | I | 2 x 10-9 | | |
|  | Fm 255 | S | 6 x 10-10 | | |
|  |  | I | 4 x 10-10 | | |
|  | Fm 256 | S | 1 x 10-10 | | |
|  |  | I | 6 x 10-11 | | |
| Fluorine (9) | F 18 | S | 2 x 10-7 | | |
|  |  | I | 9 x 10-8 | | |
| Gadolinium (64) | Gd 153 | S | 8 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
|  | Gd 159 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
| Gallium (31) | Ga 72 | S | 8 x 10-9 | | |
|  |  | I | 6 x 10-9 | | |
| Germanium (32) | Ge 71 | S | 4 x 10-7 | | |
|  |  | I | 2 x 10-7 | | |
| Gold (79) | Au 196 | S | 4 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
|  | Au 198 | S | 1 x 10-8 | | |
|  |  | I | 8 x 10-9 | | |
|  | Au 199 | S | 4 x 10-8 | | |
|  |  | I | 3 x 10-8 | | |
| Hafnium (72) | Hf 181 | S | 1 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
| Holmium (67) | Ho 166 | S | 7 x 10-9 | | |
|  |  | I | 6 x 10-9 | | |
| Hydrogen (1) | H3 | S | 2 x 10-7 | | |
|  |  | I | 2 x 10-7 | | |
|  |  | Sub | 4 x 10-5 | | |
| Indium (49) | In 113m | S | 3 x 10-7 | | |
|  |  | I | 2 x 10-7 | | |
|  | In 114m | S | 4 x 10-9 | | |
|  |  | I | 7 x 10-10 | | |
|  | In 115m | S | 8 x 10-8 | | |
|  |  | I | 6 x 10-8 | | |
|  | In 115 | S | 9 x 10-9 | | |
|  |  | I | 1 x 10-9 | | |
| Iodine (53) | I 125 | S | 8 x 10-11 | | |
|  |  | I | 6 x 10-9 | | |
|  | I 126 | S | 9 x 10-11 | | |
|  |  | I | 1 x 10-8 | | |
|  | I 129 | S | 2 x 10-11 | | |
|  |  | I | 2 x 10-9 | | |
|  | I 131 | S | 1 x 10-10 | | |
|  |  | I | 1 x 10-8 | | |
|  | I 132 | S | 3 x 10-9 | | |
|  |  | I | 3 x 10-8 | | |
|  | I 133 | S | 4 x 10-10 | | |
|  |  | I | 7 x 10-9 | | |
|  | I 134 | S | 6 x 10-9 | | |
|  |  | I | 1 x 10-7 | | |
|  | I 135 | S | 1 x 10-9 | | |
|  |  | I | 1 x 10-8 | | |
| Iridium (77) | Ir 190 | S | 4 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Ir 192 | S | 4 x 10-9 | | |
|  |  | I | 9 x 10-10 | | |
|  | Ir 194 | S | 8 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
| Iron (26) | Fe 55 | S | 3 x 10-8 | | |
|  |  | I | 3 x 10-8 | | |
|  | Fe 59 | S | 5 x 10-9 | | |
|  |  | I | 2 x 10-9 | | |
| Krypton (36) | Kr 85m | Sub | 1 x 10-7 | | |
|  | Kr 85 | Sub | 3 x 10-7 | | |
|  | Kr 87 | Sub | 2 x 10-8 | | |
|  | Kr 88 | Sub | 2 x 10-8 | | |
| Lanthanum (57) | La 140 | S | 5 x 10-9 | | |
|  |  | I | 4 x 10-9 | | |
| Lead (82) | Pb 203 | S | 9 x 10-8 | | |
|  |  | I | 6 x 10-8 | | |
|  | Pb 210 | S | 4 x 10-12 | | |
|  |  | I | 8 x 10-12 | | |
|  | Pb 212 | S | 6 x 10-10 | | |
|  |  | I | 7 x 10-10 | | |
| Lutetium (71) | Lu 177 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Manganese (25) | Mn 52 | S | 7 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
|  | Mn 54 | S | 1 x 10-8 | | |
|  |  | I | 1 x 10-9 | | |
|  | Mn 56 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Mercury (80) | Hg 197m | S | 3 x 10-8 | | |
|  |  | I | 3 x 10-8 | | |
|  | Hg 197 | S | 4 x 10-8 | | |
|  |  | I | 9 x 10-8 | | |
|  | Hg 203 | S | 2 x 10-9 | | |
|  |  | I | 4 x 10-9 | | |
| Molybdenum (42) | Mo 99 | S | 3 x 10-8 | | |
|  |  | I | 7 x 10-9 | | |
| Neodymium (60) | Nd 144 | S | 3 x 10-12 | | |
|  |  | I | 1 x 10-11 | | |
|  | Nd 147 | S | 1 x 10-8 | | |
|  |  | I | 8 x 10-9 | | |
|  | Nd 149 | S | 6 x 10-8 | | |
|  |  | I | 5 x 10-8 | | |
| Neptunium (93) | Np 237 | S | 1 x 10-13 | | |
|  |  | I | 4 x 10-12 | | |
|  | Np 239 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Nickel (28) | Ni 59 | S | 2 x 10-8 | | |
|  |  | I | 3 x 10-8 | | |
|  | Ni 63 | S | 2 x 10-9 | | |
|  |  | I | 1 x 10-8 | | |
|  | Ni 65 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Niobium (Columbium) (41) | Nb 93m | S | 4 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
|  | Nb 95 | S | 2 x 10-8 | | |
|  |  | I | 3 x 10-9 | | |
|  | Nb 97 | S | 2 x 10-7 | | |
|  |  | I | 2 x 10-7 | | |
| Osmium (76) | Os 185 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-9 | | |
|  | Os 191m | S | 6 x 10-7 | | |
|  |  | I | 3 x 10-7 | | |
|  | Os 191 | S | 4 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Os 193 | S | 1 x 10-8 | | |
|  |  | I | 9 x 10-9 | | |
| Palladium (46) | Pd 103 | S | 5 x 10-8 | | |
|  |  | I | 3 x 10-8 | | |
|  | Pd 109 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
| Phosphorus (15) | P 32 | S | 2 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
| Platinum (78) | Pt 191 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
|  | Pt 193m | S | 2 x 10-7 | | |
|  |  | I | 2 x 10-7 | | |
|  | Pt 193 | S | 4 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Pt 197m | S | 2 x 10-7 | | |
|  |  | I | 2 x 10-7 | | |
|  | Pt 197 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Plutonium (94) | Pu 238 | S | 7 x 10-14 | | |
|  |  | I | 1 x 10-12 | | |
|  | Pu 239 | S | 6 x 10-14 | | |
|  |  | I | 1 x 10-12 | | |
|  | Pu 240 | S | 6 x 10-14 | | |
|  |  | I | 1 x 10-12 | | |
|  | Pu 241 | S | 3 x 10-12 | | |
|  |  | I | 1 x 10-9 | | |
|  | Pu 242 | S | 6 x 10-14 | | |
|  |  | I | 1 x 10-12 | | |
|  | Pu 243 | S | 6 x 10-8 | | |
|  |  | I | 8 x 10-8 | | |
|  | Pu 244 | S | 6 x 10-14 | | |
|  |  | I | 1 x 10-12 | | |
| Polonium (84) | Po 210 | S | 2 x 10-11 | | |
|  |  | I | 7 x 10-12 | | |
| Potassium (19) | K 42 | S | 7 x 10-8 | | |
|  |  | I | 4 x 10-9 | | |
| Praseodymium (59) | Pr 142 | S | 7 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
|  | Pr 143 | S | 1 x 10-8 | | |
|  |  | I | 6 x 10-9 | | |
| Promethium (61) | Pm 147 | S | 2 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
|  | Pm 149 | S | 1 x 10-8 | | |
|  |  | I | 8 x 10-9 | | |
| Protoactinium (91) | Pa 230 | S | 6 x 10-11 | | |
|  |  | I | 3 x 10-11 | | |
|  | Pa 231 | S | 4 x 10-14 | | |
|  |  | I | 4 x 10-12 | | |
|  | Pa 233 | S | 2 x 10-8 | | |
|  |  | I | 6 x 10-9 | | |
| Radium (88) | Ra 223 | S | 6 x 10-11 | | |
|  |  | I | 8 x 10-12 | | |
|  | Ra 224 | S | 2 x 10-10 | | |
|  |  | I | 2 x 10-11 | | |
|  | Ra 226 | S | 3 x 10-12 | | |
|  |  | I | 2 x 10-12 | | |
|  | Ra 228 | S | 2 x 10-12 | | |
|  |  | I | 1 x 10-12 | | |
| Radon (86) | Rn 220 | S | 1 x 10-8 | | |
|  | Rn 2223 | I | 3 x 10-9 | | |
| Rhenium (75) | Re 183 | S | 9 x 10-8 | | |
|  |  | I | 5 x 10-9 | | |
|  | Re 186 | S | 2 x 10-8 | | |
|  |  | I | 8 x 10-9 | | |
|  | Re 187 | S | 3 x 10-7 | | |
|  |  | I | 2 x 10-8 | | |
|  | Re 188 | S | 1 x 10-8 | | |
|  |  | I | 6 x 10-9 | | |
| Rhodium (45) | Rh 103m | S | 3 x 10-6 | | |
|  |  | I | 2 x 10-6 | | |
|  | Rh 105 | S | 3 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Rubidium (37) | Rb 86 | S | 1 x 10-8 | | |
|  |  | I | 2 x 10-9 | | |
|  | Rb 87 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-9 | | |
| Ruthenium (44) | Ru 97 | S | 8 x 10-8 | | |
|  |  | I | 6 x 10-8 | | |
|  | Ru 103 | S | 2 x 10-8 | | |
|  |  | I | 3 x 10-9 | | |
|  | Ru 105 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
|  | Ru 106 | S | 3 x 10-9 | | |
|  |  | I | 2 x 10-10 | | |
| Samarium (62) | Sm 147 | S | 2 x 10-12 | | |
|  |  | I | 9 x 10-12 | | |
|  | Sm 151 | S | 2 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
|  | Sm 153 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
| Scandium (21) | Sc 46 | S | 8 x 10-9 | | |
|  |  | I | 8 x 10-10 | | |
|  | Sc 47 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
|  | Sc 48 | S | 6 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
| Selenium (34) | Se 75 | S | 4 x 10-8 | | |
|  |  | I | 4 x 10-9 | | |
| Silicon (14) | Si 31 | S | 2 x 10-7 | | |
|  |  | I | 3 x 10-8 | | |
| Silver (47) | Ag 105 | S | 2 x 10-8 | | |
|  |  | I | 3 x 10-9 | | |
|  | Ag 110m | S | 7 x 10-9 | | |
|  |  | I | 3 x 10-10 | | |
|  | Ag 111 | S | 1 x 10-8 | | |
|  |  | I | 8 x 10-9 | | |
| Sodium (11) | Na 22 | S | 6 x 10-9 | | |
|  |  | I | 3 x 10-10 | | |
|  | Na 24 | S | 4 x 10-8 | | |
|  |  | I | 5 x 10-9 | | |
| Strontium (38) | Sr 85m | S | 1 x 10-6 | | |
|  |  | I | 1 x 10-6 | | |
|  | Sr 85 | S | 8 x 10-9 | | |
|  |  | I | 4 x 10-9 | | |
|  | Sr 89 | S | 3 x 10-10 | | |
|  |  | I | 1 x 10-9 | | |
|  | Sr 90 | S | 3 x 10-11 | | |
|  |  | I | 2 x 10-10 | | |
|  | Sr 91 | S | 2 x 10-8 | | |
|  |  | I | 9 x 10-9 | | |
|  | Sr 92 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
| Sulfur (16) | S 35 | S | 9 x 10-9 | | |
|  |  | I | 9 x 10-9 | | |
| Tantalum (73) | Ta 182 | S | 1 x 10-9 | | |
|  |  | I | 7 x 10-10 | | |
| Technetium (43) | Tc 96m | S | 3 x 10-6 | | |
|  |  | I | 1 x 10-6 | | |
|  | Tc 96 | S | 2 x 10-8 | | |
|  |  | I | 8 x 10-9 | | |
|  | Tc 97m | S | 8 x 10-8 | | |
|  |  | I | 5 x 10-9 | | |
|  | Tc 97 | S | 4 x 10-7 | | |
|  |  | I | 1 x 10-8 | | |
|  | Tc 99m | S | 1 x 10-6 | | |
|  |  | I | 5 x 10-7 | | |
|  | Tc 99 | S | 7 x 10-8 | | |
|  |  | I | 2 x 10-9 | | |
| Tellurium (52) | Te 125m | S | 1 x 10-8 | | |
|  |  | I | 4 x 10-9 | | |
|  | Te 127m | S | 5 x 10-9 |
|  |  | I | 1 x 10-9 |
|  | Te 127 | S | 6 x 10-8 |
|  |  | I | 3 x 10-8 |
|  | Te 129m | S | 3 x 10-9 |
|  |  | I | 1 x 10-9 |
|  | Te 129 | S | 2 x 10-7 |
|  |  | I | 1 x 10-7 |
|  | Te 131m | S | 1 x 10-8 |
|  |  | I | 6 x 10-9 |
|  | Te 132 | S | 7 x 10-9 |
|  |  | I | 4 x 10-9 |
| Terbium (65) | Tb 160 | S | 3 x 10-9 |
|  |  | I | 1 x 10-9 |
| Thallium (81) | Tl 200 | S | 9 x 10-8 |
|  |  | I | 4 x 10-8 |
|  | Tl 201 | S | 7 x 10-8 |
|  |  | I | 3 x 10-8 |
|  | Tl 202 | S | 3 x 10-8 |
|  |  | I | 8 x 10-9 |
|  | Tl 204 | S | 2 x 10-8 |
|  |  | I | 9 x 10-10 |
| Thorium (90) | Th 227 | S | 1 x 10-11 |
|  |  | I | 6 x 10-12 |
|  | Th 228 | S | 3 x 10-13 |
|  |  | I | 2 x 10-13 |
|  | Th 230 | S | 8 x 10-14 |
|  |  | I | 3 x 10-13 |
|  | Th 231 | S | 5 x 10-8 |
|  |  | I | 4 x 10-8 |
|  | Th 232 | S | 1 x 10-12 |
|  |  | I | 1 x 10-12 |
|  | Th natural | S | 2 x 10-12 |
|  |  | I | 2 x 10-12 |
|  | Th 234 | S | 2 x 10-9 |
|  |  | I | 1 x 10-9 |
| Thulium (69) | Tm 170 | S | 1 x 10-9 |
|  |  | I | 1 x 10-9 |
|  | Tm 171 | S | 4 x 10-9 |
|  |  | I | 8 x 10-9 |
| Tin (50) | Sn 113 | S | 1 x 10-8 |
|  |  | I | 2 x 10-9 |
|  | Sn 125 | S | 4 x 10-9 |
|  |  | I | 3 x 10-9 |
| Tungsten (Wolfram) (74) | W 181 | S | 8 x 10-8 |
|  |  | I | 4 x 10-9 |
|  | W 185 | S | 3 x 10-8 | | |
|  |  | I | 4 x 10-9 | | |
|  | W 187 | S | 2 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
| Uranium (92) | U 230 | S | 1 x 10-11 | | |
|  |  | I | 4 x 10-12 | | |
|  | U 232 | S | 3 x 10-12 | | |
|  |  | I | 9 x 10-13 | | |
|  | U 233 | S | 2 x 10-11 | | |
|  |  | I | 4 x 10-12 | | |
|  | U 234 | S4 | 2 x 10-11 | | |
|  |  | I | 4 x 10-12 | | |
|  | U 235 | S4 | 2 x 10-11 | | |
|  |  | I | 4 x 10-12 | | |
|  | U 236 | S | 2 x 10-11 | | |
|  |  | I | 4 x 10-12 | | |
|  | U 238 | S4 | 3 x 10-12 | | |
|  |  | I | 5 x 10-12 | | |
|  | U 240 | S | 8 x 10-9 | | |
|  |  | I | 6 x 10-9 | | |
|  | U-natural | S4 | 5 x 10-12 | | |
|  |  | I | 5 x 10-12 | | |
| Vanadium (23) | V 48 | S | 6 x 10-9 | | |
|  |  | I | 2 x 10-9 | | |
| Xenon (54) | Xe 131m | Sub | 4 x 10-7 | | |
|  | Xe 133 | Sub | 3 x 10-7 | | |
|  | Xe 133m | Sub | 3 x 10-7 | | |
|  | Xe 135 | Sub | 1 x 10-7 | | |
| Ytterbium (70) | Yb 175 | S | 2 x 10-8 | | |
|  |  | I | 2 x 10-8 | | |
| Yttrium (39) | Y 90 | S | 4 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
|  | Y 91m | S | 8 x 10-7 | | |
|  |  | I | 6 x 10-7 | | |
|  | Y 91 | S | 1 x 10-9 | | |
|  |  | I | 1 x 10-9 | | |
|  | Y 92 | S | 1 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Y 93 | S | 6 x 10-9 | | |
|  |  | I | 5 x 10-9 | | |
| Zinc (30) | Zn 65 | S | 4 x 10-9 | | |
|  |  | I | 2 x 10-9 | | |
|  | Zn 69m | S | 1 x 10-8 | | |
|  |  | I | 1 x 10-8 | | |
|  | Zn 69 | S | 2 x 10-7 | | |
|  |  | I | 3 x 10-7 | | |
| Zirconium (40) | Zr 93 | S | 4 x 10-9 | | |
|  |  | I | 1 x 10-8 | | |
|  | Zr 95 | S | 4 x 10-9 | | |
|  |  | I | 1 x 10-9 | | |
|  | Zr 97 | S | 4 x 10-9 | | |
|  |  | I | 3 x 10-9 | | |
| Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours. |  | Sub | 3 x 10-6 | | |
|  |  |  |  | | |
| Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours. |  |  | 1 x 10-10 | | |
|  |  |  |  | | |
| Any single radionuclide not listed above, that decays by alpha emission or spontaneous fission. |  |  | 2 x 10-14 | | |

1Soluble (S); Insoluble (I).

2"Sub" means that values given are for submersion in a semispherical infinite cloud of airborne material.

3These radon concentrations are appropriate for protection from radon-222 combined with its short-lived daughters. The value may be replaced by one-thirtieth (1/30) of a "working level." A "working level" is defined as any combination of short-lived radon-222 daughters, polonium-218, lead-214, bismuth-214 and polonium-214, in one liter of air, without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3 x 105 MeV of alpha particle energy.

4For soluble mixtures of U-238, U-234 and U-235 in air chemical toxicity may be the limiting factor. The concentration value is 0.007 milligrams of uranium per cubic meter of air. The specific activity for natural uranium is 6.77 x 10-7 curies per gram U. The specific activity (SA) for other mixtures of U-238, U-235 and U-234, if not known, will be:

SA = 3.6 x 10-7 curies/gram U U-depleted

SA = (0.4 + 0.38 E + 0.0034 E2) 10-6 E ≥ 0.72

where E is the percentage by weight of U-235, expressed as a percent.

NOTE: When a mixture in air of more than one radionuclide exists, the limiting values of this Appendix should be determined as follows:

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit otherwise established in Appendix A for the specific radionuclide when not in a mixture. The sum of the ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity").

EXAMPLE: If radionuclides A, B, and C are present in concentrations CA, CB, CC, and if the applicable MPCs are MPCA, and MPCB, and MPCC respectively, then the concentrations must be limited so that the following relationship exists:

(CA/MPCA) + (CB/MPCB) + (CC/MPCC) ≤ 1

2. If either the identity or the concentration of any radionuclide in the mixture is not known, the limiting values of Appendix A must be 2 x 10-14.

3. If any of the conditions specified below are met, the corresponding values specified below may be used instead of those specified in paragraph 2 above.

a. If the identity of each radionuclide in the mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the concentration limit for the mixture is the limit specified in Appendix A for the radionuclide in the mixture having the lowest concentration limit; or

b. If the identity of each radionuclide in the mixture is not known but it is known that radionuclides specified in Appendix A are not present in the mixture, the concentration limit for the mixture is the lowest concentration limit specified in Appendix A for any radionuclide that is not known to be absent from the mixture; or

c. Element (atomic number) and isotope. µCi/ml

|  |  |
| --- | --- |
| If it is known that alpha-emitters and Sr 90, I 129, Pb 210, Ac 227, Ra 228, Pa 230, Pu 241, and Bk 249 are not present. | 1 x 10-10 |
|  |  |
| If it is known that alpha-emitters and Pb 210, Ac 227, Ra 228, and Pu 241 are not present. | 1 x 10-11 |
|  |  |
| If it is known that alpha-emitters and Ac 227 are not present. | 1 x 10-12 |
|  |  |
| If it is known that Ac 227, Th 230, Pa 231, Pu 238, Pu 239, Pu 240, Pu 242, Pu 244, Cm 248, Cf 249 and Cf 251 are not present. | 1 x 10-13 |

4. If a mixture of radionuclides consists of uranium and its daughters in ore dust before chemical separation of the uranium from the ore, the following values may be used for uranium and its daughters through radium-226, instead of those from paragraphs 1, 2, or 3 above:

3 x 10-12 µCi/ml gross alpha activity; 2 x 10-12 µCi/ml natural uranium; or 3 micrograms per cubic meter of air natural uranium.

5. For this note, a radionuclide may be considered as not present in a mixture if:

a. the ratio of the concentration of that radionuclide in the mixture (CA) to the concentration limit for that radionuclide specified in Appendix A (MPCA) does not exceed 1/10 (i.e., CA/MPCA ≤ 1/10), and

b. the sum of such ratios for all the radionuclides considered as not present in the mixtures does not exceed 1/4, (i.e., (CA/MPCA + CB/MPCB + … ≤ 1/4).

(Source: Amended at 47 Ill. Reg. 6679, effective May 4, 2023)