

**4731.2750 ANNUAL LIMITS ON INTAKE AND DERIVED AIR CONCENTRATIONS.**

Subpart 1. **General explanation.** For each radionuclide, subpart 7, Table 1, indicates the chemical form that is to be used for selecting the appropriate annual limit on intake (ALI) or derived air concentration (DAC) value. The ALIs and DACs for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of 1  $\mu\text{m}$  and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks, or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D of less than ten days, for W from ten to 100 days, and for Y greater than 100 days. The class (D, W, or Y) given in the column headed "Atomic Number (AN), Radionuclide, and Class" applies only to the inhalation ALIs and DACs given in subpart 7, Table 1, columns 2 and 3. Subpart 7, Table 2, provides concentration limits for airborne and liquid effluents released to the general environment. Subpart 7, Table 3, provides concentration limits for discharges to sanitary sewer systems.

Subp. 2. **Notation.** The values in subpart 7, Tables 1, 2, and 3, are presented in the computer "E" notation. In this notation, a value of 6E-02 represents a value of  $6 \times 10^{-2}$  or 0.06, 6E+2 represents  $6 \times 10^2$  or 600, and 6E+0 represents  $6 \times 10^0$  or 6.

Subp. 3. **Table 1 explanation; occupational values.**

A. The columns in subpart 7, Table 1, are applicable to occupational exposure to radioactive material. Column 1 is the oral ingestion ALI, expressed in  $\mu\text{Ci}$ . Column 2 is the inhalation ALI, expressed in  $\mu\text{Ci}$ . Column 3 is the inhalation DAC, expressed in  $\mu\text{Ci}/\text{ml}$ .

B. The ALIs in this part are the annual intakes of a given radionuclide by reference man that would result in:

- (1) a committed effective dose equivalent of five rems (stochastic ALI); or
- (2) a committed dose equivalent of 50 rems to an organ or tissue (nonstochastic ALI).

C. The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of five rems.

D. The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor,  $W_T$ . This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of  $W_T$  are listed under part 4731.0100, subpart 261. The nonstochastic ALIs were derived to avoid nonstochastic effects, such as prompt damage to tissue or reduction in organ function.

E. A value of  $W_T=0.06$  is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalents and the dose equivalents of all other remaining tissues may be disregarded.

F. The following parts of the gastrointestinal tract are to be treated as four separate organs: stomach, small intestine, upper large intestine, and lower large intestine.

G. The dose equivalents for extremities (hands and forearms, feet and lower legs), skin, and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

H. When an ALI is defined by the stochastic dose limit, this value alone is given. When an ALI is determined by the nonstochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. Abbreviated organ or tissue designations are used:

LLI = lower large intestine wall;

Stom = stomach wall;

Blad = bladder wall;

Bone = bone surface;

Kid = kidneys; and

Thyr = thyroid.

I. The use of the ALIs listed first, the more limiting of the stochastic and nonstochastic ALIs, will ensure that nonstochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the nonstochastic ALI is limiting, use of that nonstochastic ALI is considered unduly conservative, a licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee must also ensure that the 50-rem dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose to that organ (not the effective dose). For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic ALIs ( $ALI_{ns}$ ) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity:  $\sum \mu p \times (\text{intake (in } \mu\text{Ci) of each radionuclide} / ALI_{ns}) < 1.0$ . If there is an external deep dose equivalent contribution of  $H_d$ , then this sum must be less than  $1 - (H_d/50)$  instead of being less than 1.0.

J. The DAC values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by:

$$\text{DAC} = \text{ALI}(\text{in } \mu\text{Ci}) / (2000 \text{ hours per working year} \times 60 \text{ minutes/hour} \times 2 \times 10^4 \text{ ml per minute}) = [\text{ALI} / 2.4 \times 10^9] \mu\text{Ci/ml}$$

where  $2 \times 10^4$  ml is the volume of air breathed per minute at work by reference man under working conditions of light work.

K. The DAC values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. Derived air concentrations based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

L. The ALI and DAC values relate to exposure to the single radionuclide named, but also include contributions from the in-growth of any daughter radionuclide produced in the body by the decay of the parent. However, intakes that include both the parent and daughter radionuclides should be treated by the general method appropriate for mixtures.

M. The values of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external irradiation.

N. When an individual is exposed to radioactive materials that fall under several of the translocation classifications (Class D, W, or Y) of the same radionuclide, the exposure may be evaluated as if it were a mixture of different radionuclides.

O. The classification of a compound as Class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radioisotopes. For this reason, values are given for Class D, W, and Y compounds, even for very short-lived radionuclides.

**Subp. 4. Table 2 explanation; effluent concentrations.**

A. The columns in subpart 7, Table 2, are applicable to the assessment and control of dose to the public, particularly in the implementation of part 4731.2095. Column 1 is the effluent concentration limit for air, expressed in  $\mu\text{Ci/ml}$ . Column 2 is the effluent concentration limit for water, expressed in  $\mu\text{Ci/ml}$ . The concentration values given in subpart 7, Table 2, columns 1 and 2, are equivalent to the radionuclide concentrations that, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 mrem or 0.5 mSv).

B. Consideration of nonstochastic limits has not been included in deriving the air and water effluent concentration limits because nonstochastic effects are presumed not to occur at the dose levels established for individual members of the public. For radionuclides, where the nonstochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in subpart 7, Table 2. For this reason, the DAC and airborne effluent limits are not always

proportional as they were in previous Code of Federal Regulations, title 10, sections 20.1 to 20.602, Appendix B.

C. The air concentration values in subpart 7, Table 2, column 1, were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by  $2.4 \times 10^9$  (ml), relating the inhalation ALI to the DAC, and then divided by a factor of 300. The factor of 300 includes the following components: a factor of 50 to relate the five-rem annual occupational dose limit to the 0.1-rem limit for members of the public; a factor of three to adjust for the difference in exposure time and inhalation rate for a worker and for members of the public; and a factor of two to adjust the occupational values derived for adults so that they are applicable to other age groups.

D. For those radionuclides for which submersion (external dose) is limiting, the occupational DAC in subpart 7, Table 1, column 3, was divided by 219. The factor of 219 is composed of a factor of 50, according to item C, and a factor of 4.38 relating occupational exposure for 2,000 hours per year to full-time exposure (8,760 hours per year). An additional factor of two for age considerations is not warranted in the submersion case.

E. The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by  $7.3 \times 10^7$ . The factor of  $7.3 \times 10^7$  (ml) includes the following components: the factors of 50 and two, according to item C, and a factor of  $7.3 \times 10^5$  (ml), which is the annual water intake of reference man.

F. Subpart 8 provides groupings of radionuclides that are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation ALIs and DACs, air and water effluent concentrations and sewerage, require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded, either from knowledge of the radionuclide composition of the source or from actual measurements.

Subp. 5. **Table 3 explanation; releases to sewers.** Subpart 7, Table 3, gives the monthly average concentrations for release to sanitary sewers, expressed in  $\mu\text{Ci/ml}$ . The monthly average concentrations for release to sanitary sewers are applicable to part 4731.2420. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by  $7.3 \times 10^6$  (ml). The factor of  $7.3 \times 10^6$  (ml) is composed of a factor of  $7.3 \times 10^5$  (ml), the annual water intake by reference man, and a factor of ten, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a reference man during a year, would result in a committed effective dose equivalent of 0.5 rem.

Subp. 6. **List of elements.**

| Name        | Symbol | Atomic Number (AN) |
|-------------|--------|--------------------|
| Actinium    | Ac     | 89                 |
| Aluminum    | Al     | 13                 |
| Americium   | Am     | 95                 |
| Antimony    | Sb     | 51                 |
| Argon       | Ar     | 18                 |
| Arsenic     | As     | 33                 |
| Astatine    | At     | 85                 |
| Barium      | Ba     | 56                 |
| Berkelium   | Bk     | 97                 |
| Beryllium   | Be     | 4                  |
| Bismuth     | Bi     | 83                 |
| Bromine     | Br     | 35                 |
| Cadmium     | Cd     | 48                 |
| Calcium     | Ca     | 20                 |
| Californium | Cf     | 98                 |
| Carbon      | C      | 6                  |
| Cerium      | Ce     | 58                 |
| Cesium      | Cs     | 55                 |
| Chlorine    | Cl     | 17                 |
| Chromium    | Cr     | 24                 |
| Cobalt      | Co     | 27                 |
| Copper      | Cu     | 29                 |
| Curium      | Cm     | 96                 |
| Dysprosium  | Dy     | 66                 |
| Einsteinium | Es     | 99                 |
| Erbium      | Er     | 68                 |
| Europium    | Eu     | 63                 |

|             |    |     |
|-------------|----|-----|
| Fermium     | Fm | 100 |
| Fluorine    | F  | 9   |
| Francium    | Fr | 87  |
| Gadolinium  | Gd | 64  |
| Gallium     | Ga | 31  |
| Germanium   | Ge | 32  |
| Gold        | Au | 79  |
| Hafnium     | Hf | 72  |
| Holmium     | Ho | 67  |
| Hydrogen    | H  | 1   |
| Indium      | In | 49  |
| Iodine      | I  | 53  |
| Iridium     | Ir | 77  |
| Iron        | Fe | 26  |
| Krypton     | Kr | 36  |
| Lanthanum   | La | 57  |
| Lead        | Pb | 82  |
| Lutetium    | Lu | 71  |
| Magnesium   | Mg | 12  |
| Manganese   | Mn | 25  |
| Mendelevium | Md | 101 |
| Mercury     | Hg | 80  |
| Molybdenum  | Mo | 42  |
| Neodymium   | Nd | 60  |
| Neptunium   | Np | 93  |
| Nickel      | Ni | 28  |
| Niobium     | Nb | 41  |

|              |    |    |
|--------------|----|----|
| Nitrogen     | N  | 7  |
| Osmium       | Os | 76 |
| Oxygen       | O  | 8  |
| Palladium    | Pd | 46 |
| Phosphorus   | P  | 15 |
| Platinum     | Pt | 78 |
| Plutonium    | Pu | 94 |
| Polonium     | Po | 84 |
| Potassium    | K  | 19 |
| Praseodymium | Pr | 59 |
| Promethium   | Pm | 61 |
| Protactinium | Pa | 91 |
| Radium       | Ra | 88 |
| Radon        | Rn | 86 |
| Rhenium      | Re | 75 |
| Rhodium      | Rh | 45 |
| Rubidium     | Rb | 37 |
| Ruthenium    | Ru | 44 |
| Samarium     | Sm | 62 |
| Scandium     | Sc | 21 |
| Selenium     | Se | 34 |
| Silicon      | Si | 14 |
| Silver       | Ag | 47 |
| Sodium       | Na | 11 |
| Strontium    | Sr | 38 |
| Sulfur       | S  | 16 |
| Tantalum     | Ta | 73 |
| Technetium   | Tc | 43 |

|           |    |    |
|-----------|----|----|
| Tellurium | Te | 52 |
| Terbium   | Tb | 65 |
| Thallium  | Tl | 81 |
| Thorium   | Th | 90 |
| Thulium   | Tm | 69 |
| Tin       | Sn | 50 |
| Titanium  | Ti | 22 |
| Tungsten  | W  | 74 |
| Uranium   | U  | 92 |
| Vanadium  | V  | 23 |
| Xenon     | Xe | 54 |
| Ytterbium | Yb | 70 |
| Yttrium   | Y  | 39 |
| Zinc      | Zn | 30 |
| Zirconium | Zr | 40 |

Subp. 7. **Table of ALIs and DACs.**

| Atomic Number (AN),<br>Radionuclide, and Class | Table<br>1 |      |      | Table<br>2 |      | Table<br>3 |
|------------------------------------------------|------------|------|------|------------|------|------------|
|                                                | 1          | 2    | 3    | 1          | 2    |            |
| <b>AN 1</b>                                    |            |      |      |            |      |            |
| Hydrogen-3                                     |            |      |      |            |      |            |
| Water, DAC includes skin<br>absorption         | 8E+4       | 8E+4 | 2E-5 | 1E-7       | 1E-3 | 1E-2       |

Gas (HT or T<sub>2</sub>) submersion<sup>1</sup>:  
 Use above values as HT and  
 T<sub>2</sub> oxidize in air and in the  
 body to HTO.

**AN 4**

## Beryllium-7

W, all compounds except  
 those given for Y

4E+4      2E+4      9E-6      3E-8      6E-4      6E-3

Y, oxides, halides, and nitrates —

2E+4      8E-6      3E-8      —      —

## Beryllium-10

W, see <sup>7</sup>Be

1E+3      2E+2      6E-8      2E-10      —      —

LLI  
 (1E+3)

—      —      2E-5      2E-4      —

Y, see <sup>7</sup>Be

—      1E+1      6E-9      2E-11      —      —

**AN 6**Carbon-11<sup>2</sup>

Monoxide

—      1E+6      5E-4      2E-6      —      —

Dioxide

—      6E+5      3E-4      9E-7      —      —

Compounds

4E+5      4E+5      2E-4      6E-7      6E-3      6E-2

## Carbon-14

Monoxide

—      2E+6      7E-4      2E-6      —      —

Dioxide

—      2E+5      9E-5      3E-7      —      —

Compounds

2E+3      2E+3      1E-6      3E-9      3E-5      3E-4

**AN 7**Nitrogen-13<sup>2</sup>

Submersion<sup>1</sup>

—      —      4E-6      2E-8      —      —

**AN 8**Oxygen-15<sup>2</sup>

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 4E-6 | 2E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

**AN 9**Fluorine-18<sup>2</sup>D, fluorides of H, Li, Na, K,  
Rb, Cs, and Fr

|      |      |      |      |   |   |
|------|------|------|------|---|---|
| 5E+4 | 7E+4 | 3E-5 | 1E-7 | — | — |
|------|------|------|------|---|---|

Stom

|        |   |   |   |      |      |
|--------|---|---|---|------|------|
| (5E+4) | — | — | — | 7E-4 | 7E-3 |
|--------|---|---|---|------|------|

W, fluorides of Be, Mg, Ca,  
Sr, Ba, Ra, Al, Ga, In, Tl, As,  
Sb, Bi, Fe, Ru, Os, Co, Ni,  
Pd, Pt, Cu, Ag, Au, Zn, Cd,  
Hg, Sc, Y, Ti, Zr, V, Nb, Ta,  
Mn, Tc, and Re

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 9E+4 | 4E-5 | 1E-7 | — | — |
|---|------|------|------|---|---|

Y, lanthanum fluoride

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 8E+4 | 3E-5 | 1E-7 | — | — |
|---|------|------|------|---|---|

**AN 11**

Sodium-22

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| D, all compounds | 4E+2 | 6E+2 | 3E-7 | 9E-10 | 6E-6 | 6E-5 |
|------------------|------|------|------|-------|------|------|

Sodium-24

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 4E+3 | 5E+3 | 2E-6 | 7E-9 | 5E-5 | 5E-4 |
|------------------|------|------|------|------|------|------|

**AN 12**

Magnesium-28

D, all compounds except  
those given for W

|      |      |      |      |      |      |
|------|------|------|------|------|------|
| 7E+2 | 2E+3 | 7E-7 | 2E-9 | 9E-6 | 9E-5 |
|------|------|------|------|------|------|

W, oxides, hydroxides,  
carbides, halides, and nitrates

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 1E+3 | 5E-7 | 2E-9 | — | — |
|---|------|------|------|---|---|

**AN 13**

## Aluminum-26

D, all compounds except  
those given for W

4E+2      6E+1      3E-8      9E-11      6E-6      6E-5

W, oxides, hydroxides,  
carbides, halides, and nitrates

—      9E+1      4E-8      1E-10      —      —

**AN 14**

## Silicon-31

D, all compounds except  
those given for W and Y

9E+3      3E+4      1E-5      4E-8      1E-4      1E-3

W, oxides, hydroxides,  
carbides, and nitrates

—      3E+4      1E-5      5E-8      —      —

Y, aluminosilicate glass

—      3E+4      1E-5      4E-8      —      —

## Silicon-32

D, see <sup>31</sup>Si

2E+3      2E+2      1E-7      3E-10      —      —

LLI

(3E+3)      —      —      —      4E-5      4E-4

W, see <sup>31</sup>Si

—      1E+2      5E-8      2E-10      —      —

Y, see <sup>31</sup>Si

—      5E+0      2E-9      7E-12      —      —

**AN 15**

## Phosphorus-32

D, all compounds except  
phosphates given for W

6E+2      9E+2      4E-7      1E-9      9E-6      9E-5

W, phosphates of Zn<sup>2+</sup>,  
S<sup>3+</sup>, Mg<sup>2+</sup>, Fe<sup>3+</sup>, Bi<sup>3+</sup>, and  
lanthanides

—      4E+2      2E-7      5E-10      —      —

## Phosphorus-33

|                        |      |      |      |      |      |      |
|------------------------|------|------|------|------|------|------|
| D, see $^{32}\text{P}$ | 6E+3 | 8E+3 | 4E-6 | 1E-8 | 8E-5 | 8E-4 |
| W, see $^{32}\text{P}$ | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |

**AN 16**

## Sulfur-35

|                                                                                                                                                |        |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|------|------|------|
| Vapor                                                                                                                                          | 1E+4   | 6E-6 | 2E-8 | —    | —    | —    |
| D, sulfides and sulfates except those given for W                                                                                              | 1E+4   | 2E+4 | 7E-6 | 2E-8 | —    | —    |
| LLI                                                                                                                                            | (8E+3) | —    | —    | —    | 1E-4 | 1E-3 |
|                                                                                                                                                | 6E+3   | —    | —    | —    | —    | —    |
| W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi | —      | 2E+3 | 9E-7 | 3E-9 | —    | —    |

**AN 17**

## Chlorine-36

|                                                                                                                                                                                                                  |      |      |      |       |      |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|------|------|
| D, chlorides of H, Li, Na, K, Rb, Cs, and Fr                                                                                                                                                                     | 2E+3 | 2E+3 | 1E-6 | 3E-9  | 2E-5 | 2E-4 |
| W, chlorides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, and Re | —    | 2E+2 | 1E-7 | 3E-10 | —    | —    |

Chlorine-38<sup>2</sup>

|                         |        |      |      |      |      |      |
|-------------------------|--------|------|------|------|------|------|
| D, see $^{36}\text{Cl}$ | 2E+4   | 4E+4 | 2E-5 | 6E-8 | —    | —    |
| Stom                    | (3E+4) | —    | —    | —    | 3E-4 | 3E-3 |

|                           |                |      |      |       |      |      |
|---------------------------|----------------|------|------|-------|------|------|
| W, see $^{36}\text{Cl}$   | —              | 5E+4 | 2E-5 | 6E-8  | —    | —    |
| Chlorine-39 <sup>2</sup>  |                |      |      |       |      |      |
| D, see $^{36}\text{Cl}$   | 2E+4           | 5E+4 | 2E-5 | 7E-8  | —    | —    |
|                           | Stom<br>(4E+4) | —    | —    | —     | 5E-4 | 5E-3 |
| W, see $^{36}\text{Cl}$   | —              | 6E+4 | 2E-5 | 8E-8  | —    | —    |
| <b>AN 18</b>              |                |      |      |       |      |      |
| Argon-37                  |                |      |      |       |      |      |
| Submersion <sup>1</sup>   | —              | —    | 1E+0 | 6E-3  | —    | —    |
| Argon-39                  |                |      |      |       |      |      |
| Submersion <sup>1</sup>   | —              | —    | 2E-4 | 8E-7  | —    | —    |
| Argon-41                  |                |      |      |       |      |      |
| Submersion <sup>1</sup>   | —              | —    | 3E-6 | 1E-8  | —    | —    |
| <b>AN 19</b>              |                |      |      |       |      |      |
| Potassium-40              |                |      |      |       |      |      |
| D, all compounds          | 3E+2           | 4E+2 | 2E-7 | 6E-10 | 4E-6 | 4E-5 |
| Potassium-42              |                |      |      |       |      |      |
| D, all compounds          | 5E+3           | 5E+3 | 2E-6 | 7E-9  | 6E-5 | 6E-4 |
| Potassium-43              |                |      |      |       |      |      |
| D, all compounds          | 6E+3           | 9E+3 | 4E-6 | 1E-8  | 9E-5 | 9E-4 |
| Potassium-44 <sup>2</sup> |                |      |      |       |      |      |
| D, all compounds          | 2E+4           | 7E+4 | 3E-5 | 9E-8  | —    | —    |

|                           |                |                |      |      |      |      |
|---------------------------|----------------|----------------|------|------|------|------|
|                           | Stom<br>(4E+4) | —              | —    | 5E-4 | 5E-3 | —    |
| Potassium-45 <sup>2</sup> |                |                |      |      |      |      |
| D, all compounds          | 3E+4           | 1E+5           | 5E-5 | 2E-7 | —    | —    |
|                           | Stom<br>(5E+4) | —              | —    | —    | 7E-4 | 7E-3 |
| <b>AN 20</b>              |                |                |      |      |      |      |
| Calcium-41                |                |                |      |      |      |      |
| W, all compounds          | 3E+3           | 4E+3           | 2E-6 | —    | —    | —    |
|                           | Bone<br>(4E+3) | Bone<br>(4E+3) | —    | 5E-9 | 6E-5 | 6E-4 |
| Calcium-45                |                |                |      |      |      |      |
| W, all compounds          | 2E+3           | 8E+2           | 4E-7 | 1E-9 | 2E-5 | 2E-4 |
| Calcium-47                |                |                |      |      |      |      |
| W, all compounds          | 8E+2           | 9E+2           | 4E-7 | 1E-9 | 1E-5 | 1E-4 |
| <b>AN 21</b>              |                |                |      |      |      |      |
| Scandium-43               |                |                |      |      |      |      |
| Y, all compounds          | 7E+3           | 2E+4           | 9E-6 | 3E-8 | 1E-4 | 1E-3 |
| Scandium-44m              |                |                |      |      |      |      |
| Y, all compounds          | 5E+2           | 7E+2           | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
| Scandium-44               |                |                |      |      |      |      |
| Y, all compounds          | 4E+3           | 1E+4           | 5E-6 | 2E-8 | 5E-5 | 5E-4 |
| Scandium-46               |                |                |      |      |      |      |

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| Y, all compounds | 9E+2 | 2E+2 | 1E-7 | 3E-10 | 1E-5 | 1E-4 |
|------------------|------|------|------|-------|------|------|

## Scandium-47

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 2E+3 | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| LLI<br>(3E+3)    | —    | —    | —    | —    | 4E-5 | 4E-4 |

## Scandium-48

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 8E+2 | 1E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
|------------------|------|------|------|------|------|------|

Scandium-49<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 2E+4 | 5E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
|------------------|------|------|------|------|------|------|

**AN 22**

## Titanium-44

|                                                    |      |      |      |       |      |      |
|----------------------------------------------------|------|------|------|-------|------|------|
| D, all compounds except<br>those given for W and Y | 3E+2 | 1E+1 | 5E-9 | 2E-11 | 4E-6 | 4E-5 |
|----------------------------------------------------|------|------|------|-------|------|------|

|                                                           |   |      |      |       |   |   |
|-----------------------------------------------------------|---|------|------|-------|---|---|
| W, oxides, hydroxides,<br>carbides, halides, and nitrates | — | 3E+1 | 1E-8 | 4E-11 | — | — |
|-----------------------------------------------------------|---|------|------|-------|---|---|

|                       |   |      |      |       |   |   |
|-----------------------|---|------|------|-------|---|---|
| Y, SrTiO <sub>3</sub> | — | 6E+0 | 2E-9 | 8E-12 | — | — |
|-----------------------|---|------|------|-------|---|---|

## Titanium-45

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>44</sup> Ti | 9E+3 | 3E+4 | 1E-5 | 3E-8 | 1E-4 | 1E-3 |
|-------------------------|------|------|------|------|------|------|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| W, see <sup>44</sup> Ti | — | 4E+4 | 1E-5 | 5E-8 | — | — |
|-------------------------|---|------|------|------|---|---|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| Y, see <sup>44</sup> Ti | — | 3E+4 | 1E-5 | 4E-8 | — | — |
|-------------------------|---|------|------|------|---|---|

**AN 23**Vanadium-47<sup>2</sup>

|                                              |      |      |      |      |   |   |
|----------------------------------------------|------|------|------|------|---|---|
| D, all compounds except<br>those given for W | 3E+4 | 8E+4 | 3E-5 | 1E-7 | — | — |
|----------------------------------------------|------|------|------|------|---|---|

|                |   |   |   |   |      |      |
|----------------|---|---|---|---|------|------|
| Stom<br>(3E+4) | — | — | — | — | 4E-4 | 4E-3 |
|----------------|---|---|---|---|------|------|

W, oxides hydroxides,  
carbides, and halides

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 1E+5 | 4E-5 | 1E-7 | — | — |
|---|------|------|------|---|---|

#### Vanadium-48

|                        |      |      |      |      |      |      |
|------------------------|------|------|------|------|------|------|
| D, see <sup>47</sup> V | 6E+2 | 1E+3 | 5E-7 | 2E-9 | 9E-6 | 9E-5 |
|------------------------|------|------|------|------|------|------|

|                        |   |      |      |       |   |   |
|------------------------|---|------|------|-------|---|---|
| W, see <sup>47</sup> V | — | 6E+2 | 3E-7 | 9E-10 | — | — |
|------------------------|---|------|------|-------|---|---|

#### Vanadium-49

|                        |      |      |      |   |   |   |
|------------------------|------|------|------|---|---|---|
| D, see <sup>47</sup> V | 7E+4 | 3E+4 | 1E-5 | — | — | — |
|------------------------|------|------|------|---|---|---|

|               |                |   |      |      |      |
|---------------|----------------|---|------|------|------|
| LLI<br>(9E+4) | Bone<br>(3E+4) | — | 5E-8 | 1E-3 | 1E-2 |
|---------------|----------------|---|------|------|------|

|                        |   |      |      |      |   |   |
|------------------------|---|------|------|------|---|---|
| W, see <sup>47</sup> V | — | 2E+4 | 8E-6 | 2E-8 | — | — |
|------------------------|---|------|------|------|---|---|

### AN 24

#### Chromium-48

|                                                    |      |      |      |      |      |      |
|----------------------------------------------------|------|------|------|------|------|------|
| D, all compounds except<br>those given for W and Y | 6E+3 | 1E+4 | 5E-6 | 2E-8 | 8E-5 | 8E-4 |
|----------------------------------------------------|------|------|------|------|------|------|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| W, halides and nitrates | — | 7E+3 | 3E-6 | 1E-8 | — | — |
|-------------------------|---|------|------|------|---|---|

|                      |   |      |      |      |   |   |
|----------------------|---|------|------|------|---|---|
| Y, oxides hydroxides | — | 7E+3 | 3E-6 | 1E-8 | — | — |
|----------------------|---|------|------|------|---|---|

#### Chromium-49<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>48</sup> Cr | 3E+4 | 8E+4 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
|-------------------------|------|------|------|------|------|------|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| W, see <sup>48</sup> Cr | — | 1E+5 | 4E-5 | 1E-7 | — | — |
|-------------------------|---|------|------|------|---|---|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| Y, see <sup>48</sup> Cr | — | 9E+4 | 4E-5 | 1E-7 | — | — |
|-------------------------|---|------|------|------|---|---|

#### Chromium-51

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>48</sup> Cr | 4E+4 | 5E+4 | 2E-5 | 6E-8 | 5E-4 | 5E-3 |
|-------------------------|------|------|------|------|------|------|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| W, see <sup>48</sup> Cr | — | 2E+4 | 1E-5 | 3E-8 | — | — |
|-------------------------|---|------|------|------|---|---|

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| Y, see <sup>48</sup> Cr | — | 2E+4 | 8E-6 | 3E-8 | — | — |
|-------------------------|---|------|------|------|---|---|

### AN 25

#### Manganese-51<sup>2</sup>

D, all compounds except  
those given for W

2E+4    5E+4    2E-5    7E-8    3E-4    3E-3

W, oxides, hydroxides  
halides, and nitrates

—    6E+4    3E-5    8E-8    —    —

Manganese-52m<sup>2</sup>

D, see <sup>51</sup>Mn

3E+4    9E+4    4E-5    1E-7    —    —

Stom  
(4E+4)

—    —    —    5E-4    5E-3

W, see <sup>51</sup>Mn

—    1E+5    4E-5    1E-7    —    —

Manganese-52

D, see <sup>51</sup>Mn

7E+2    1E+3    5E-7    2E-9    1E-5    1E-4

W, see <sup>51</sup>Mn

—    9E+2    4E-7    1E-9    —    —

Manganese-53

D, see <sup>51</sup>Mn

5E+4    1E+4    5E-6    —    7E-4    7E-3

Bone

—    (2E+4)    —    3E-8    —    —

W, see <sup>51</sup>Mn

—    1E+4    5E-6    2E-8    —    —

Manganese-54

D, see <sup>51</sup>Mn

2E+3    9E+2    4E-7    1E-9    3E-5    3E-4

W, see <sup>51</sup>Mn

—    8E+2    3E-7    1E-9    —    —

Manganese-56

D, see <sup>51</sup>Mn

5E+3    2E+4    6E-6    2E-8    7E-5    7E-4

W, see <sup>51</sup>Mn

—    2E+4    9E-6    3E-8    —    —

**AN 26**

Iron-52

D, all compounds except  
those given for W

9E+2      3E+3      1E-6      4E-9      1E-5      1E-4

W, oxides, hydroxides, and  
halides

—      2E+3      1E-6      3E-9      —      —

#### Iron-55

D, see  $^{52}\text{Fe}$

9E+3      2E+3      8E-7      3E-9      1E-4      1E-3

W, see  $^{52}\text{Fe}$

—      4E+3      2E-6      6E-9      —      —

#### Iron-59

D, see  $^{52}\text{Fe}$

8E+2      3E+2      1E-7      5E-10      1E-5      1E-4

W, see  $^{52}\text{Fe}$

—      5E+2      2E-7      7E-10      —      —

#### Iron-60

D, see  $^{52}\text{Fe}$

3E+1      6E+0      3E-9      9E-12      4E-7      4E-6

W, see  $^{52}\text{Fe}$

—      2E+1      8E-9      3E-11      —      —

### AN 27

#### Cobalt-55

W, all compounds except  
those given for Y

1E+3      3E+3      1E-6      4E-9      2E-5      2E-4

Y, oxides, hydroxides,  
halides, and nitrates

—      3E+3      1E-6      4E-9      —      —

#### Cobalt-56

W, see  $^{55}\text{Co}$

5E+2      3E+2      1E-7      4E-10      6E-6      6E-5

Y, see  $^{55}\text{Co}$

4E+2      2E+2      8E-8      3E-10      —      —

#### Cobalt-57

W, see  $^{55}\text{Co}$

8E+3      3E+3      1E-6      4E-9      6E-5      6E-4

Y, see  $^{55}\text{Co}$

4E+3      7E+2      3E-7      9E-10      —      —

## Cobalt-58m

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{55}\text{Co}$ | 6E+4 | 9E+4 | 4E-5 | 1E-7 | 8E-4 | 8E-3 |
| Y, see $^{55}\text{Co}$ | —    | 6E+4 | 3E-5 | 9E-8 | —    | —    |

## Cobalt-58

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{55}\text{Co}$ | 2E+3 | 1E+3 | 5E-7 | 2E-9 | 2E-5 | 2E-4 |
| Y, see $^{55}\text{Co}$ | 1E+3 | 7E+2 | 3E-7 | 1E-9 | —    | —    |

Cobalt-60m<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{55}\text{Co}$ | 1E+6 | 4E+6 | 2E-3 | 6E-6 | —    | —    |
| Stom<br>(1E+6)          | —    | —    | —    | —    | 2E-2 | 2E-1 |
| Y, see $^{55}\text{Co}$ | —    | 3E+6 | 1E-3 | 4E-6 | —    | —    |

## Cobalt-60

|                         |      |      |      |       |      |      |
|-------------------------|------|------|------|-------|------|------|
| W, see $^{55}\text{Co}$ | 5E+2 | 2E+2 | 7E-8 | 2E-10 | 3E-6 | 3E-5 |
| Y, see $^{55}\text{Co}$ | 2E+2 | 3E+1 | 1E-8 | 5E-11 | —    | —    |

Cobalt-61<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{55}\text{Co}$ | 2E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| Y, see $^{55}\text{Co}$ | 2E+4 | 6E+4 | 2E-5 | 8E-8 | —    | —    |

Cobalt-62m<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{55}\text{Co}$ | 4E+4 | 2E+5 | 7E-5 | 2E-7 | —    | —    |
| Stom<br>(5E+4)          | —    | —    | —    | —    | 7E-4 | 7E-3 |
| Y, see $^{55}\text{Co}$ | —    | 2E+5 | 6E-5 | 2E-7 | —    | —    |

**AN 28**

## Nickel-56

D, all compounds except  
those given for W

1E+3      2E+3      8E-7      3E-9      2E-5      2E-4

W, oxides, hydroxides, and  
carbides

—      1E+3      5E-7      2E-9      —      —

Vapor

—      1E+3      5E-7      2E-9      —      —

#### Nickel-57

D, see <sup>56</sup>Ni

2E+3      5E+3      2E-6      7E-9      2E-5      2E-4

W, see <sup>56</sup>Ni

—      3E+3      1E-6      4E-9      —      —

Vapor

—      6E+3      3E-6      9E-9      —      —

#### Nickel-59

D, see <sup>56</sup>Ni

2E+4      4E+3      2E-6      5E-9      3E-4      3E-3

W, see <sup>56</sup>Ni

—      7E+3      3E-6      1E-8      —      —

Vapor

—      2E+3      8E-7      3E-9      —      —

#### Nickel-63

D, see <sup>56</sup>Ni

9E+3      2E+3      7E-7      2E-9      1E-4      1E-3

W, see <sup>56</sup>Ni

—      3E+3      1E-6      4E-9      —      —

Vapor

—      8E+2      3E-7      1E-9      —      —

#### Nickel-65

D, see <sup>56</sup>Ni

8E+3      2E+4      1E-5      3E-8      1E-4      1E-3

W, see <sup>56</sup>Ni

—      3E+4      1E-5      4E-8      —      —

Vapor

—      2E+4      7E-6      2E-8      —      —

#### Nickel-66

D, see <sup>56</sup>Ni

4E+2      2E+3      7E-7      2E-9      —      —

LLI

(5E+2)      —      —      —      6E-6      6E-5

|                         |   |      |      |       |   |   |
|-------------------------|---|------|------|-------|---|---|
| W, see $^{56}\text{Ni}$ | — | 6E+2 | 3E-7 | 9E-10 | — | — |
| Vapor                   | — | 3E+3 | 1E-6 | 4E-9  | — | — |

**AN 29**Copper-60<sup>2</sup>

D, all compounds except those given for W and Y

|                |      |      |      |      |      |
|----------------|------|------|------|------|------|
| 3E+4           | 9E+4 | 4E-5 | 1E-7 | —    | —    |
| Stom<br>(3E+4) | —    | —    | —    | 4E-4 | 4E-3 |

W, sulfides, halides, and nitrates

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 1E+5 | 5E-5 | 2E-7 | — | — |
|---|------|------|------|---|---|

Y, oxides and hydroxides

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 1E+5 | 4E-5 | 1E-7 | — | — |
|---|------|------|------|---|---|

## Copper-61

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{60}\text{Cu}$ | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| W, see $^{60}\text{Cu}$ | —    | 4E+4 | 2E-5 | 6E-8 | —    | —    |
| Y, see $^{60}\text{Cu}$ | —    | 4E+4 | 1E-5 | 5E-8 | —    | —    |

## Copper-64

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{60}\text{Cu}$ | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| W, see $^{60}\text{Cu}$ | —    | 2E+4 | 1E-5 | 3E-8 | —    | —    |
| Y, see $^{60}\text{Cu}$ | —    | 2E+4 | 9E-6 | 3E-8 | —    | —    |

## Copper-67

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{60}\text{Cu}$ | 5E+3 | 8E+3 | 3E-6 | 1E-8 | 6E-5 | 6E-4 |
| W, see $^{60}\text{Cu}$ | —    | 5E+3 | 2E-6 | 7E-9 | —    | —    |
| Y, see $^{60}\text{Cu}$ | —    | 5E+3 | 2E-6 | 6E-9 | —    | —    |

**AN 30**

## Zinc-62

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 1E+3 | 3E+3 | 1E-6 | 4E-9 | 2E-5 | 2E-4 |
|------------------|------|------|------|------|------|------|

Zinc-63<sup>2</sup>

|                  |                |      |      |      |      |      |
|------------------|----------------|------|------|------|------|------|
| Y, all compounds | 2E+4           | 7E+4 | 3E-5 | 9E-8 | —    | —    |
|                  | Stom<br>(3E+4) | —    | —    | —    | 3E-4 | 3E-3 |

## Zinc-65

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| Y, all compounds | 4E+2 | 3E+2 | 1E-7 | 4E-10 | 5E-6 | 5E-5 |
|------------------|------|------|------|-------|------|------|

## Zinc-69m

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 4E+3 | 7E+3 | 3E-6 | 1E-8 | 6E-5 | 6E-4 |
|------------------|------|------|------|------|------|------|

Zinc-69<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 6E+4 | 1E+5 | 6E-5 | 2E-7 | 8E-4 | 8E-3 |
|------------------|------|------|------|------|------|------|

## Zinc-71m

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 6E+3 | 2E+4 | 7E-6 | 2E-8 | 8E-5 | 8E-4 |
|------------------|------|------|------|------|------|------|

## Zinc-72

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| Y, all compounds | 1E+3 | 1E+3 | 5E-7 | 2E-9 | 1E-5 | 1E-4 |
|------------------|------|------|------|------|------|------|

**AN 31**Gallium-65<sup>2</sup>

D, all compounds except  
those given for W

|                |      |      |      |      |      |
|----------------|------|------|------|------|------|
| 5E+4           | 2E+5 | 7E-5 | 2E-7 | —    | —    |
| Stom<br>(6E+4) | —    | —    | —    | 9E-4 | 9E-3 |

W, oxides, hydroxides,  
carbides, halides, and nitrates

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 2E+5 | 8E-5 | 3E-7 | — | — |
|---|------|------|------|---|---|

## Gallium-66

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>65</sup> Ga | 1E+3 | 4E+3 | 1E-6 | 5E-9 | 1E-5 | 1E-4 |
|-------------------------|------|------|------|------|------|------|

|                                              |                |      |      |      |      |      |
|----------------------------------------------|----------------|------|------|------|------|------|
| W, see <sup>65</sup> Ga                      | —              | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| Gallium-67                                   |                |      |      |      |      |      |
| D, see <sup>65</sup> Ga                      | 7E+3           | 1E+4 | 6E-6 | 2E-8 | 1E-4 | 1E-3 |
| W, see <sup>65</sup> Ga                      | —              | 1E+4 | 4E-6 | 1E-8 | —    | —    |
| Gallium-68 <sup>2</sup>                      |                |      |      |      |      |      |
| D, see <sup>65</sup> Ga                      | 2E+4           | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see <sup>65</sup> Ga                      | —              | 5E+4 | 2E-5 | 7E-8 | —    | —    |
| Gallium-70 <sup>2</sup>                      |                |      |      |      |      |      |
| D, see <sup>65</sup> Ga                      | 5E+4           | 2E+5 | 7E-5 | 2E-7 | —    | —    |
|                                              | Stom<br>(7E+4) | —    | —    | —    | 1E-3 | 1E-2 |
| W, see <sup>65</sup> Ga                      | —              | 2E+5 | 8E-5 | 3E-7 | —    | —    |
| Gallium-72                                   |                |      |      |      |      |      |
| D, see <sup>65</sup> Ga                      | 1E+3           | 4E+3 | 1E-6 | 5E-9 | 2E-5 | 2E-4 |
| W, see <sup>65</sup> Ga                      | —              | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| Gallium-73                                   |                |      |      |      |      |      |
| D, see <sup>65</sup> Ga                      | 5E+3           | 2E+4 | 6E-6 | 2E-8 | 7E-5 | 7E-4 |
| W, see <sup>65</sup> Ga                      | —              | 2E+4 | 6E-6 | 2E-8 | —    | —    |
| <b>AN 32</b>                                 |                |      |      |      |      |      |
| Germanium-66                                 |                |      |      |      |      |      |
| D, all compounds except<br>those given for W | 2E+4           | 3E+4 | 1E-5 | 4E-8 | 3E-4 | 3E-3 |
| W, oxides, sulfides, and<br>halides          | —              | 2E+4 | 8E-6 | 3E-8 | —    | —    |
| Germanium-67 <sup>2</sup>                    |                |      |      |      |      |      |

|                           |      |      |      |       |      |      |
|---------------------------|------|------|------|-------|------|------|
| D, see $^{66}\text{Ge}$   | 3E+4 | 9E+4 | 4E-5 | 1E-7  | —    | —    |
| Stom<br>(4E+4)            | —    | —    | —    | 6E-4  | 6E-3 | —    |
| W, see $^{66}\text{Ge}$   | —    | 1E+5 | 4E-5 | 1E-7  | —    | —    |
| Germanium-68              |      |      |      |       |      |      |
| D, see $^{66}\text{Ge}$   | 5E+3 | 4E+3 | 2E-6 | 5E-9  | 6E-5 | 6E-4 |
| W, see $^{66}\text{Ge}$   | —    | 1E+2 | 4E-8 | 1E-10 | —    | —    |
| Germanium-69              |      |      |      |       |      |      |
| D, see $^{66}\text{Ge}$   | 1E+4 | 2E+4 | 6E-6 | 2E-8  | 2E-4 | 2E-3 |
| W, see $^{66}\text{Ge}$   | —    | 8E+3 | 3E-6 | 1E-8  | —    | —    |
| Germanium-71              |      |      |      |       |      |      |
| D, see $^{66}\text{Ge}$   | 5E+5 | 4E+5 | 2E-4 | 6E-7  | 7E-3 | 7E-2 |
| W, see $^{66}\text{Ge}$   | —    | 4E+4 | 2E-5 | 6E-8  | —    | —    |
| Germanium-75 <sup>2</sup> |      |      |      |       |      |      |
| D, see $^{66}\text{Ge}$   | 4E+4 | 8E+4 | 3E-5 | 1E-7  | —    | —    |
| Stom<br>(7E+4)            | —    | —    | —    | —     | 9E-4 | 9E-3 |
| W, see $^{66}\text{Ge}$   | —    | 8E+4 | 4E-5 | 1E-7  | —    | —    |
| Germanium-77              |      |      |      |       |      |      |
| D, see $^{66}\text{Ge}$   | 9E+3 | 1E+4 | 4E-6 | 1E-8  | 1E-4 | 1E-3 |
| W, see $^{66}\text{Ge}$   | —    | 6E+3 | 2E-6 | 8E-9  | —    | —    |
| Germanium-78 <sup>2</sup> |      |      |      |       |      |      |
| D, see $^{66}\text{Ge}$   | 2E+4 | 2E+4 | 9E-6 | 3E-8  | —    | —    |

|                         |                |      |      |      |      |      |
|-------------------------|----------------|------|------|------|------|------|
|                         | Stom<br>(2E+4) | —    | —    | —    | 3E-4 | 3E-3 |
| W, see <sup>66</sup> Ge | —              | 2E+4 | 9E-6 | 3E-8 | —    | —    |

**AN 33**Arsenic-69<sup>2</sup>

|                  |                |      |      |      |      |      |
|------------------|----------------|------|------|------|------|------|
| W, all compounds | 3E+4           | 1E+5 | 5E-5 | 2E-7 | —    | —    |
|                  | Stom<br>(4E+4) | —    | —    | —    | 6E-4 | 6E-3 |

Arsenic-70<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+4 | 5E+4 | 2E-5 | 7E-8 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

## Arsenic-71

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 4E+3 | 5E+3 | 2E-6 | 6E-9 | 5E-5 | 5E-4 |
|------------------|------|------|------|------|------|------|

## Arsenic-72

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 9E+2 | 1E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
|------------------|------|------|------|------|------|------|

## Arsenic-73

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 8E+3 | 2E+3 | 7E-7 | 2E-9 | 1E-4 | 1E-3 |
|------------------|------|------|------|------|------|------|

## Arsenic-74

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+3 | 8E+2 | 3E-7 | 1E-9 | 2E-5 | 2E-4 |
|------------------|------|------|------|------|------|------|

## Arsenic-76

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+3 | 1E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
|------------------|------|------|------|------|------|------|

## Arsenic-77

|                  |      |      |      |      |   |   |
|------------------|------|------|------|------|---|---|
| W, all compounds | 4E+3 | 5E+3 | 2E-6 | 7E-9 | — | — |
|------------------|------|------|------|------|---|---|

|                                                      |               |      |      |       |      |      |
|------------------------------------------------------|---------------|------|------|-------|------|------|
|                                                      | LLI<br>(5E+3) | —    | —    | —     | 6E-5 | 6E-4 |
| Arsenic-78 <sup>2</sup>                              |               |      |      |       |      |      |
| W, all compounds                                     | 8E+3          | 2E+4 | 9E-6 | 3E-8  | 1E-4 | 1E-3 |
| AN 34                                                |               |      |      |       |      |      |
| Selenium-70 <sup>2</sup>                             |               |      |      |       |      |      |
| D, all compounds except<br>those given for W         | 2E+4          | 4E+4 | 2E-5 | 5E-8  | 1E-4 | 1E-3 |
| W, oxides, hydroxides,<br>carbides, and elemental Se | 1E+4          | 4E+4 | 2E-5 | 6E-8  | —    | —    |
| Selenium-73m <sup>2</sup>                            |               |      |      |       |      |      |
| D, see <sup>70</sup> Se                              | 6E+4          | 2E+5 | 6E-5 | 2E-7  | 4E-4 | 4E-3 |
| W, see <sup>70</sup> Se                              | 3E+4          | 1E+5 | 6E-5 | 2E-7  | —    | —    |
| Selenium-73                                          |               |      |      |       |      |      |
| D, see <sup>70</sup> Se                              | 3E+3          | 1E+4 | 5E-6 | 2E-8  | 4E-5 | 4E-4 |
| W, see <sup>70</sup> Se                              | —             | 2E+4 | 7E-6 | 2E-8  | —    | —    |
| Selenium-75                                          |               |      |      |       |      |      |
| D, see <sup>70</sup> Se                              | 5E+2          | 7E+2 | 3E-7 | 1E-9  | 7E-6 | 7E-5 |
| W, see <sup>70</sup> Se                              | —             | 6E+2 | 3E-7 | 8E-10 | —    | —    |
| Selenium-79                                          |               |      |      |       |      |      |
| D, see <sup>70</sup> Se                              | 6E+2          | 8E+2 | 3E-7 | 1E-9  | 8E-6 | 8E-5 |
| W, see <sup>70</sup> Se                              | —             | 6E+2 | 2E-7 | 8E-10 | —    | —    |
| Selenium-81m <sup>2</sup>                            |               |      |      |       |      |      |
| D, see <sup>70</sup> Se                              | 4E+4          | 7E+4 | 3E-5 | 9E-8  | 3E-4 | 3E-3 |

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see $^{70}\text{Se}$  | 2E+4           | 7E+4 | 3E-5 | 1E-7 | —    | —    |
| Selenium-81 <sup>2</sup> |                |      |      |      |      |      |
| D, see $^{70}\text{Se}$  | 6E+4           | 2E+5 | 9E-5 | 3E-7 | —    | —    |
|                          | Stom<br>(8E+4) | —    | —    | —    | 1E-3 | 1E-2 |
| W, see $^{70}\text{Se}$  | —              | 2E+5 | 1E-4 | 3E-7 | —    | —    |
| Selenium-83 <sup>2</sup> |                |      |      |      |      |      |
| D, see $^{70}\text{Se}$  | 4E+4           | 1E+5 | 5E-5 | 2E-7 | 4E-4 | 4E-3 |
| W, see $^{70}\text{Se}$  | 3E+4           | 1E+5 | 5E-5 | 2E-7 | —    | —    |

**AN 35**Bromine-74m<sup>2</sup>

|                                                                                                                                                                                                                        |                |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------|------|------|------|------|
| D, bromides of H, Li, Na, K,<br>Rb, Cs, and Fr                                                                                                                                                                         | 1E+4           | 4E+4 | 2E-5 | 5E-8 | —    | —    |
|                                                                                                                                                                                                                        | Stom<br>(2E+4) | —    | —    | —    | 3E-4 | 3E-3 |
| W, bromides of lanthanides,<br>Be, Mg, Ca, Sr, Ba, Ra, Al,<br>Ga, In, Tl, Ge, Sn, Pb, As, Sb,<br>Bi, Fe, Ru, Os, Co, Rh, Ir, Ni,<br>Pd, Pt, Cu, Ag, Au, Zn, Cd,<br>Hg, Sc, Y, Ti, Zr, Hf, V, Nb,<br>Ta, Mn, Tc, and Re | —              | 4E+4 | 2E-5 | 6E-8 | —    | —    |

Bromine-74<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| D, see $^{74m}\text{Br}$ | 2E+4           | 7E+4 | 3E-5 | 1E-7 | —    | —    |
|                          | Stom<br>(4E+4) | —    | —    | —    | 5E-4 | 5E-3 |
| W, see $^{74m}\text{Br}$ | —              | 8E+4 | 4E-5 | 1E-7 | —    | —    |

Bromine-75<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{74m}\text{Br}$ | 3E+4 | 5E+4 | 2E-5 | 7E-8 | —    | —    |
| Stom<br>(4E+4)           | —    | —    | —    | —    | 5E-4 | 5E-3 |
| W, see $^{74m}\text{Br}$ | —    | 5E+4 | 2E-5 | 7E-8 | —    | —    |
| Bromine-76               |      |      |      |      |      |      |
| D, see $^{74m}\text{Br}$ | 4E+3 | 5E+3 | 2E-6 | 7E-9 | 5E-5 | 5E-4 |
| W, see $^{74m}\text{Br}$ | —    | 4E+3 | 2E-6 | 6E-9 | —    | —    |
| Bromine-77               |      |      |      |      |      |      |
| D, see $^{74m}\text{Br}$ | 2E+4 | 2E+4 | 1E-5 | 3E-8 | 2E-4 | 2E-3 |
| W, see $^{74m}\text{Br}$ | —    | 2E+4 | 8E-6 | 3E-8 | —    | —    |
| Bromine-80m              |      |      |      |      |      |      |
| D, see $^{74m}\text{Br}$ | 2E+4 | 2E+4 | 7E-6 | 2E-8 | 3E-4 | 3E-3 |
| W, see $^{74m}\text{Br}$ | —    | 1E+4 | 6E-6 | 2E-8 | —    | —    |
| Bromine-80 <sup>2</sup>  |      |      |      |      |      |      |
| D, see $^{74m}\text{Br}$ | 5E+4 | 2E+5 | 8E-5 | 3E-7 | —    | —    |
| Stom<br>(9E+4)           | —    | —    | —    | —    | 1E-3 | 1E-2 |
| W, see $^{74m}\text{Br}$ | —    | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| Bromine-82               |      |      |      |      |      |      |
| D, see $^{74m}\text{Br}$ | 3E+3 | 4E+3 | 2E-6 | 6E-9 | 4E-5 | 4E-4 |
| W, see $^{74m}\text{Br}$ | —    | 4E+3 | 2E-6 | 5E-9 | —    | —    |
| Bromine-83               |      |      |      |      |      |      |
| D, see $^{74m}\text{Br}$ | 5E+4 | 6E+4 | 3E-5 | 9E-8 | —    | —    |
| Stom<br>(7E+4)           | —    | —    | —    | —    | 9E-4 | 9E-3 |

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see <sup>74m</sup> Br | —              | 6E+4 | 3E-5 | 9E-8 | —    | —    |
| Bromine-84 <sup>2</sup>  |                |      |      |      |      |      |
| D, see <sup>74m</sup> Br | 2E+4           | 6E+4 | 2E-5 | 8E-8 | —    | —    |
|                          | Stom<br>(3E+4) | —    | —    | —    | 4E-4 | 4E-3 |
| W, see <sup>74m</sup> Br | —              | 6E+4 | 3E-5 | 9E-8 | —    | —    |
| <b>AN 36</b>             |                |      |      |      |      |      |
| Krypton-74 <sup>2</sup>  |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 3E-6 | 1E-8 | —    | —    |
| Krypton-76               |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 9E-6 | 4E-8 | —    | —    |
| Krypton-77 <sup>2</sup>  |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 4E-6 | 2E-8 | —    | —    |
| Krypton-79               |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 2E-5 | 7E-8 | —    | —    |
| Krypton-81               |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 7E-4 | 3E-6 | —    | —    |
| Krypton-83m <sup>2</sup> |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 1E-2 | 5E-5 | —    | —    |
| Krypton-85m              |                |      |      |      |      |      |
| Submersion <sup>1</sup>  | —              | —    | 2E-5 | 1E-7 | —    | —    |
| Krypton-85               |                |      |      |      |      |      |

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Submersion <sup>1</sup>   | —    | —    | 1E-4 | 7E-7 | —    | —    |
| Krypton-87 <sup>2</sup>   |      |      |      |      |      |      |
| Submersion <sup>1</sup>   | —    | —    | 5E-6 | 2E-8 | —    | —    |
| Krypton-88                |      |      |      |      |      |      |
| Submersion <sup>1</sup>   | —    | —    | 2E-6 | 9E-9 | —    | —    |
| <b>AN 37</b>              |      |      |      |      |      |      |
| Rubidium-79 <sup>2</sup>  |      |      |      |      |      |      |
| D, all compounds          | 4E+4 | 1E+5 | 5E-5 | 2E-7 | —    | —    |
| Stom<br>(6E+4)            | —    | —    | —    | —    | 8E-4 | 8E-3 |
| Rubidium-81m <sup>2</sup> |      |      |      |      |      |      |
| D, all compounds          | 2E+5 | 3E+5 | 1E-4 | 5E-7 | —    | —    |
| Stom<br>(3E+5)            | —    | —    | —    | —    | 4E-3 | 4E-2 |
| Rubidium-81               |      |      |      |      |      |      |
| D, all compounds          | 4E+4 | 5E+4 | 2E-5 | 7E-8 | 5E-4 | 5E-3 |
| Rubidium-82m              |      |      |      |      |      |      |
| D, all compounds          | 1E+4 | 2E+4 | 7E-6 | 2E-8 | 2E-4 | 2E-3 |
| Rubidium-83               |      |      |      |      |      |      |
| D, all compounds          | 6E+2 | 1E+3 | 4E-7 | 1E-9 | 9E-6 | 9E-5 |
| Rubidium-84               |      |      |      |      |      |      |
| D, all compounds          | 5E+2 | 8E+2 | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
| Rubidium-86               |      |      |      |      |      |      |

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 5E+2 | 8E+2 | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
|------------------|------|------|------|------|------|------|

Rubidium-87

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 1E+3 | 2E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
|------------------|------|------|------|------|------|------|

Rubidium-88<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+4 | 6E+4 | 3E-5 | 9E-8 | —    | —    |
| Stom<br>(3E+4)   | —    | —    | —    | —    | 4E-4 | 4E-3 |

Rubidium-89<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 4E+4 | 1E+5 | 6E-5 | 2E-7 | —    | —    |
| Stom<br>(6E+4)   | —    | —    | —    | —    | 9E-4 | 9E-3 |

### AN 38

Strontium-80<sup>2</sup>

|                                                       |      |      |      |      |      |      |
|-------------------------------------------------------|------|------|------|------|------|------|
| D, all soluble compounds<br>except SrTiO <sub>3</sub> | 4E+3 | 1E+4 | 5E-6 | 2E-8 | 6E-5 | 6E-4 |
|-------------------------------------------------------|------|------|------|------|------|------|

|                                                      |   |      |      |      |   |   |
|------------------------------------------------------|---|------|------|------|---|---|
| Y, all insoluble compounds<br>and SrTiO <sub>3</sub> | — | 1E+4 | 5E-6 | 2E-8 | — | — |
|------------------------------------------------------|---|------|------|------|---|---|

Strontium-81<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>80</sup> Sr | 3E+4 | 8E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
|-------------------------|------|------|------|------|------|------|

|                         |      |      |      |      |   |   |
|-------------------------|------|------|------|------|---|---|
| Y, see <sup>80</sup> Sr | 2E+4 | 8E+4 | 3E-5 | 1E-7 | — | — |
|-------------------------|------|------|------|------|---|---|

Strontium-82

|                         |      |      |      |       |   |   |
|-------------------------|------|------|------|-------|---|---|
| D, see <sup>80</sup> Sr | 3E+2 | 4E+2 | 2E-7 | 6E-10 | — | — |
|-------------------------|------|------|------|-------|---|---|

|               |   |   |   |   |      |      |
|---------------|---|---|---|---|------|------|
| LLI<br>(2E+2) | — | — | — | — | 3E-6 | 3E-5 |
|---------------|---|---|---|---|------|------|

|                         |      |      |      |       |   |   |
|-------------------------|------|------|------|-------|---|---|
| Y, see <sup>80</sup> Sr | 2E+2 | 9E+1 | 4E-8 | 1E-10 | — | — |
|-------------------------|------|------|------|-------|---|---|

## Strontium-83

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{80}\text{Sr}$ | 3E+3 | 7E+3 | 3E-6 | 1E-8 | 3E-5 | 3E-4 |
| Y, see $^{80}\text{Sr}$ | 2E+3 | 4E+3 | 1E-6 | 5E-9 | —    | —    |

Strontium-85m<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{80}\text{Sr}$ | 2E+5 | 6E+5 | 3E-4 | 9E-7 | 3E-3 | 3E-2 |
| Y, see $^{80}\text{Sr}$ | —    | 8E+5 | 4E-4 | 1E-6 | —    | —    |

## Strontium-85

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{80}\text{Sr}$ | 3E+3 | 3E+3 | 1E-6 | 4E-9 | 4E-5 | 4E-4 |
| Y, see $^{80}\text{Sr}$ | —    | 2E+3 | 6E-7 | 2E-9 | —    | —    |

## Strontium-87m

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{80}\text{Sr}$ | 5E+4 | 1E+5 | 5E-5 | 2E-7 | 6E-4 | 6E-3 |
| Y, see $^{80}\text{Sr}$ | 4E+4 | 2E+5 | 6E-5 | 2E-7 | —    | —    |

## Strontium-89

|                         |               |      |      |       |      |      |
|-------------------------|---------------|------|------|-------|------|------|
| D, see $^{80}\text{Sr}$ | 6E+2          | 8E+2 | 4E-7 | 1E-9  | —    | —    |
|                         | LLI<br>(6E+2) | —    | —    | —     | 8E-6 | 8E-5 |
| Y, see $^{80}\text{Sr}$ | 5E+2          | 1E+2 | 6E-8 | 2E-10 | —    | —    |

## Strontium-90

|                         |                |                |      |       |      |      |
|-------------------------|----------------|----------------|------|-------|------|------|
| D, see $^{80}\text{Sr}$ | 3E+1           | 2E+1           | 8E-9 | —     | —    | —    |
|                         | Bone<br>(4E+1) | Bone<br>(2E+1) | —    | 3E-11 | 5E-7 | 5E-6 |
| Y, see $^{80}\text{Sr}$ | —              | 4E+0           | 2E-9 | 6E-12 | —    | —    |

## Strontium-91

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{80}\text{Sr}$ | 2E+3 | 6E+3 | 2E-6 | 8E-9 | 2E-5 | 2E-4 |
| Y, see $^{80}\text{Sr}$ | —    | 4E+3 | 1E-6 | 5E-9 | —    | —    |

## Strontium-92

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see $^{80}\text{Sr}$ | 3E+3 | 9E+3 | 4E-6 | 1E-8 | 4E-5 | 4E-4 |
| Y, see $^{80}\text{Sr}$ | —    | 7E+3 | 3E-6 | 9E-9 | —    | —    |

## AN 39

Yttrium-86m<sup>2</sup>

|                                           |      |      |      |      |      |      |
|-------------------------------------------|------|------|------|------|------|------|
| W, all compounds except those given for Y | 2E+4 | 6E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
| Y, oxides and hydroxides                  | —    | 5E+4 | 2E-5 | 8E-8 | —    | —    |

## Yttrium-86

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{86m}\text{Y}$ | 1E+3 | 3E+3 | 1E-6 | 5E-9 | 2E-5 | 2E-4 |
| Y, see $^{86m}\text{Y}$ | —    | 3E+3 | 1E-6 | 5E-9 | —    | —    |

## Yttrium-87

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{86m}\text{Y}$ | 2E+3 | 3E+3 | 1E-6 | 5E-9 | 3E-5 | 3E-4 |
| Y, see $^{86m}\text{Y}$ | —    | 3E+3 | 1E-6 | 5E-9 | —    | —    |

## Yttrium-88

|                         |      |      |      |       |      |      |
|-------------------------|------|------|------|-------|------|------|
| W, see $^{86m}\text{Y}$ | 1E+3 | 3E+2 | 1E-7 | 3E-10 | 1E-5 | 1E-4 |
| Y, see $^{86m}\text{Y}$ | —    | 2E+2 | 1E-7 | 3E-10 | —    | —    |

## Yttrium-90m

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| W, see $^{86m}\text{Y}$ | 8E+3 | 1E+4 | 5E-6 | 2E-8 | 1E-4 | 1E-3 |
| Y, see $^{86m}\text{Y}$ | —    | 1E+4 | 5E-6 | 2E-8 | —    | —    |

## Yttrium-90

|                         |      |      |      |       |      |      |
|-------------------------|------|------|------|-------|------|------|
| W, see $^{86m}\text{Y}$ | 4E+2 | 7E+2 | 3E-7 | 9E-10 | —    | —    |
| LLI<br>(5E+2)           | —    | —    | —    | —     | 7E-6 | 7E-5 |

|                          |                |      |      |       |      |      |
|--------------------------|----------------|------|------|-------|------|------|
| Y, see $^{86m}\text{Y}$  | —              | 6E+2 | 3E-7 | 9E-10 | —    | —    |
| Yttrium-91m <sup>2</sup> |                |      |      |       |      |      |
| W, see $^{86m}\text{Y}$  | 1E+5           | 2E+5 | 1E-4 | 3E-7  | 2E-3 | 2E-2 |
| Y, see $^{86m}\text{Y}$  | —              | 2E+5 | 7E-5 | 2E-7  | —    | —    |
| Yttrium-91               |                |      |      |       |      |      |
| W, see $^{86m}\text{Y}$  | 5E+2           | 2E+2 | 7E-8 | 2E-10 | —    | —    |
|                          | LLI<br>(6E+2)  | —    | —    | —     | 8E-6 | 8E-5 |
| Y, see $^{86m}\text{Y}$  | —              | 1E+2 | 5E-8 | 2E-10 | —    | —    |
| Yttrium-92               |                |      |      |       |      |      |
| W, see $^{86m}\text{Y}$  | 3E+3           | 9E+3 | 4E-6 | 1E-8  | 4E-5 | 4E-4 |
| Y, see $^{86m}\text{Y}$  | —              | 8E+3 | 3E-6 | 1E-8  | —    | —    |
| Yttrium-93               |                |      |      |       |      |      |
| W, see $^{86m}\text{Y}$  | 1E+3           | 3E+3 | 1E-6 | 4E-9  | 2E-5 | 2E-4 |
| Y, see $^{86m}\text{Y}$  | —              | 2E+3 | 1E-6 | 3E-9  | —    | —    |
| Yttrium-94 <sup>2</sup>  |                |      |      |       |      |      |
| W, see $^{86m}\text{Y}$  | 2E+4           | 8E+4 | 3E-5 | 1E-7  | —    | —    |
|                          | Stom<br>(3E+4) | —    | —    | —     | 4E-4 | 4E-3 |
| Y, see $^{86m}\text{Y}$  | —              | 8E+4 | 3E-5 | 1E-7  | —    | —    |
| Yttrium-95 <sup>2</sup>  |                |      |      |       |      |      |
| W, see $^{86m}\text{Y}$  | 4E+4           | 2E+5 | 6E-5 | 2E-7  | —    | —    |
|                          | Stom<br>(5E+4) | —    | —    | —     | 7E-4 | 7E-3 |
| Y, see $^{86m}\text{Y}$  | —              | 1E+5 | 6E-5 | 2E-7  | —    | —    |

**AN 40****Zirconium-86**

D, all compounds except  
those given for W and Y

1E+3      4E+3      2E-6      6E-9      2E-5      2E-4

W, oxides, hydroxides,  
halides, and nitrates

—      3E+3      1E-6      4E-9      —      —

Y, carbide

—      2E+3      1E-6      3E-9      —      —

**Zirconium-88**

D, see <sup>86</sup>Zr

4E+3      2E+2      9E-8      3E-10      5E-5      5E-4

W, see <sup>86</sup>Zr

—      5E+2      2E-7      7E-10      —      —

Y, see <sup>86</sup>Zr

—      3E+2      1E-7      4E-10      —      —

**Zirconium-89**

D, see <sup>86</sup>Zr

2E+3      4E+3      1E-6      5E-9      2E-5      2E-4

W, see <sup>86</sup>Zr

—      2E+3      1E-6      3E-9      —      —

Y, see <sup>86</sup>Zr

—      2E+3      1E-6      3E-9      —      —

**Zirconium-93**

D, see <sup>86</sup>Zr

1E+3      6E+0      3E-9      —      —      —

Bone  
(3E+3)

Bone  
(2E+1)

—      2E-11      4E-5      4E-4

W, see <sup>86</sup>Zr

—      2E+1      1E-8      —      —      —

Bone

—      (6E+1)      —      9E-11      —      —

Y, see <sup>86</sup>Zr

—      6E+1      2E-8      —      —      —

Bone

—      (7E+1)      —      9E-11      —      —

**Zirconium-95**

D, see <sup>86</sup>Zr

1E+3      1E+2      5E-8      —      2E-5      2E-4

|                                              |                |        |      |       |      |      |
|----------------------------------------------|----------------|--------|------|-------|------|------|
|                                              |                | Bone   |      |       |      |      |
|                                              | —              | (3E+2) | —    | 4E-10 | —    | —    |
| W, see $^{86}\text{Zr}$                      | —              | 4E+2   | 2E-7 | 5E-10 | —    | —    |
| Y, see $^{86}\text{Zr}$                      | —              | 3E+2   | 1E-7 | 4E-10 | —    | —    |
| Zirconium-97                                 |                |        |      |       |      |      |
| D, see $^{86}\text{Zr}$                      | 6E+2           | 2E+3   | 8E-7 | 3E-9  | 9E-6 | 9E-5 |
| W, see $^{86}\text{Zr}$                      | —              | 1E+3   | 6E-7 | 2E-9  | —    | —    |
| Y, see $^{86}\text{Zr}$                      | —              | 1E+3   | 5E-7 | 2E-9  | —    | —    |
| AN 41                                        |                |        |      |       |      |      |
| Niobium-88 <sup>2</sup>                      |                |        |      |       |      |      |
| W, all compounds except<br>those given for Y | 5E+4           | 2E+5   | 9E-5 | 3E-7  | —    | —    |
|                                              | Stom<br>(7E+4) | —      | —    | —     | 1E-3 | 1E-2 |
| Y, oxides and hydroxides                     | —              | 2E+5   | 9E-5 | 3E-7  | —    | —    |
| Niobium-89 <sup>2</sup> (66 min)             |                |        |      |       |      |      |
| W, see $^{88}\text{Nb}$                      | 1E+4           | 4E+4   | 2E-5 | 6E-8  | 1E-4 | 1E-3 |
| Y, see $^{88}\text{Nb}$                      | —              | 4E+4   | 2E-5 | 5E-8  | —    | —    |
| Niobium-89 (122 min)                         |                |        |      |       |      |      |
| W, see $^{88}\text{Nb}$                      | 5E+3           | 2E+4   | 8E-6 | 3E-8  | 7E-5 | 7E-4 |
| Y, see $^{88}\text{Nb}$                      | —              | 2E+4   | 6E-6 | 2E-8  | —    | —    |
| Niobium-90                                   |                |        |      |       |      |      |
| W, see $^{88}\text{Nb}$                      | 1E+3           | 3E+3   | 1E-6 | 4E-9  | 1E-5 | 1E-4 |
| Y, see $^{88}\text{Nb}$                      | —              | 2E+3   | 1E-6 | 3E-9  | —    | —    |
| Niobium-93m                                  |                |        |      |       |      |      |

|                         |      |      |      |       |      |      |
|-------------------------|------|------|------|-------|------|------|
| W, see $^{88}\text{Nb}$ | 9E+3 | 2E+3 | 8E-7 | 3E-9  | —    | —    |
| LLI<br>(1E+4)           | —    | —    | —    | —     | 2E-4 | 2E-3 |
| Y, see $^{88}\text{Nb}$ | —    | 2E+2 | 7E-8 | 2E-10 | —    | —    |
| Niobium-94              |      |      |      |       |      |      |
| W, see $^{88}\text{Nb}$ | 9E+2 | 2E+2 | 8E-8 | 3E-10 | 1E-5 | 1E-4 |
| Y, see $^{88}\text{Nb}$ | —    | 2E+1 | 6E-9 | 2E-11 | —    | —    |
| Niobium-95m             |      |      |      |       |      |      |
| W, see $^{88}\text{Nb}$ | 2E+3 | 3E+3 | 1E-6 | 4E-9  | —    | —    |
| LLI<br>(2E+3)           | —    | —    | —    | —     | 3E-5 | 3E-4 |
| Y, see $^{88}\text{Nb}$ | —    | 2E+3 | 9E-7 | 3E-9  | —    | —    |
| Niobium-95              |      |      |      |       |      |      |
| W, see $^{88}\text{Nb}$ | 2E+3 | 1E+3 | 5E-7 | 2E-9  | 3E-5 | 3E-4 |
| Y, see $^{88}\text{Nb}$ | —    | 1E+3 | 5E-7 | 2E-9  | —    | —    |
| Niobium-96              |      |      |      |       |      |      |
| W, see $^{88}\text{Nb}$ | 1E+3 | 3E+3 | 1E-6 | 4E-9  | 2E-5 | 2E-4 |
| Y, see $^{88}\text{Nb}$ | —    | 2E+3 | 1E-6 | 3E-9  | —    | —    |
| Niobium-97 <sup>2</sup> |      |      |      |       |      |      |
| W, see $^{88}\text{Nb}$ | 2E+4 | 8E+4 | 3E-5 | 1E-7  | 3E-4 | 3E-3 |
| Y, see $^{88}\text{Nb}$ | —    | 7E+4 | 3E-5 | 1E-7  | —    | —    |
| Niobium-98 <sup>2</sup> |      |      |      |       |      |      |
| W, see $^{88}\text{Nb}$ | 1E+4 | 5E+4 | 2E-5 | 8E-8  | 2E-4 | 2E-3 |
| Y, see $^{88}\text{Nb}$ | —    | 5E+4 | 2E-5 | 7E-8  | —    | —    |

**AN 42****Molybdenum-90**

D, all compounds except  
those given for Y

4E+3      7E+3      3E-6      1E-8      3E-5      3E-4

Y, oxides, hydroxides, and  
MoS<sub>2</sub>

2E+3      5E+3      2E-6      6E-9      —      —

**Molybdenum-93m**

D, see <sup>90</sup>Mo

9E+3      2E+4      7E-6      2E-8      6E-5      6E-4

Y, see <sup>90</sup>Mo

4E+3      1E+4      6E-6      2E-8      —      —

**Molybdenum-93**

D, see <sup>90</sup>Mo

4E+3      5E+3      2E-6      8E-9      5E-5      5E-4

Y, see <sup>90</sup>Mo

2E+4      2E+2      8E-8      2E-10      —      —

**Molybdenum-99**

D, see <sup>90</sup>Mo

2E+3      3E+3      1E-6      4E-9      —      —

LLI

(1E+3)      —      —      —      2E-5      2E-4

Y, see <sup>90</sup>Mo

1E+3      1E+3      6E-7      2E-9      —      —

**Molybdenum-101<sup>2</sup>**

D, see <sup>90</sup>Mo

4E+4      1E+5      6E-5      2E-7      —      —

Stom

(5E+4)      —      —      —      7E-4      7E-3

Y, see <sup>90</sup>Mo

—      1E+5      6E-5      2E-7      —      —

**AN 43****Technetium-93m<sup>2</sup>**

D, all compounds except  
those given for W

7E+4      2E+5      6E-5      2E-7      1E-3      1E-2

W, oxides, hydroxides,  
halides, and nitrates

— 3E+5 1E-4 4E-7 — —

#### Technetium-93

D, see  $^{93m}\text{Tc}$  3E+4 7E+4 3E-5 1E-7 4E-4 4E-3

W, see  $^{93m}\text{Tc}$  — 1E+5 4E-5 1E-7 — —

#### Technetium-94m<sup>2</sup>

D, see  $^{93m}\text{Tc}$  2E+4 4E+4 2E-5 6E-8 3E-4 3E-3

W, see  $^{93m}\text{Tc}$  — 6E+4 2E-5 8E-8 — —

#### Technetium-94

D, see  $^{93m}\text{Tc}$  9E+3 2E+4 8E-6 3E-8 1E-4 1E-3

W, see  $^{93m}\text{Tc}$  — 2E+4 1E-5 3E-8 — —

#### Technetium-95m

D, see  $^{93m}\text{Tc}$  4E+3 5E+3 2E-6 8E-9 5E-5 5E-4

W, see  $^{93m}\text{Tc}$  — 2E+3 8E-7 3E-9 — —

#### Technetium-95

D, see  $^{93m}\text{Tc}$  1E+4 2E+4 9E-6 3E-8 1E-4 1E-3

W, see  $^{93m}\text{Tc}$  — 2E+4 8E-6 3E-8 — —

#### Technetium-96m<sup>2</sup>

D, see  $^{93m}\text{Tc}$  2E+5 3E+5 1E-4 4E-7 2E-3 2E-2

W, see  $^{93m}\text{Tc}$  — 2E+5 1E-4 3E-7 — —

#### Technetium-96

D, see  $^{93m}\text{Tc}$  2E+3 3E+3 1E-6 5E-9 3E-5 3E-4

W, see  $^{93m}\text{Tc}$  — 2E+3 9E-7 3E-9 — —

#### Technetium-97m

|                             |                |                |      |       |      |      |
|-----------------------------|----------------|----------------|------|-------|------|------|
| D, see $^{93m}\text{Tc}$    | 5E+3           | 7E+3           | 3E-6 | —     | 6E-5 | 6E-4 |
|                             | —              | Stom<br>(7E+3) | —    | 1E-8  | —    | —    |
| W, see $^{93m}\text{Tc}$    | —              | 1E+3           | 5E-7 | 2E-9  | —    | —    |
| Technetium-97               |                |                |      |       |      |      |
| D, see $^{93m}\text{Tc}$    | 4E+4           | 5E+4           | 2E-5 | 7E-8  | 5E-4 | 5E-3 |
| W, see $^{93m}\text{Tc}$    | —              | 6E+3           | 2E-6 | 8E-9  | —    | —    |
| Technetium-98               |                |                |      |       |      |      |
| D, see $^{93m}\text{Tc}$    | 1E+3           | 2E+3           | 7E-7 | 2E-9  | 1E-5 | 1E-4 |
| W, see $^{93m}\text{Tc}$    | —              | 3E+2           | 1E-7 | 4E-10 | —    | —    |
| Technetium-99m              |                |                |      |       |      |      |
| D, see $^{93m}\text{Tc}$    | 8E+4           | 2E+5           | 6E-5 | 2E-7  | 1E-3 | 1E-2 |
| W, see $^{93m}\text{Tc}$    | —              | 2E+5           | 1E-4 | 3E-7  | —    | —    |
| Technetium-99               |                |                |      |       |      |      |
| D, see $^{93m}\text{Tc}$    | 4E+3           | 5E+3           | 2E-6 | —     | 6E-5 | 6E-4 |
|                             | —              | Stom<br>(6E+3) | —    | 8E-9  | —    | —    |
| W, see $^{93m}\text{Tc}$    | —              | 7E+2           | 3E-7 | 9E-10 | —    | —    |
| Technetium-101 <sup>2</sup> |                |                |      |       |      |      |
| D, see $^{93m}\text{Tc}$    | 9E+4           | 3E+5           | 1E-4 | 5E-7  | —    | —    |
|                             | Stom<br>(1E+5) | —              | —    | —     | 2E-3 | 2E-2 |
| W, see $^{93m}\text{Tc}$    | —              | 4E+5           | 2E-4 | 5E-7  | —    | —    |
| Technetium-104 <sup>2</sup> |                |                |      |       |      |      |
| D, see $^{93m}\text{Tc}$    | 2E+4           | 7E+4           | 3E-5 | 1E-7  | —    | —    |

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
|                          | Stom<br>(3E+4) | —    | —    | —    | 4E-4 | 4E-3 |
| W, see <sup>93m</sup> Tc | —              | 9E+4 | 4E-5 | 1E-7 | —    | —    |

**AN 44****Ruthenium-94<sup>2</sup>**

D, all compounds except  
those given for W and Y

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
|                          | 2E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, halides               | —    | 6E+4 | 3E-5 | 9E-8 | —    | —    |
| Y, oxides and hydroxides | —    | 6E+4 | 2E-5 | 8E-8 | —    | —    |

**Ruthenium-97**

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>94</sup> Ru | 8E+3 | 2E+4 | 8E-6 | 3E-8 | 1E-4 | 1E-3 |
| W, see <sup>94</sup> Ru | —    | 1E+4 | 5E-6 | 2E-8 | —    | —    |
| Y, see <sup>94</sup> Ru | —    | 1E+4 | 5E-6 | 2E-8 | —    | —    |

**Ruthenium-103**

|                         |      |      |      |       |      |      |
|-------------------------|------|------|------|-------|------|------|
| D, see <sup>94</sup> Ru | 2E+3 | 2E+3 | 7E-7 | 2E-9  | 3E-5 | 3E-4 |
| W, see <sup>94</sup> Ru | —    | 1E+3 | 4E-7 | 1E-9  | —    | —    |
| Y, see <sup>94</sup> Ru | —    | 6E+2 | 3E-7 | 9E-10 | —    | —    |

**Ruthenium-105**

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>94</sup> Ru | 5E+3 | 1E+4 | 6E-6 | 2E-8 | 7E-5 | 7E-4 |
| W, see <sup>94</sup> Ru | —    | 1E+4 | 6E-6 | 2E-8 | —    | —    |
| Y, see <sup>94</sup> Ru | —    | 1E+4 | 5E-6 | 2E-8 | —    | —    |

**Ruthenium-106**

|                         |      |      |      |       |      |      |
|-------------------------|------|------|------|-------|------|------|
| D, see <sup>94</sup> Ru | 2E+2 | 9E+1 | 4E-8 | 1E-10 | —    | —    |
| LLI<br>(2E+2)           | —    | —    | —    | —     | 3E-6 | 3E-5 |

|                         |   |      |      |       |   |   |
|-------------------------|---|------|------|-------|---|---|
| W, see $^{94}\text{Ru}$ | — | 5E+1 | 2E-8 | 8E-11 | — | — |
| Y, see $^{94}\text{Ru}$ | — | 1E+1 | 5E-9 | 2E-11 | — | — |

**AN 45**

## Rhodium-99m

|                                                 |      |      |      |      |      |      |
|-------------------------------------------------|------|------|------|------|------|------|
| D, all compounds except those given for W and Y | 2E+4 | 6E+4 | 2E-5 | 8E-8 | 2E-4 | 2E-3 |
| W, halides                                      | —    | 8E+4 | 3E-5 | 1E-7 | —    | —    |
| Y, oxides and hydroxides                        | —    | 7E+4 | 3E-5 | 9E-8 | —    | —    |

## Rhodium-99

|                                 |      |      |      |      |      |      |
|---------------------------------|------|------|------|------|------|------|
| D, see $^{99\text{m}}\text{Rh}$ | 2E+3 | 3E+3 | 1E-6 | 4E-9 | 3E-5 | 3E-4 |
| W, see $^{99\text{m}}\text{Rh}$ | —    | 2E+3 | 9E-7 | 3E-9 | —    | —    |
| Y, see $^{99\text{m}}\text{Rh}$ | —    | 2E+3 | 8E-7 | 3E-9 | —    | —    |

## Rhodium-100

|                                 |      |      |      |      |      |      |
|---------------------------------|------|------|------|------|------|------|
| D, see $^{99\text{m}}\text{Rh}$ | 2E+3 | 5E+3 | 2E-6 | 7E-9 | 2E-5 | 2E-4 |
| W, see $^{99\text{m}}\text{Rh}$ | —    | 4E+3 | 2E-6 | 6E-9 | —    | —    |
| Y, see $^{99\text{m}}\text{Rh}$ | —    | 4E+3 | 2E-6 | 5E-9 | —    | —    |

## Rhodium-101m

|                                 |      |      |      |      |      |      |
|---------------------------------|------|------|------|------|------|------|
| D, see $^{99\text{m}}\text{Rh}$ | 6E+3 | 1E+4 | 5E-6 | 2E-8 | 8E-5 | 8E-4 |
| W, see $^{99\text{m}}\text{Rh}$ | —    | 8E+3 | 4E-6 | 1E-8 | —    | —    |
| Y, see $^{99\text{m}}\text{Rh}$ | —    | 8E+3 | 3E-6 | 1E-8 | —    | —    |

## Rhodium-101

|                                 |      |      |      |       |      |      |
|---------------------------------|------|------|------|-------|------|------|
| D, see $^{99\text{m}}\text{Rh}$ | 2E+3 | 5E+2 | 2E-7 | 7E-10 | 3E-5 | 3E-4 |
| W, see $^{99\text{m}}\text{Rh}$ | —    | 8E+2 | 3E-7 | 1E-9  | —    | —    |
| Y, see $^{99\text{m}}\text{Rh}$ | —    | 2E+2 | 6E-8 | 2E-10 | —    | —    |

## Rhodium-102m

|                           |      |      |      |       |      |      |
|---------------------------|------|------|------|-------|------|------|
| D, see <sup>99m</sup> Rh  | 1E+3 | 5E+2 | 2E-7 | 7E-10 | —    | —    |
| LLI<br>(1E+3)             | —    | —    | —    | —     | 2E-5 | 2E-4 |
| W, see <sup>99m</sup> Rh  | —    | 4E+2 | 2E-7 | 5E-10 | —    | —    |
| Y, see <sup>99m</sup> Rh  | —    | 1E+2 | 5E-8 | 2E-10 | —    | —    |
| Rhodium-102               |      |      |      |       |      |      |
| D, see <sup>99m</sup> Rh  | 6E+2 | 9E+1 | 4E-8 | 1E-10 | 8E-6 | 8E-5 |
| W, see <sup>99m</sup> Rh  | —    | 2E+2 | 7E-8 | 2E-10 | —    | —    |
| Y, see <sup>99m</sup> Rh  | —    | 6E+1 | 2E-8 | 8E-11 | —    | —    |
| Rhodium-103m <sup>2</sup> |      |      |      |       |      |      |
| D, see <sup>99m</sup> Rh  | 4E+5 | 1E+6 | 5E-4 | 2E-6  | 6E-3 | 6E-2 |
| W, see <sup>99m</sup> Rh  | —    | 1E+6 | 5E-4 | 2E-6  | —    | —    |
| Y, see <sup>99m</sup> Rh  | —    | 1E+6 | 5E-4 | 2E-6  | —    | —    |
| Rhodium-105               |      |      |      |       |      |      |
| D, see <sup>99m</sup> Rh  | 4E+3 | 1E+4 | 5E-6 | 2E-8  | —    | —    |
| LLI<br>(4E+3)             | —    | —    | —    | —     | 5E-5 | 5E-4 |
| W, see <sup>99m</sup> Rh  | —    | 6E+3 | 3E-6 | 9E-9  | —    | —    |
| Y, see <sup>99m</sup> Rh  | —    | 6E+3 | 2E-6 | 8E-9  | —    | —    |
| Rhodium-106m              |      |      |      |       |      |      |
| D, see <sup>99m</sup> Rh  | 8E+3 | 3E+4 | 1E-5 | 4E-8  | 1E-4 | 1E-3 |
| W, see <sup>99m</sup> Rh  | —    | 4E+4 | 2E-5 | 5E-8  | —    | —    |
| Y, see <sup>99m</sup> Rh  | —    | 4E+4 | 1E-5 | 5E-8  | —    | —    |
| Rhodium-107 <sup>2</sup>  |      |      |      |       |      |      |
| D, see <sup>99m</sup> Rh  | 7E+4 | 2E+5 | 1E-4 | 3E-7  | —    | —    |

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
|                          | Stom<br>(9E+4) | —    | —    | —    | 1E-3 | 1E-2 |
| W, see <sup>99m</sup> Rh | —              | 3E+5 | 1E-4 | 4E-7 | —    | —    |
| Y, see <sup>99m</sup> Rh | —              | 3E+5 | 1E-4 | 3E-7 | —    | —    |

**AN 46****Palladium-100**

D, all compounds except  
those given for W and Y

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
|                          | 1E+3 | 1E+3 | 6E-7 | 2E-9 | 2E-5 | 2E-4 |
| W, nitrates              | —    | 1E+3 | 5E-7 | 2E-9 | —    | —    |
| Y, oxides and hydroxides | —    | 1E+3 | 6E-7 | 2E-9 | —    | —    |

**Palladium-101**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>100</sup> Pd | 1E+4 | 3E+4 | 1E-5 | 5E-8 | 2E-4 | 2E-3 |
| W, see <sup>100</sup> Pd | —    | 3E+4 | 1E-5 | 5E-8 | —    | —    |
| Y, see <sup>100</sup> Pd | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |

**Palladium-103**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>100</sup> Pd | 6E+3 | 6E+3 | 3E-6 | 9E-9 | —    | —    |
| LLI<br>(7E+3)            | —    | —    | —    | —    | 1E-4 | 1E-3 |
| W, see <sup>100</sup> Pd | —    | 4E+3 | 2E-6 | 6E-9 | —    | —    |
| Y, see <sup>100</sup> Pd | —    | 4E+3 | 1E-6 | 5E-9 | —    | —    |

**Palladium-107**

|                          |               |      |      |       |      |      |
|--------------------------|---------------|------|------|-------|------|------|
| D, see <sup>100</sup> Pd | 3E+4          | 2E+4 | 9E-6 | —     | —    | —    |
| LLI<br>(4E+4)            | Kid<br>(2E+4) | —    | —    | 3E-8  | 5E-4 | 5E-3 |
| W, see <sup>100</sup> Pd | —             | 7E+3 | 3E-6 | 1E-8  | —    | —    |
| Y, see <sup>100</sup> Pd | —             | 4E+2 | 2E-7 | 6E-10 | —    | —    |

**Palladium-109**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{100}\text{Pd}$ | 2E+3 | 6E+3 | 3E-6 | 9E-9 | 3E-5 | 3E-4 |
| W, see $^{100}\text{Pd}$ | —    | 5E+3 | 2E-6 | 8E-9 | —    | —    |
| Y, see $^{100}\text{Pd}$ | —    | 5E+3 | 2E-6 | 6E-9 | —    | —    |

**AN 47**Silver-102<sup>2</sup>

D, all compounds except those given for W and Y

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
|                          | 5E+4 | 2E+5 | 8E-5 | 2E-7 | —    | —    |
| Stom<br>(6E+4)           | —    | —    | —    | —    | 9E-4 | 9E-3 |
| W, nitrates and sulfides | —    | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| Y, oxides and hydroxides | —    | 2E+5 | 8E-5 | 3E-7 | —    | —    |

Silver-103<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{102}\text{Ag}$ | 4E+4 | 1E+5 | 4E-5 | 1E-7 | 5E-4 | 5E-3 |
| W, see $^{102}\text{Ag}$ | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |

Silver-104m<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{102}\text{Ag}$ | 3E+4 | 9E+4 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
| W, see $^{102}\text{Ag}$ | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |

Silver-104<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{102}\text{Ag}$ | 2E+4 | 7E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
| W, see $^{102}\text{Ag}$ | —    | 1E+5 | 6E-5 | 2E-7 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —    | 1E+5 | 6E-5 | 2E-7 | —    | —    |

## Silver-105

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{102}\text{Ag}$ | 3E+3 | 1E+3 | 4E-7 | 1E-9 | 4E-5 | 4E-4 |
| W, see $^{102}\text{Ag}$ | —    | 2E+3 | 7E-7 | 2E-9 | —    | —    |

|                          |                |                 |      |       |      |      |
|--------------------------|----------------|-----------------|------|-------|------|------|
| Y, see $^{102}\text{Ag}$ | —              | 2E+3            | 7E-7 | 2E-9  | —    | —    |
| Silver-106m              |                |                 |      |       |      |      |
| D, see $^{102}\text{Ag}$ | 8E+2           | 7E+2            | 3E-7 | 1E-9  | 1E-5 | 1E-4 |
| W, see $^{102}\text{Ag}$ | —              | 9E+2            | 4E-7 | 1E-9  | —    | —    |
| Y, see $^{102}\text{Ag}$ | —              | 9E+2            | 4E-7 | 1E-9  | —    | —    |
| Silver-106 <sup>2</sup>  |                |                 |      |       |      |      |
| D, see $^{102}\text{Ag}$ | 6E+4           | 2E+5            | 8E-5 | 3E-7  | —    | —    |
|                          | Stom<br>(6E+4) | —               | —    | —     | 9E-4 | 9E-3 |
| W, see $^{102}\text{Ag}$ | —              | 2E+5            | 9E-5 | 3E-7  | —    | —    |
| Y, see $^{102}\text{Ag}$ | —              | 2E+5            | 8E-5 | 3E-7  | —    | —    |
| Silver-108m              |                |                 |      |       |      |      |
| D, see $^{102}\text{Ag}$ | 6E+2           | 2E+2            | 8E-8 | 3E-10 | 9E-6 | 9E-5 |
| W, see $^{102}\text{Ag}$ | —              | 3E+2            | 1E-7 | 4E-10 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —              | 2E+1            | 1E-8 | 3E-11 | —    | —    |
| Silver-110m              |                |                 |      |       |      |      |
| D, see $^{102}\text{Ag}$ | 5E+2           | 1E+2            | 5E-8 | 2E-10 | 6E-6 | 6E-5 |
| W, see $^{102}\text{Ag}$ | —              | 2E+2            | 8E-8 | 3E-10 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —              | 9E+1            | 4E-8 | 1E-10 | —    | —    |
| Silver-111               |                |                 |      |       |      |      |
| D, see $^{102}\text{Ag}$ | 9E+2           | 2E+3            | 6E-7 | —     | —    | —    |
|                          | LLI<br>(1E+3)  | Liver<br>(2E+3) | —    | 2E-9  | 2E-5 | 2E-4 |
| W, see $^{102}\text{Ag}$ | —              | 9E+2            | 4E-7 | 1E-9  | —    | —    |
| Y, see $^{102}\text{Ag}$ | —              | 9E+2            | 4E-7 | 1E-9  | —    | —    |
| Silver-112               |                |                 |      |       |      |      |

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{102}\text{Ag}$ | 3E+3 | 8E+3 | 3E-6 | 1E-8 | 4E-5 | 4E-4 |
| W, see $^{102}\text{Ag}$ | —    | 1E+4 | 4E-6 | 1E-8 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —    | 9E+3 | 4E-6 | 1E-8 | —    | —    |

Silver-115<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| D, see $^{102}\text{Ag}$ | 3E+4           | 9E+4 | 4E-5 | 1E-7 | —    | —    |
|                          | Stom<br>(3E+4) | —    | —    | —    | 4E-4 | 4E-3 |
| W, see $^{102}\text{Ag}$ | —              | 9E+4 | 4E-5 | 1E-7 | —    | —    |
| Y, see $^{102}\text{Ag}$ | —              | 8E+4 | 3E-5 | 1E-7 | —    | —    |

**AN 48**Cadmium-104<sup>2</sup>

|                                                 |      |      |      |      |      |      |
|-------------------------------------------------|------|------|------|------|------|------|
| D, all compounds except those given for W and Y | 2E+4 | 7E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| W, sulfides, halides, and nitrates              | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |
| Y, oxides and hydroxides                        | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |

## Cadmium-107

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{104}\text{Cd}$ | 2E+4 | 5E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
| W, see $^{104}\text{Cd}$ | —    | 6E+4 | 2E-5 | 8E-8 | —    | —    |
| Y, see $^{104}\text{Cd}$ | —    | 5E+4 | 2E-5 | 7E-8 | —    | —    |

## Cadmium-109

|                          |               |               |      |       |      |      |
|--------------------------|---------------|---------------|------|-------|------|------|
| D, see $^{104}\text{Cd}$ | 3E+2          | 4E+1          | 1E-8 | —     | —    | —    |
|                          | Kid<br>(4E+2) | Kid<br>(5E+1) | —    | 7E-11 | 6E-6 | 6E-5 |
| W, see $^{104}\text{Cd}$ | —             | 1E+2          | 5E-8 | —     | —    | —    |
|                          | —             | Kid<br>(1E+2) | —    | 2E-10 | —    | —    |

|                          |               |               |       |       |      |      |
|--------------------------|---------------|---------------|-------|-------|------|------|
| Y, see $^{104}\text{Cd}$ | —             | 1E+2          | 5E-8  | 2E-10 | —    | —    |
| Cadmium-113m             |               |               |       |       |      |      |
| D, see $^{104}\text{Cd}$ | 2E+1          | 2E+0          | 1E-9  | —     | —    | —    |
|                          | Kid<br>(4E+1) | Kid<br>(4E+0) | —     | 5E-12 | 5E-7 | 5E-6 |
| W, see $^{104}\text{Cd}$ | —             | 8E+0          | 4E-9  | —     | —    | —    |
|                          | —             | Kid<br>(1E+1) | —     | 2E-11 | —    | —    |
| Y, see $^{104}\text{Cd}$ | —             | 1E+1          | 5E-9  | 2E-11 | —    | —    |
| Cadmium-113              |               |               |       |       |      |      |
| D, see $^{104}\text{Cd}$ | 2E+1          | 2E+0          | 9E-10 | —     | —    | —    |
|                          | Kid<br>(3E+1) | Kid<br>(3E+0) | —     | 5E-12 | 4E-7 | 4E-6 |
| W, see $^{104}\text{Cd}$ | —             | 8E+0          | 3E-9  | —     | —    | —    |
|                          | —             | Kid<br>(1E+1) | —     | 2E-11 | —    | —    |
| Y, see $^{104}\text{Cd}$ | —             | 1E+1          | 6E-9  | 2E-11 | —    | —    |
| Cadmium-115m             |               |               |       |       |      |      |
| D, see $^{104}\text{Cd}$ | 3E+2          | 5E+1          | 2E-8  | —     | 4E-6 | 4E-5 |
|                          | —             | Kid<br>(8E+1) | —     | 1E-10 | —    | —    |
| W, see $^{104}\text{Cd}$ | —             | 1E+2          | 5E-8  | 2E-10 | —    | —    |
| Y, see $^{104}\text{Cd}$ | —             | 1E+2          | 6E-8  | 2E-10 | —    | —    |
| Cadmium-115              |               |               |       |       |      |      |
| D, see $^{104}\text{Cd}$ | 9E+2          | 1E+3          | 6E-7  | 2E-9  | —    | —    |
|                          | LLI<br>(1E+3) | —             | —     | —     | 1E-5 | 1E-4 |
| W, see $^{104}\text{Cd}$ | —             | 1E+3          | 5E-7  | 2E-9  | —    | —    |

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| Y, see $^{104}\text{Cd}$ | — | 1E+3 | 6E-7 | 2E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

## Cadmium-117m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{104}\text{Cd}$ | 5E+3 | 1E+4 | 5E-6 | 2E-8 | 6E-5 | 6E-4 |
| W, see $^{104}\text{Cd}$ | —    | 2E+4 | 7E-6 | 2E-8 | —    | —    |
| Y, see $^{104}\text{Cd}$ | —    | 1E+4 | 6E-6 | 2E-8 | —    | —    |

## Cadmium-117

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{104}\text{Cd}$ | 5E+3 | 1E+4 | 5E-6 | 2E-8 | 6E-5 | 6E-4 |
| W, see $^{104}\text{Cd}$ | —    | 2E+4 | 7E-6 | 2E-8 | —    | —    |
| Y, see $^{104}\text{Cd}$ | —    | 1E+4 | 6E-6 | 2E-8 | —    | —    |

**AN 49**

## Indium-109

|                                              |      |      |      |      |      |      |
|----------------------------------------------|------|------|------|------|------|------|
| D, all compounds except those given for W    | 2E+4 | 4E+4 | 2E-5 | 6E-8 | 3E-4 | 3E-3 |
| W, oxides, hydroxides, halides, and nitrates | —    | 6E+4 | 3E-5 | 9E-8 | —    | —    |

Indium-110<sup>2</sup> (69.1 min)

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{109}\text{In}$ | 2E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see $^{109}\text{In}$ | —    | 6E+4 | 2E-5 | 8E-8 | —    | —    |

## Indium-110 (4.9 h)

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{109}\text{In}$ | 5E+3 | 2E+4 | 7E-6 | 2E-8 | 7E-5 | 7E-4 |
| W, see $^{109}\text{In}$ | —    | 2E+4 | 8E-6 | 3E-8 | —    | —    |

## Indium-111

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{109}\text{In}$ | 4E+3 | 6E+3 | 3E-6 | 9E-9 | 6E-5 | 6E-4 |
| W, see $^{109}\text{In}$ | —    | 6E+3 | 3E-6 | 9E-9 | —    | —    |

Indium-112<sup>2</sup>

|                          |               |      |       |       |      |      |
|--------------------------|---------------|------|-------|-------|------|------|
| D, see $^{109}\text{In}$ | 2E+5          | 6E+5 | 3E-4  | 9E-7  | 2E-3 | 2E-2 |
| W, see $^{109}\text{In}$ | —             | 7E+5 | 3E-4  | 1E-6  | —    | —    |
| Indium-113m <sup>2</sup> |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 5E+4          | 1E+5 | 6E-5  | 2E-7  | 7E-4 | 7E-3 |
| W, see $^{109}\text{In}$ | —             | 2E+5 | 8E-5  | 3E-7  | —    | —    |
| Indium-114m              |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 3E+2          | 6E+1 | 3E-8  | 9E-11 | —    | —    |
|                          | LLI<br>(4E+2) | —    | —     | —     | 5E-6 | 5E-5 |
| W, see $^{109}\text{In}$ | —             | 1E+2 | 4E-8  | 1E-10 | —    | —    |
| Indium-115m              |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 1E+4          | 4E+4 | 2E-5  | 6E-8  | 2E-4 | 2E-3 |
| W, see $^{109}\text{In}$ | —             | 5E+4 | 2E-5  | 7E-8  | —    | —    |
| Indium-115               |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 4E+1          | 1E+0 | 6E-10 | 2E-12 | 5E-7 | 5E-6 |
| W, see $^{109}\text{In}$ | —             | 5E+0 | 2E-9  | 8E-12 | —    | —    |
| Indium-116m <sup>2</sup> |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 2E+4          | 8E+4 | 3E-5  | 1E-7  | 3E-4 | 3E-3 |
| W, see $^{109}\text{In}$ | —             | 1E+5 | 5E-5  | 2E-7  | —    | —    |
| Indium-117m <sup>2</sup> |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 1E+4          | 3E+4 | 1E-5  | 5E-8  | 2E-4 | 2E-3 |
| W, see $^{109}\text{In}$ | —             | 4E+4 | 2E-5  | 6E-8  | —    | —    |
| Indium-117 <sup>2</sup>  |               |      |       |       |      |      |
| D, see $^{109}\text{In}$ | 6E+4          | 2E+5 | 7E-5  | 2E-7  | 8E-4 | 8E-3 |

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{109}\text{In}$ | — | 2E+5 | 9E-5 | 3E-7 | — | — |
|--------------------------|---|------|------|------|---|---|

Indium-119m<sup>2</sup>

|                          |      |      |      |      |   |   |
|--------------------------|------|------|------|------|---|---|
| D, see $^{109}\text{In}$ | 4E+4 | 1E+5 | 5E-5 | 2E-7 | — | — |
|--------------------------|------|------|------|------|---|---|

Stom  
(5E+4)

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{109}\text{In}$ | — | 1E+5 | 6E-5 | 2E-7 | — | — |
|--------------------------|---|------|------|------|---|---|

**AN 50**

## Tin-110

D, all compounds except  
those given for W

|      |      |      |      |      |      |
|------|------|------|------|------|------|
| 4E+3 | 1E+4 | 5E-6 | 2E-8 | 5E-5 | 5E-4 |
|------|------|------|------|------|------|

W, sulfides, oxides,  
hydroxides, halides, nitrates,  
and stannic phosphate

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 1E+4 | 5E-6 | 2E-8 | — | — |
|---|------|------|------|---|---|

Tin-111<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{110}\text{Sn}$ | 7E+4 | 2E+5 | 9E-5 | 3E-7 | 1E-3 | 1E-2 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{110}\text{Sn}$ | — | 3E+5 | 1E-4 | 4E-7 | — | — |
|--------------------------|---|------|------|------|---|---|

## Tin-113

|                          |      |      |      |      |   |   |
|--------------------------|------|------|------|------|---|---|
| D, see $^{110}\text{Sn}$ | 2E+3 | 1E+3 | 5E-7 | 2E-9 | — | — |
|--------------------------|------|------|------|------|---|---|

LLI  
(2E+3)

|                          |   |      |      |       |   |   |
|--------------------------|---|------|------|-------|---|---|
| W, see $^{110}\text{Sn}$ | — | 5E+2 | 2E-7 | 8E-10 | — | — |
|--------------------------|---|------|------|-------|---|---|

## Tin-117m

|                          |      |      |      |   |   |   |
|--------------------------|------|------|------|---|---|---|
| D, see $^{110}\text{Sn}$ | 2E+3 | 1E+3 | 5E-7 | — | — | — |
|--------------------------|------|------|------|---|---|---|

LLI  
(2E+3)

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{110}\text{Sn}$ | — | 1E+3 | 6E-7 | 2E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

## Tin-119m

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{110}\text{Sn}$ | 3E+3 | 2E+3 | 1E-6 | 3E-9  | —    | —    |
| LLI<br>(4E+3)            | —    | —    | —    | —     | 6E-5 | 6E-4 |
| W, see $^{110}\text{Sn}$ | —    | 1E+3 | 4E-7 | 1E-9  | —    | —    |
| Tin-121m                 |      |      |      |       |      |      |
| D, see $^{110}\text{Sn}$ | 3E+3 | 9E+2 | 4E-7 | 1E-9  | —    | —    |
| LLI<br>(4E+3)            | —    | —    | —    | —     | 5E-5 | 5E-4 |
| W, see $^{110}\text{Sn}$ | —    | 5E+2 | 2E-7 | 8E-10 | —    | —    |
| Tin-121                  |      |      |      |       |      |      |
| D, see $^{110}\text{Sn}$ | 6E+3 | 2E+4 | 6E-6 | 2E-8  | —    | —    |
| LLI<br>(6E+3)            | —    | —    | —    | —     | 8E-5 | 8E-4 |
| W, see $^{110}\text{Sn}$ | —    | 1E+4 | 5E-6 | 2E-8  | —    | —    |
| Tin-123m <sup>2</sup>    |      |      |      |       |      |      |
| D, see $^{110}\text{Sn}$ | 5E+4 | 1E+5 | 5E-5 | 2E-7  | 7E-4 | 7E-3 |
| W, see $^{110}\text{Sn}$ | —    | 1E+5 | 6E-5 | 2E-7  | —    | —    |
| Tin-123                  |      |      |      |       |      |      |
| D, see $^{110}\text{Sn}$ | 5E+2 | 6E+2 | 3E-7 | 9E-10 | —    | —    |
| LLI<br>(6E+2)            | —    | —    | —    | —     | 9E-6 | 9E-5 |
| W, see $^{110}\text{Sn}$ | —    | 2E+2 | 7E-8 | 2E-10 | —    | —    |
| Tin-125                  |      |      |      |       |      |      |
| D, see $^{110}\text{Sn}$ | 4E+2 | 9E+2 | 4E-7 | 1E-9  | —    | —    |
| LLI<br>(5E+2)            | —    | —    | —    | —     | 6E-6 | 6E-5 |

|                          |   |      |      |       |   |   |
|--------------------------|---|------|------|-------|---|---|
| W, see $^{110}\text{Sn}$ | — | 4E+2 | 1E-7 | 5E-10 | — | — |
|--------------------------|---|------|------|-------|---|---|

## Tin-126

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{110}\text{Sn}$ | 3E+2 | 6E+1 | 2E-8 | 8E-11 | 4E-6 | 4E-5 |
|--------------------------|------|------|------|-------|------|------|

|                          |   |      |      |       |   |   |
|--------------------------|---|------|------|-------|---|---|
| W, see $^{110}\text{Sn}$ | — | 7E+1 | 3E-8 | 9E-11 | — | — |
|--------------------------|---|------|------|-------|---|---|

## Tin-127

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{110}\text{Sn}$ | 7E+3 | 2E+4 | 8E-6 | 3E-8 | 9E-5 | 9E-4 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{110}\text{Sn}$ | — | 2E+4 | 8E-6 | 3E-8 | — | — |
|--------------------------|---|------|------|------|---|---|

Tin-128<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{110}\text{Sn}$ | 9E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{110}\text{Sn}$ | — | 4E+4 | 1E-5 | 5E-8 | — | — |
|--------------------------|---|------|------|------|---|---|

**AN 51**Antimony-115<sup>2</sup>

|                                           |      |      |      |      |      |      |
|-------------------------------------------|------|------|------|------|------|------|
| D, all compounds except those given for W | 8E+4 | 2E+5 | 1E-4 | 3E-7 | 1E-3 | 1E-2 |
|-------------------------------------------|------|------|------|------|------|------|

|                                                                  |   |      |      |      |   |   |
|------------------------------------------------------------------|---|------|------|------|---|---|
| W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates | — | 3E+5 | 1E-4 | 4E-7 | — | — |
|------------------------------------------------------------------|---|------|------|------|---|---|

Antimony-116m<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 2E+4 | 7E+4 | 3E-5 | 1E-7 | 3E-4 | 3E-3 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{115}\text{Sb}$ | — | 1E+5 | 6E-5 | 2E-7 | — | — |
|--------------------------|---|------|------|------|---|---|

Antimony-116<sup>2</sup>

|                          |      |      |      |      |   |   |
|--------------------------|------|------|------|------|---|---|
| D, see $^{115}\text{Sb}$ | 7E+4 | 3E+5 | 1E-4 | 4E-7 | — | — |
|--------------------------|------|------|------|------|---|---|

|             |   |   |   |      |      |
|-------------|---|---|---|------|------|
| Stom (9E+4) | — | — | — | 1E-3 | 1E-2 |
|-------------|---|---|---|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{115}\text{Sb}$ | — | 3E+5 | 1E-4 | 5E-7 | — | — |
|--------------------------|---|------|------|------|---|---|

## Antimony-117

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 7E+4 | 2E+5 | 9E-5 | 3E-7 | 9E-4 | 9E-3 |
| W, see $^{115}\text{Sb}$ | —    | 3E+5 | 1E-4 | 4E-7 | —    | —    |

## Antimony-118m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 6E+3 | 2E+4 | 8E-6 | 3E-8 | 7E-5 | 7E-4 |
| W, see $^{115}\text{Sb}$ | 5E+3 | 2E+4 | 9E-6 | 3E-8 | —    | —    |

## Antimony-119

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 2E+4 | 5E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see $^{115}\text{Sb}$ | 2E+4 | 3E+4 | 1E-5 | 4E-8 | —    | —    |

Antimony-120<sup>2</sup> (16 min)

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 1E+5           | 4E+5 | 2E-4 | 6E-7 | —    | —    |
|                          | Stom<br>(2E+5) | —    | —    | —    | 2E-3 | 2E-2 |
| W, see $^{115}\text{Sb}$ | —              | 5E+5 | 2E-4 | 7E-7 | —    | —    |

## Antimony-120 (5.76 d)

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 1E+3 | 2E+3 | 9E-7 | 3E-9 | 1E-5 | 1E-4 |
| W, see $^{115}\text{Sb}$ | 9E+2 | 1E+3 | 5E-7 | 2E-9 | —    | —    |

## Antimony-122

|                          |               |      |      |      |      |      |
|--------------------------|---------------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 8E+2          | 2E+3 | 1E-6 | 3E-9 | —    | —    |
|                          | LLI<br>(8E+2) | —    | —    | —    | 1E-5 | 1E-4 |
| W, see $^{115}\text{Sb}$ | 7E+2          | 1E+3 | 4E-7 | 2E-9 | —    | —    |

Antimony-124m<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 3E+5 | 8E+5 | 4E-4 | 1E-6 | 3E-3 | 3E-2 |
| W, see $^{115}\text{Sb}$ | 2E+5 | 6E+5 | 2E-4 | 8E-7 | —    | —    |

## Antimony-124

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{115}\text{Sb}$ | 6E+2 | 9E+2 | 4E-7 | 1E-9  | 7E-6 | 7E-5 |
| W, see $^{115}\text{Sb}$ | 5E+2 | 2E+2 | 1E-7 | 3E-10 | —    | —    |

## Antimony-125

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{115}\text{Sb}$ | 2E+3 | 2E+3 | 1E-6 | 3E-9  | 3E-5 | 3E-4 |
| W, see $^{115}\text{Sb}$ | —    | 5E+2 | 2E-7 | 7E-10 | —    | —    |

Antimony-126m<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 5E+4           | 2E+5 | 8E-5 | 3E-7 | —    | —    |
|                          | Stom<br>(7E+4) | —    | —    | —    | 9E-4 | 9E-3 |
| W, see $^{115}\text{Sb}$ | —              | 2E+5 | 8E-5 | 3E-7 | —    | —    |

## Antimony-126

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{115}\text{Sb}$ | 6E+2 | 1E+3 | 5E-7 | 2E-9  | 7E-6 | 7E-5 |
| W, see $^{115}\text{Sb}$ | 5E+2 | 5E+2 | 2E-7 | 7E-10 | —    | —    |

## Antimony-127

|                          |               |      |      |      |      |      |
|--------------------------|---------------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 8E+2          | 2E+3 | 9E-7 | 3E-9 | —    | —    |
|                          | LLI<br>(8E+2) | —    | —    | —    | 1E-5 | 1E-4 |
| W, see $^{115}\text{Sb}$ | 7E+2          | 9E+2 | 4E-7 | 1E-9 | —    | —    |

Antimony-128<sup>2</sup> (10.4 min)

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 8E+4           | 4E+5 | 2E-4 | 5E-7 | —    | —    |
|                          | Stom<br>(1E+5) | —    | —    | —    | 1E-3 | 1E-2 |
| W, see $^{115}\text{Sb}$ | —              | 4E+5 | 2E-4 | 6E-7 | —    | —    |

## Antimony-128 (9.01 h)

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 1E+3 | 4E+3 | 2E-6 | 6E-9 | 2E-5 | 2E-4 |
| W, see $^{115}\text{Sb}$ | —    | 3E+3 | 1E-6 | 5E-9 | —    | —    |

## Antimony-129

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 3E+3 | 9E+3 | 4E-6 | 1E-8 | 4E-5 | 4E-4 |
| W, see $^{115}\text{Sb}$ | —    | 9E+3 | 4E-6 | 1E-8 | —    | —    |

Antimony-130<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 2E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| W, see $^{115}\text{Sb}$ | —    | 8E+4 | 3E-5 | 1E-7 | —    | —    |

Antimony-131<sup>2</sup>

|                          |                |                |      |      |      |      |
|--------------------------|----------------|----------------|------|------|------|------|
| D, see $^{115}\text{Sb}$ | 1E+4           | 2E+4           | 1E-5 | —    | —    | —    |
|                          | Thyr<br>(2E+4) | Thyr<br>(4E+4) | —    | 6E-8 | 2E-4 | 2E-3 |
| W, see $^{115}\text{Sb}$ | —              | 2E+4           | 1E-5 | —    | —    | —    |
|                          | —              | Thyr<br>(4E+4) | —    | 6E-8 | —    | —    |

**AN 52**

## Tellurium-116

|                                           |      |      |      |      |      |      |
|-------------------------------------------|------|------|------|------|------|------|
| D, all compounds except those given for W | 8E+3 | 2E+4 | 9E-6 | 3E-8 | 1E-4 | 1E-3 |
| W, oxides, hydroxides, and nitrates       | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |

## Tellurium-121m

|                          |                |                |      |       |      |      |
|--------------------------|----------------|----------------|------|-------|------|------|
| D, see $^{116}\text{Te}$ | 5E+2           | 2E+2           | 8E-8 | —     | —    | —    |
|                          | Bone<br>(7E+2) | Bone<br>(4E+2) | —    | 5E-10 | 1E-5 | 1E-4 |
| W, see $^{116}\text{Te}$ | —              | 4E+2           | 2E-7 | 6E-10 | —    | —    |

## Tellurium-121

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{116}\text{Te}$ | 3E+3 | 4E+3 | 2E-6 | 6E-9 | 4E-5 | 4E-4 |
| W, see $^{116}\text{Te}$ | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |

## Tellurium-123m

|                          |                |                |      |       |      |      |
|--------------------------|----------------|----------------|------|-------|------|------|
| D, see $^{116}\text{Te}$ | 6E+2           | 2E+2           | 9E-8 | —     | —    | —    |
|                          | Bone<br>(1E+3) | Bone<br>(5E+2) | —    | 8E-10 | 1E-5 | 1E-4 |
| W, see $^{116}\text{Te}$ | —              | 5E+2           | 2E-7 | 8E-10 | —    | —    |

## Tellurium-123

|                          |                |                |      |       |      |      |
|--------------------------|----------------|----------------|------|-------|------|------|
| D, see $^{116}\text{Te}$ | 5E+2           | 2E+2           | 8E-8 | —     | —    | —    |
|                          | Bone<br>(1E+3) | Bone<br>(5E+2) | —    | 7E-10 | 2E-5 | 2E-4 |
| W, see $^{116}\text{Te}$ | —              | 4E+2           | 2E-7 | —     | —    | —    |
|                          | —              | Bone<br>(1E+3) | —    | 2E-9  | —    | —    |

## Tellurium-125m

|                          |                |                |      |      |      |      |
|--------------------------|----------------|----------------|------|------|------|------|
| D, see $^{116}\text{Te}$ | 1E+3           | 4E+2           | 2E-7 | —    | —    | —    |
|                          | Bone<br>(1E+3) | Bone<br>(1E+3) | —    | 1E-9 | 2E-5 | 2E-4 |
| W, see $^{116}\text{Te}$ | —              | 7E+2           | 3E-7 | 1E-9 | —    | —    |

## Tellurium-127m

|                          |      |                |      |       |      |      |
|--------------------------|------|----------------|------|-------|------|------|
| D, see $^{116}\text{Te}$ | 6E+2 | 3E+2           | 1E-7 | —     | 9E-6 | 9E-5 |
|                          | —    | Bone<br>(4E+2) | —    | 6E-10 | —    | —    |
| W, see $^{116}\text{Te}$ | —    | 3E+2           | 1E-7 | 4E-10 | —    | —    |

## Tellurium-127

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{116}\text{Te}$ | 7E+3 | 2E+4 | 9E-6 | 3E-8 | 1E-4 | 1E-3 |
|--------------------------|------|------|------|------|------|------|

|                            |                |                |      |       |      |      |
|----------------------------|----------------|----------------|------|-------|------|------|
| W, see $^{116}\text{Te}$   | —              | 2E+4           | 7E-6 | 2E-8  | —    | —    |
| Tellurium-129m             |                |                |      |       |      |      |
| D, see $^{116}\text{Te}$   | 5E+2           | 6E+2           | 3E-7 | 9E-10 | 7E-6 | 7E-5 |
| W, see $^{116}\text{Te}$   | —              | 2E+2           | 1E-7 | 3E-10 | —    | —    |
| Tellurium-129 <sup>2</sup> |                |                |      |       |      |      |
| D, see $^{116}\text{Te}$   | 3E+4           | 6E+4           | 3E-5 | 9E-8  | 4E-4 | 4E-3 |
| W, see $^{116}\text{Te}$   | —              | 7E+4           | 3E-5 | 1E-7  | —    | —    |
| Tellurium-131m             |                |                |      |       |      |      |
| D, see $^{116}\text{Te}$   | 3E+2           | 4E+2           | 2E-7 | —     | —    | —    |
|                            | Thyr<br>(6E+2) | Thyr<br>(1E+3) | —    | 2E-9  | 8E-6 | 8E-5 |
| W, see $^{116}\text{Te}$   | —              | 4E+2           | 2E-7 | —     | —    | —    |
|                            | —              | Thyr<br>(9E+2) | —    | 1E-9  | —    | —    |
| Tellurium-131 <sup>2</sup> |                |                |      |       |      |      |
| D, see $^{116}\text{Te}$   | 3E+3           | 5E+3           | 2E-6 | —     | —    | —    |
|                            | Thyr<br>(6E+3) | Thyr<br>(1E+4) | —    | 2E-8  | 8E-5 | 8E-4 |
| W, see $^{116}\text{Te}$   | —              | 5E+3           | 2E-6 | —     | —    | —    |
|                            | —              | Thyr<br>(1E+4) | —    | 2E-8  | —    | —    |
| Tellurium-132              |                |                |      |       |      |      |
| D, see $^{116}\text{Te}$   | 2E+2           | 2E+2           | 9E-8 | —     | —    | —    |
|                            | Thyr<br>(7E+2) | Thyr<br>(8E+2) | —    | 1E-9  | 9E-6 | 9E-5 |
| W, see $^{116}\text{Te}$   | —              | 2E+2           | 9E-8 | —     | —    | —    |

|                             |                |                |      |       |      |      |
|-----------------------------|----------------|----------------|------|-------|------|------|
|                             | —              | Thyr<br>(6E+2) | —    | 9E-10 | —    | —    |
| Tellurium-133m <sup>2</sup> |                |                |      |       |      |      |
| D, see <sup>116</sup> Te    | 3E+3           | 5E+3           | 2E-6 | —     | —    | —    |
|                             | Thyr<br>(6E+3) | Thyr<br>(1E+4) | —    | 2E-8  | 9E-5 | 9E-4 |
| W, see <sup>116</sup> Te    | —              | 5E+3           | 2E-6 | —     | —    | —    |
|                             | —              | Thyr<br>(1E+4) | —    | 2E-8  | —    | —    |
| Tellurium-133 <sup>2</sup>  |                |                |      |       |      |      |
| D, see <sup>116</sup> Te    | 1E+4           | 2E+4           | 9E-6 | —     | —    | —    |
|                             | Thyr<br>(3E+4) | Thyr<br>(6E+4) | —    | 8E-8  | 4E-4 | 4E-3 |
| W, see <sup>116</sup> Te    | —              | 2E+4           | 9E-6 | —     | —    | —    |
|                             | —              | Thyr<br>(6E+4) | —    | 8E-8  | —    | —    |
| Tellurium-134 <sup>2</sup>  |                |                |      |       |      |      |
| D, see <sup>116</sup> Te    | 2E+4           | 2E+4           | 1E-5 | —     | —    | —    |
|                             | Thyr<br>(2E+4) | Thyr<br>(5E+4) | —    | 7E-8  | 3E-4 | 3E-3 |
| W, see <sup>116</sup> Te    | —              | 2E+4           | 1E-5 | —     | —    | —    |
|                             | —              | Thyr<br>(5E+4) | —    | 7E-8  | —    | —    |
| <b>AN 53</b>                |                |                |      |       |      |      |
| Iodine-120m <sup>2</sup>    |                |                |      |       |      |      |
| D, all compounds            | 1E+4           | 2E+4           | 9E-6 | 3E-8  | —    | —    |
|                             | Thyr<br>(1E+4) | —              | —    | —     | 2E-4 | 2E-3 |

Iodine-120<sup>2</sup>

|                  |                |                |      |      |      |      |
|------------------|----------------|----------------|------|------|------|------|
| D, all compounds | 4E+3           | 9E+3           | 4E-6 | —    | —    | —    |
|                  | Thyr<br>(8E+3) | Thyr<br>(1E+4) | —    | 2E-8 | 1E-4 | 1E-3 |

## Iodine-121

|                  |                |                |      |      |      |      |
|------------------|----------------|----------------|------|------|------|------|
| D, all compounds | 1E+4           | 2E+4           | 8E-6 | —    | —    | —    |
|                  | Thyr<br>(3E+4) | Thyr<br>(5E+4) | —    | 7E-8 | 4E-4 | 4E-3 |

## Iodine-123

|                  |                |                |      |      |      |      |
|------------------|----------------|----------------|------|------|------|------|
| D, all compounds | 3E+3           | 6E+3           | 3E-6 | —    | —    | —    |
|                  | Thyr<br>(1E+4) | Thyr<br>(2E+4) | —    | 2E-8 | 1E-4 | 1E-3 |

## Iodine-124

|                  |                |                |      |       |      |      |
|------------------|----------------|----------------|------|-------|------|------|
| D, all compounds | 5E+1           | 8E+1           | 3E-8 | —     | —    | —    |
|                  | Thyr<br>(2E+2) | Thyr<br>(3E+2) | —    | 4E-10 | 2E-6 | 2E-5 |

## Iodine-125

|                  |                |                |      |       |      |      |
|------------------|----------------|----------------|------|-------|------|------|
| D, all compounds | 4E+1           | 6E+1           | 3E-8 | —     | —    | —    |
|                  | Thyr<br>(1E+2) | Thyr<br>(2E+2) | —    | 3E-10 | 2E-6 | 2E-5 |

## Iodine-126

|                  |                |                |      |       |      |      |
|------------------|----------------|----------------|------|-------|------|------|
| D, all compounds | 2E+1           | 4E+1           | 1E-8 | —     | —    | —    |
|                  | Thyr<br>(7E+1) | Thyr<br>(1E+2) | —    | 2E-10 | 1E-6 | 1E-5 |

Iodine-128<sup>2</sup>

|                  |      |      |      |      |   |   |
|------------------|------|------|------|------|---|---|
| D, all compounds | 4E+4 | 1E+5 | 5E-5 | 2E-7 | — | — |
|------------------|------|------|------|------|---|---|

|                          |                        |                        |           |            |           |           |
|--------------------------|------------------------|------------------------|-----------|------------|-----------|-----------|
|                          | Stom<br>(6E+4)         | —                      | —         | —          | 8E-4      | 8E-3      |
| Iodine-129               |                        |                        |           |            |           |           |
| D, all compounds         | 5E+0<br>Thyr<br>(2E+1) | 9E+0<br>Thyr<br>(3E+1) | 4E-9<br>— | —<br>4E-11 | —<br>2E-7 | —<br>2E-6 |
| Iodine-130               |                        |                        |           |            |           |           |
| D, all compounds         | 4E+2<br>Thyr<br>(1E+3) | 7E+2<br>Thyr<br>(2E+3) | 3E-7<br>— | —<br>3E-9  | —<br>2E-5 | —<br>2E-4 |
| Iodine-131               |                        |                        |           |            |           |           |
| D, all compounds         | 3E+1<br>Thyr<br>(9E+1) | 5E+1<br>Thyr<br>(2E+2) | 2E-8<br>— | —<br>2E-10 | —<br>1E-6 | —<br>1E-5 |
| Iodine-132m <sup>2</sup> |                        |                        |           |            |           |           |
| D, all compounds         | 4E+3<br>Thyr<br>(1E+4) | 8E+3<br>Thyr<br>(2E+4) | 4E-6<br>— | —<br>3E-8  | —<br>1E-4 | —<br>1E-3 |
| Iodine-132               |                        |                        |           |            |           |           |
| D, all compounds         | 4E+3<br>Thyr<br>(9E+3) | 8E+3<br>Thyr<br>(1E+4) | 3E-6<br>— | —<br>2E-8  | —<br>1E-4 | —<br>1E-3 |
| Iodine-133               |                        |                        |           |            |           |           |
| D, all compounds         | 1E+2<br>Thyr<br>(5E+2) | 3E+2<br>Thyr<br>(9E+2) | 1E-7<br>— | —<br>1E-9  | —<br>7E-6 | —<br>7E-5 |

Iodine-134<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+4 | 5E+4 | 2E-5 | 6E-8 | —    | —    |
| Thyr<br>(3E+4)   | —    | —    | —    | —    | 4E-4 | 4E-3 |

## Iodine-135

|                  |                |      |      |      |      |      |
|------------------|----------------|------|------|------|------|------|
| D, all compounds | 8E+2           | 2E+3 | 7E-7 | —    | —    | —    |
| Thyr<br>(3E+3)   | Thyr<br>(4E+3) | —    | —    | 6E-9 | 3E-5 | 3E-4 |

**AN 54**Xenon-120<sup>2</sup>

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 1E-5 | 4E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

Xenon-121<sup>2</sup>

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 2E-6 | 1E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-122

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 7E-5 | 3E-7 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-123

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 6E-6 | 3E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-125

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 2E-5 | 7E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-127

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 1E-5 | 6E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-129m

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 2E-4 | 9E-7 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-131m

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 4E-4 | 2E-6 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-133m

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 1E-4 | 6E-7 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-133

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 1E-4 | 5E-7 | — | — |
|-------------------------|---|---|------|------|---|---|

Xenon-135m<sup>2</sup>

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 9E-6 | 4E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

## Xenon-135

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 1E-5 | 7E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

Xenon-138<sup>2</sup>

|                         |   |   |      |      |   |   |
|-------------------------|---|---|------|------|---|---|
| Submersion <sup>1</sup> | — | — | 4E-6 | 2E-8 | — | — |
|-------------------------|---|---|------|------|---|---|

**AN 55**Cesium-125<sup>2</sup>

|                  |                |      |      |      |      |      |
|------------------|----------------|------|------|------|------|------|
| D, all compounds | 5E+4           | 1E+5 | 6E-5 | 2E-7 | —    | —    |
|                  | Stom<br>(9E+4) | —    | —    | —    | 1E-3 | 1E-2 |

## Cesium-127

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 6E+4 | 9E+4 | 4E-5 | 1E-7 | 9E-4 | 9E-3 |
|------------------|------|------|------|------|------|------|

## Cesium-129

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+4 | 3E+4 | 1E-5 | 5E-8 | 3E-4 | 3E-3 |
|------------------|------|------|------|------|------|------|

Cesium-130<sup>2</sup>

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, all compounds         | 6E+4 | 2E+5 | 8E-5 | 3E-7  | —    | —    |
| Stom<br>(1E+5)           | —    | —    | —    | —     | 1E-3 | 1E-2 |
| Cesium-131               |      |      |      |       |      |      |
| D, all compounds         | 2E+4 | 3E+4 | 1E-5 | 4E-8  | 3E-4 | 3E-3 |
| Cesium-132               |      |      |      |       |      |      |
| D, all compounds         | 3E+3 | 4E+3 | 2E-6 | 6E-9  | 4E-5 | 4E-4 |
| Cesium-134m              |      |      |      |       |      |      |
| D, all compounds         | 1E+5 | 1E+5 | 6E-5 | 2E-7  | —    | —    |
| Stom<br>(1E+5)           | —    | —    | —    | —     | 2E-3 | 2E-2 |
| Cesium-134               |      |      |      |       |      |      |
| D, all compounds         | 7E+1 | 1E+2 | 4E-8 | 2E-10 | 9E-7 | 9E-6 |
| Cesium-135m <sup>2</sup> |      |      |      |       |      |      |
| D, all compounds         | 1E+5 | 2E+5 | 8E-5 | 3E-7  | 1E-3 | 1E-2 |
| Cesium-135               |      |      |      |       |      |      |
| D, all compounds         | 7E+2 | 1E+3 | 5E-7 | 2E-9  | 1E-5 | 1E-4 |
| Cesium-136               |      |      |      |       |      |      |
| D, all compounds         | 4E+2 | 7E+2 | 3E-7 | 9E-10 | 6E-6 | 6E-5 |
| Cesium-137               |      |      |      |       |      |      |
| D, all compounds         | 1E+2 | 2E+2 | 6E-8 | 2E-10 | 1E-6 | 1E-5 |
| Cesium-138 <sup>2</sup>  |      |      |      |       |      |      |

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+4 | 6E+4 | 2E-5 | 8E-8 | —    | —    |
| Stom<br>(3E+4)   | —    | —    | —    | —    | 4E-4 | 4E-3 |

**AN 56**Barium-126<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 6E+3 | 2E+4 | 6E-6 | 2E-8 | 8E-5 | 8E-4 |
|------------------|------|------|------|------|------|------|

## Barium-128

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 5E+2 | 2E+3 | 7E-7 | 2E-9 | 7E-6 | 7E-5 |
|------------------|------|------|------|------|------|------|

Barium-131m<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 4E+5 | 1E+6 | 6E-4 | 2E-6 | —    | —    |
| Stom<br>(5E+5)   | —    | —    | —    | —    | 7E-3 | 7E-2 |

## Barium-131

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 3E+3 | 8E+3 | 3E-6 | 1E-8 | 4E-5 | 4E-4 |
|------------------|------|------|------|------|------|------|

## Barium-133

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+3 | 9E+3 | 4E-6 | 1E-8 | —    | —    |
| LLI<br>(3E+3)    | —    | —    | —    | —    | 4E-5 | 4E-4 |

## Barium-133

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| D, all compounds | 2E+3 | 7E+2 | 3E-7 | 9E-10 | 2E-5 | 2E-4 |
|------------------|------|------|------|-------|------|------|

## Barium-135m

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 3E+3 | 1E+4 | 5E-6 | 2E-8 | 4E-5 | 4E-4 |
|------------------|------|------|------|------|------|------|

Barium-139<sup>2</sup>

|                                              |      |        |      |       |      |      |
|----------------------------------------------|------|--------|------|-------|------|------|
| D, all compounds                             | 1E+4 | 3E+4   | 1E-5 | 4E-8  | 2E-4 | 2E-3 |
| Barium-140                                   |      |        |      |       |      |      |
| D, all compounds                             | 5E+2 | 1E+3   | 6E-7 | 2E-9  | —    | —    |
| LLI<br>(6E+2)                                | —    | —      | —    | —     | 8E-6 | 8E-5 |
| Barium-141 <sup>2</sup>                      |      |        |      |       |      |      |
| D, all compounds                             | 2E+4 | 7E+4   | 3E-5 | 1E-7  | 3E-4 | 3E-3 |
| Barium-142 <sup>2</sup>                      |      |        |      |       |      |      |
| D, all compounds                             | 5E+4 | 1E+5   | 6E-5 | 2E-7  | 7E-4 | 7E-3 |
| <b>AN 57</b>                                 |      |        |      |       |      |      |
| Lanthanum-131 <sup>2</sup>                   |      |        |      |       |      |      |
| D, all compounds except<br>those given for W | 5E+4 | 1E+5   | 5E-5 | 2E-7  | 6E-4 | 6E-3 |
| W, oxides and hydroxides                     | —    | 2E+5   | 7E-5 | 2E-7  | —    | —    |
| Lanthanum-132                                |      |        |      |       |      |      |
| D, see <sup>131</sup> La                     | 3E+3 | 1E+4   | 4E-6 | 1E-8  | 4E-5 | 4E-4 |
| W, see <sup>131</sup> La                     | —    | 1E+4   | 5E-6 | 2E-8  | —    | —    |
| Lanthanum-135                                |      |        |      |       |      |      |
| D, see <sup>131</sup> La                     | 4E+4 | 1E+5   | 4E-5 | 1E-7  | 5E-4 | 5E-3 |
| W, see <sup>131</sup> La                     | —    | 9E+4   | 4E-5 | 1E-7  | —    | —    |
| Lanthanum-137                                |      |        |      |       |      |      |
| D, see <sup>131</sup> La                     | 1E+4 | 6E+1   | 3E-8 | —     | 2E-4 | 2E-3 |
|                                              |      | Liver  |      |       |      |      |
|                                              | —    | (7E+1) | —    | 1E-10 | —    | —    |

|                                              |                |                 |      |       |      |      |
|----------------------------------------------|----------------|-----------------|------|-------|------|------|
| W, see $^{131}\text{La}$                     | —              | 3E+2            | 1E-7 | —     | —    | —    |
|                                              | —              | Liver<br>(3E+2) | —    | 4E-10 | —    | —    |
| Lanthanum-138                                |                |                 |      |       |      |      |
| D, see $^{131}\text{La}$                     | 9E+2           | 4E+0            | 1E-9 | 5E-12 | 1E-5 | 1E-4 |
| W, see $^{131}\text{La}$                     | —              | 1E+1            | 6E-9 | 2E-11 | —    | —    |
| Lanthanum-140                                |                |                 |      |       |      |      |
| D, see $^{131}\text{La}$                     | 6E+2           | 1E+3            | 6E-7 | 2E-9  | 9E-6 | 9E-5 |
| W, see $^{131}\text{La}$                     | —              | 1E+3            | 5E-7 | 2E-9  | —    | —    |
| Lanthanum-141                                |                |                 |      |       |      |      |
| D, see $^{131}\text{La}$                     | 4E+3           | 9E+3            | 4E-6 | 1E-8  | 5E-5 | 5E-4 |
| W, see $^{131}\text{La}$                     | —              | 1E+4            | 5E-6 | 2E-8  | —    | —    |
| Lanthanum-142 <sup>2</sup>                   |                |                 |      |       |      |      |
| D, see $^{131}\text{La}$                     | 8E+3           | 2E+4            | 9E-6 | 3E-8  | 1E-4 | 1E-3 |
| W, see $^{131}\text{La}$                     | —              | 3E+4            | 1E-5 | 5E-8  | —    | —    |
| Lanthanum-143 <sup>2</sup>                   |                |                 |      |       |      |      |
| D, see $^{131}\text{La}$                     | 4E+4           | 1E+5            | 4E-5 | 1E-7  | —    | —    |
|                                              | Stom<br>(4E+4) | —               | —    | —     | 5E-4 | 5E-3 |
| W, see $^{131}\text{La}$                     | —              | 9E+4            | 4E-5 | 1E-7  | —    | —    |
| <b>AN 58</b>                                 |                |                 |      |       |      |      |
| Cerium-134                                   |                |                 |      |       |      |      |
| W, all compounds except<br>those given for Y | 5E+2           | 7E+2            | 3E-7 | 1E-9  | —    | —    |
|                                              | LLI<br>(6E+2)  | —               | —    | —     | 8E-6 | 8E-5 |

Y, oxides, hydroxides, and  
fluorides

— 7E+2 3E-7 9E-10 — —

Cerium-135

W, see  $^{134}\text{Ce}$  2E+3 4E+3 2E-6 5E-9 2E-5 2E-4

Y, see  $^{134}\text{Ce}$  — 4E+3 1E-6 5E-9 — —

Cerium-137m

W, see  $^{134}\text{Ce}$  2E+3 4E+3 2E-6 6E-9 — —

LLI

(2E+3) — — — 3E-5 3E-4

Y, see  $^{134}\text{Ce}$  — 4E+3 2E-6 5E-9 — —

Cerium-137

W, see  $^{134}\text{Ce}$  5E+4 1E+5 6E-5 2E-7 7E-4 7E-3

Y, see  $^{134}\text{Ce}$  — 1E+5 5E-5 2E-7 — —

Cerium-139

W, see  $^{134}\text{Ce}$  5E+3 8E+2 3E-7 1E-9 7E-5 7E-4

Y, see  $^{134}\text{Ce}$  — 7E+2 3E-7 9E-10 — —

Cerium-141

W, see  $^{134}\text{Ce}$  2E+3 7E+2 3E-7 1E-9 — —

LLI

(2E+3) — — — 3E-5 3E-4

Y, see  $^{134}\text{Ce}$  — 6E+2 2E-7 8E-10 — —

Cerium-143

W, see  $^{134}\text{Ce}$  1E+3 2E+3 8E-7 3E-9 — —

LLI

(1E+3) — — — 2E-5 2E-4

Y, see  $^{134}\text{Ce}$  — 2E+3 7E-7 2E-9 — —

## Cerium-144

|                          |               |      |      |       |      |      |
|--------------------------|---------------|------|------|-------|------|------|
| W, see $^{134}\text{Ce}$ | 2E+2          | 3E+1 | 1E-8 | 4E-11 | —    | —    |
|                          | LLI<br>(3E+2) | —    | —    | —     | 3E-6 | 3E-5 |
| Y, see $^{134}\text{Ce}$ | —             | 1E+1 | 6E-9 | 2E-11 | —    | —    |

**AN 59**Praseodymium-136<sup>2</sup>

|                                              |                |      |      |      |      |      |
|----------------------------------------------|----------------|------|------|------|------|------|
| W, all compounds except<br>those given for Y | 5E+4           | 2E+5 | 1E-4 | 3E-7 | —    | —    |
|                                              | Stom<br>(7E+4) | —    | —    | —    | 1E-3 | 1E-2 |

Y, oxides, hydroxides,  
carbides, and fluorides

— 2E+5 9E-5 3E-7 — —

Praseodymium-137<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 4E+4 | 2E+5 | 6E-5 | 2E-7 | 5E-4 | 5E-3 |
| Y, see $^{136}\text{Pr}$ | —    | 1E+5 | 6E-5 | 2E-7 | —    | —    |

## Praseodymium-138m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 1E+4 | 5E+4 | 2E-5 | 8E-8 | 1E-4 | 1E-3 |
| Y, see $^{136}\text{Pr}$ | —    | 4E+4 | 2E-5 | 6E-8 | —    | —    |

## Praseodymium-139

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 4E+4 | 1E+5 | 5E-5 | 2E-7 | 6E-4 | 6E-3 |
| Y, see $^{136}\text{Pr}$ | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |

Praseodymium-142m<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 8E+4 | 2E+5 | 7E-5 | 2E-7 | 1E-3 | 1E-2 |
| Y, see $^{136}\text{Pr}$ | —    | 1E+5 | 6E-5 | 2E-7 | —    | —    |

## Praseodymium-142

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 1E+3 | 2E+3 | 9E-7 | 3E-9 | 1E-5 | 1E-4 |
| Y, see $^{136}\text{Pr}$ | —    | 2E+3 | 8E-7 | 3E-9 | —    | —    |

## Praseodymium-143

|                          |               |      |      |       |      |      |
|--------------------------|---------------|------|------|-------|------|------|
| W, see $^{136}\text{Pr}$ | 9E+2          | 8E+2 | 3E-7 | 1E-9  | —    | —    |
|                          | LLI<br>(1E+3) | —    | —    | —     | 2E-5 | 2E-4 |
| Y, see $^{136}\text{Pr}$ | —             | 7E+2 | 3E-7 | 9E-10 | —    | —    |

Praseodymium-144<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 3E+4           | 1E+5 | 5E-5 | 2E-7 | —    | —    |
|                          | Stom<br>(4E+4) | —    | —    | —    | 6E-4 | 6E-3 |
| Y, see $^{136}\text{Pr}$ | —              | 1E+5 | 5E-5 | 2E-7 | —    | —    |

## Praseodymium-145

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 3E+3 | 9E+3 | 4E-6 | 1E-8 | 4E-5 | 4E-4 |
| Y, see $^{136}\text{Pr}$ | —    | 8E+3 | 3E-6 | 1E-8 | —    | —    |

Praseodymium-147<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see $^{136}\text{Pr}$ | 5E+4           | 2E+5 | 8E-5 | 3E-7 | —    | —    |
|                          | Stom<br>(8E+4) | —    | —    | —    | 1E-3 | 1E-2 |
| Y, see $^{136}\text{Pr}$ | —              | 2E+5 | 8E-5 | 3E-7 | —    | —    |

**AN 60**Neodymium-136<sup>2</sup>

|                                              |      |      |      |      |      |      |
|----------------------------------------------|------|------|------|------|------|------|
| W, all compounds except<br>those given for Y | 1E+4 | 6E+4 | 2E-5 | 8E-8 | 2E-4 | 2E-3 |
|----------------------------------------------|------|------|------|------|------|------|

Y, oxides, hydroxides,  
carbides, and fluorides

— 5E+4 2E-5 8E-8 — —

Neodymium-138

W, see  $^{136}\text{Nd}$  2E+3 6E+3 3E-6 9E-9 3E-5 3E-4

Y, see  $^{136}\text{Nd}$  — 5E+3 2E-6 7E-9 — —

Neodymium-139m

W, see  $^{136}\text{Nd}$  5E+3 2E+4 7E-6 2E-8 7E-5 7E-4

Y, see  $^{136}\text{Nd}$  — 1E+4 6E-6 2E-8 — —

Neodymium-139<sup>2</sup>

W, see  $^{136}\text{Nd}$  9E+4 3E+5 1E-4 5E-7 1E-3 1E-2

Y, see  $^{136}\text{Nd}$  — 3E+5 1E-4 4E-7 — —

Neodymium-141

W, see  $^{136}\text{Nd}$  2E+5 7E+5 3E-4 1E-6 2E-3 2E-2

Y, see  $^{136}\text{Nd}$  — 6E+5 3E-4 9E-7 — —

Neodymium-147

W, see  $^{136}\text{Nd}$  1E+3 9E+2 4E-7 1E-9 — —

LLI  
(1E+3) — — — 2E-5 2E-4

Y, see  $^{136}\text{Nd}$  — 8E+2 4E-7 1E-9 — —

Neodymium-149<sup>2</sup>

W, see  $^{136}\text{Nd}$  1E+4 3E+4 1E-5 4E-8 1E-4 1E-3

Y, see  $^{136}\text{Nd}$  — 2E+4 1E-5 3E-8 — —

Neodymium-151<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{136}\text{Nd}$ | 7E+4 | 2E+5 | 8E-5 | 3E-7 | 9E-4 | 9E-3 |
| Y, see $^{136}\text{Nd}$ | —    | 2E+5 | 8E-5 | 3E-7 | —    | —    |

**AN 61****Promethium-141<sup>2</sup>**

W, all compounds except  
those given for Y

|                |      |      |      |      |      |
|----------------|------|------|------|------|------|
| 5E+4           | 2E+5 | 8E-5 | 3E-7 | —    | —    |
| Stom<br>(6E+4) | —    | —    | —    | 8E-4 | 8E-3 |

Y, oxides, hydroxides,  
carbides, and fluorides

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 2E+5 | 7E-5 | 2E-7 | — | — |
|---|------|------|------|---|---|

**Promethium-143**

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| W, see $^{141}\text{Pm}$ | 5E+3 | 6E+2 | 2E-7 | 8E-10 | 7E-5 | 7E-4 |
| Y, see $^{141}\text{Pm}$ | —    | 7E+2 | 3E-7 | 1E-9  | —    | —    |

**Promethium-144**

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| W, see $^{141}\text{Pm}$ | 1E+3 | 1E+2 | 5E-8 | 2E-10 | 5E-5 | 2E-4 |
| Y, see $^{141}\text{Pm}$ | —    | 1E+2 | 5E-8 | 2E-10 | —    | —    |

**Promethium-145**

|                          |      |                |      |       |      |      |
|--------------------------|------|----------------|------|-------|------|------|
| W, see $^{141}\text{Pm}$ | 1E+4 | 2E+2           | 7E-8 | —     | 1E-4 | 1E-3 |
|                          | —    | Bone<br>(2E+2) | —    | 3E-10 | —    | —    |
| Y, see $^{141}\text{Pm}$ | —    | 2E+2           | 8E-8 | 3E-10 | —    | —    |

**Promethium-146**

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| W, see $^{141}\text{Pm}$ | 2E+3 | 5E+1 | 2E-8 | 7E-11 | 2E-5 | 2E-4 |
| Y, see $^{141}\text{Pm}$ | —    | 4E+1 | 2E-8 | 6E-11 | —    | —    |

**Promethium-147**

|                          |      |      |      |   |   |   |
|--------------------------|------|------|------|---|---|---|
| W, see $^{141}\text{Pm}$ | 4E+3 | 1E+2 | 5E-8 | — | — | — |
|--------------------------|------|------|------|---|---|---|

|                          | LLI<br>(5E+3) | Bone<br>(2E+2) | —    | 3E-10 | 7E-5 | 7E-4 |
|--------------------------|---------------|----------------|------|-------|------|------|
| Y, see $^{141}\text{Pm}$ | —             | 1E+2           | 6E-8 | 2E-10 | —    | —    |

## Promethium-148m

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| W, see $^{141}\text{Pm}$ | 7E+2 | 3E+2 | 1E-7 | 4E-10 | 1E-5 | 1E-4 |
| Y, see $^{141}\text{Pm}$ | —    | 3E+2 | 1E-7 | 5E-10 | —    | —    |

## Promethium-148

|                          |               |      |      |       |      |      |
|--------------------------|---------------|------|------|-------|------|------|
| W, see $^{141}\text{Pm}$ | 4E+2          | 5E+2 | 2E-7 | 8E-10 | —    | —    |
|                          | LLI<br>(5E+2) | —    | —    | —     | 7E-6 | 7E-5 |
| Y, see $^{141}\text{Pm}$ | —             | 5E+2 | 2E-7 | 7E-10 | —    | —    |

## Promethium-149

|                          |               |      |      |      |      |      |
|--------------------------|---------------|------|------|------|------|------|
| W, see $^{141}\text{Pm}$ | 1E+3          | 2E+3 | 8E-7 | 3E-9 | —    | —    |
|                          | LLI<br>(1E+3) | —    | —    | —    | 2E-5 | 2E-4 |
| Y, see $^{141}\text{Pm}$ | —             | 2E+3 | 8E-7 | 2E-9 | —    | —    |

## Promethium-150

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{141}\text{Pm}$ | 5E+3 | 2E+4 | 8E-6 | 3E-8 | 7E-5 | 7E-4 |
| Y, see $^{141}\text{Pm}$ | —    | 2E+4 | 7E-6 | 2E-8 | —    | —    |

## Promethium-151

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{141}\text{Pm}$ | 2E+3 | 4E+3 | 1E-6 | 5E-9 | 2E-5 | 2E-4 |
| Y, see $^{141}\text{Pm}$ | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |

**AN 62**Samarium-141m<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 3E+4 | 1E+5 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
|------------------|------|------|------|------|------|------|

Samarium-141<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 5E+4 | 2E+5 | 8E-5 | 2E-7 | —    | —    |
| Stom<br>(6E+4)   | —    | —    | —    | —    | 8E-4 | 8E-3 |

Samarium-142<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 8E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
|------------------|------|------|------|------|------|------|

## Samarium-145

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 6E+3 | 5E+2 | 2E-7 | 7E-10 | 8E-5 | 8E-4 |
|------------------|------|------|------|-------|------|------|

## Samarium-146

|                  |                |      |       |       |      |      |
|------------------|----------------|------|-------|-------|------|------|
| W, all compounds | 1E+1           | 4E-2 | 1E-11 | —     | —    | —    |
| Bone<br>(3E+1)   | Bone<br>(6E-2) | —    | —     | 9E-14 | 3E-7 | 3E-6 |

## Samarium-147

|                  |                |      |       |       |      |      |
|------------------|----------------|------|-------|-------|------|------|
| W, all compounds | 2E+1           | 4E-2 | 2E-11 | —     | —    | —    |
| Bone<br>(3E+1)   | Bone<br>(7E-2) | —    | —     | 1E-13 | 4E-7 | 4E-6 |

## Samarium-151

|                  |                |      |      |       |      |      |
|------------------|----------------|------|------|-------|------|------|
| W, all compounds | 1E+4           | 1E+2 | 4E-8 | —     | —    | —    |
| LLI<br>(1E+4)    | Bone<br>(2E+2) | —    | —    | 2E-10 | 2E-4 | 2E-3 |

## Samarium-153

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+3 | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| LLI<br>(2E+3)    | —    | —    | —    | —    | 3E-5 | 3E-4 |

Samarium-155<sup>2</sup>

|                        |      |      |      |       |      |      |
|------------------------|------|------|------|-------|------|------|
| W, all compounds       | 6E+4 | 2E+5 | 9E-5 | 3E-7  | —    | —    |
| Stom<br>(8E+4)         | —    | —    | —    | —     | 1E-3 | 1E-2 |
| Samarium-156           |      |      |      |       |      |      |
| W, all compounds       | 5E+3 | 9E+3 | 4E-6 | 1E-8  | 7E-5 | 7E-4 |
| <b>AN 63</b>           |      |      |      |       |      |      |
| Europium-145           |      |      |      |       |      |      |
| W, all compounds       | 2E+3 | 2E+3 | 8E-7 | 3E-9  | 2E-5 | 2E-4 |
| Europium-146           |      |      |      |       |      |      |
| W, all compounds       | 1E+3 | 1E+3 | 5E-7 | 2E-9  | 1E-5 | 1E-4 |
| Europium-147           |      |      |      |       |      |      |
| W, all compounds       | 3E+3 | 2E+3 | 7E-7 | 2E-9  | 4E-5 | 4E-4 |
| Europium-148           |      |      |      |       |      |      |
| W, all compounds       | 1E+3 | 4E+2 | 1E-7 | 5E-10 | 1E-5 | 1E-4 |
| Europium-149           |      |      |      |       |      |      |
| W, all compounds       | 1E+4 | 3E+3 | 1E-6 | 4E-9  | 2E-4 | 2E-3 |
| Europium-150 (12.62 h) |      |      |      |       |      |      |
| W, all compounds       | 3E+3 | 8E+3 | 4E-6 | 1E-8  | 4E-5 | 4E-4 |
| Europium-150 (34.2 y)  |      |      |      |       |      |      |
| W, all compounds       | 8E+2 | 2E+1 | 8E-9 | 3E-11 | 1E-5 | 1E-4 |
| Europium-152m          |      |      |      |       |      |      |
| W, all compounds       | 3E+3 | 6E+3 | 3E-6 | 9E-9  | 4E-5 | 4E-4 |

## Europium-152

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 8E+2 | 2E+1 | 1E-8 | 3E-11 | 1E-5 | 1E-4 |
|------------------|------|------|------|-------|------|------|

## Europium-154

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 5E+2 | 2E+1 | 8E-9 | 3E-11 | 7E-6 | 7E-5 |
|------------------|------|------|------|-------|------|------|

## Europium-155

|                  |      |                |      |       |      |      |
|------------------|------|----------------|------|-------|------|------|
| W, all compounds | 4E+3 | 9E+1           | 4E-8 | —     | 5E-5 | 5E-4 |
|                  | —    | Bone<br>(1E+2) | —    | 2E-10 | —    | —    |

## Europium-156

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 6E+2 | 5E+2 | 2E-7 | 6E-10 | 8E-6 | 8E-5 |
|------------------|------|------|------|-------|------|------|

## Europium-157

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+3 | 5E+3 | 2E-6 | 7E-9 | 3E-5 | 3E-4 |
|------------------|------|------|------|------|------|------|

Europium-158<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+4 | 6E+4 | 2E-5 | 8E-8 | 3E-4 | 3E-3 |
|------------------|------|------|------|------|------|------|

**AN 64**Gadolinium-145<sup>2</sup>

D, all compounds except  
those given for W

|                |      |      |      |      |      |
|----------------|------|------|------|------|------|
| 5E+4           | 2E+5 | 6E-5 | 2E-7 | —    | —    |
| Stom<br>(5E+4) | —    | —    | —    | 6E-4 | 6E-3 |

W, oxides, hydroxides, and  
fluorides

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 2E+5 | 7E-5 | 2E-7 | — | — |
|---|------|------|------|---|---|

## Gadolinium-146

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see <sup>145</sup> Gd | 1E+3 | 1E+2 | 5E-8 | 2E-10 | 2E-5 | 2E-4 |
|--------------------------|------|------|------|-------|------|------|

|                          |   |      |      |       |   |   |
|--------------------------|---|------|------|-------|---|---|
| W, see $^{145}\text{Gd}$ | — | 3E+2 | 1E-7 | 4E-10 | — | — |
|--------------------------|---|------|------|-------|---|---|

## Gadolinium-147

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{145}\text{Gd}$ | 2E+3 | 4E+3 | 2E-6 | 6E-9 | 3E-5 | 3E-4 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{145}\text{Gd}$ | — | 4E+3 | 1E-6 | 5E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

## Gadolinium-148

|                          |      |      |       |   |   |   |
|--------------------------|------|------|-------|---|---|---|
| D, see $^{145}\text{Gd}$ | 1E+1 | 8E-3 | 3E-12 | — | — | — |
|--------------------------|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(2E+1) | Bone<br>(2E-2) | — | 2E-14 | 3E-7 | 3E-6 |
|----------------|----------------|---|-------|------|------|

|                          |   |      |       |   |   |   |
|--------------------------|---|------|-------|---|---|---|
| W, see $^{145}\text{Gd}$ | — | 3E-2 | 1E-11 | — | — | — |
|--------------------------|---|------|-------|---|---|---|

|   |                |   |       |   |   |
|---|----------------|---|-------|---|---|
| — | Bone<br>(6E-2) | — | 8E-14 | — | — |
|---|----------------|---|-------|---|---|

## Gadolinium-149

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{145}\text{Gd}$ | 3E+3 | 2E+3 | 9E-7 | 3E-9 | 4E-5 | 4E-4 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{145}\text{Gd}$ | — | 2E+3 | 1E-6 | 3E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

## Gadolinium-151

|                          |      |      |      |   |      |      |
|--------------------------|------|------|------|---|------|------|
| D, see $^{145}\text{Gd}$ | 6E+3 | 4E+2 | 2E-7 | — | 9E-5 | 9E-4 |
|--------------------------|------|------|------|---|------|------|

|   |                |   |       |   |   |
|---|----------------|---|-------|---|---|
| — | Bone<br>(6E+2) | — | 9E-10 | — | — |
|---|----------------|---|-------|---|---|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| W, see $^{145}\text{Gd}$ | — | 1E+3 | 5E-7 | 2E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

## Gadolinium-152

|                          |      |      |       |   |   |   |
|--------------------------|------|------|-------|---|---|---|
| D, see $^{145}\text{Gd}$ | 2E+1 | 1E-2 | 4E-12 | — | — | — |
|--------------------------|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(3E+1) | Bone<br>(2E-2) | — | 3E-14 | 4E-7 | 4E-6 |
|----------------|----------------|---|-------|------|------|

|                          |   |      |       |   |   |   |
|--------------------------|---|------|-------|---|---|---|
| W, see $^{145}\text{Gd}$ | — | 4E-2 | 2E-11 | — | — | — |
|--------------------------|---|------|-------|---|---|---|

|   |                |   |       |   |   |
|---|----------------|---|-------|---|---|
| — | Bone<br>(8E-2) | — | 1E-13 | — | — |
|---|----------------|---|-------|---|---|

## Gadolinium-153

|                          |      |                |      |       |      |      |
|--------------------------|------|----------------|------|-------|------|------|
| D, see $^{145}\text{Gd}$ | 5E+3 | 1E+2           | 6E-8 | —     | 6E-5 | 6E-4 |
|                          | —    | Bone<br>(2E+2) | —    | 3E-10 | —    | —    |
| W, see $^{145}\text{Gd}$ | —    | 6E+2           | 2E-7 | 8E-10 | —    | —    |
| Gadolinium-159           |      |                |      |       |      |      |
| D, see $^{145}\text{Gd}$ | 3E+3 | 8E+3           | 3E-6 | 1E-8  | 4E-5 | 4E-4 |
| W, see $^{145}\text{Gd}$ | —    | 6E+3           | 2E-6 | 8E-9  | —    | —    |
| <b>AN 65</b>             |      |                |      |       |      |      |
| Terbium-147 <sup>2</sup> |      |                |      |       |      |      |
| W, all compounds         | 9E+3 | 3E+4           | 1E-5 | 5E-8  | 1E-4 | 1E-3 |
| Terbium-149              |      |                |      |       |      |      |
| W, all compounds         | 5E+3 | 7E+2           | 3E-7 | 1E-9  | 7E-5 | 7E-4 |
| Terbium-150              |      |                |      |       |      |      |
| W, all compounds         | 5E+3 | 2E+4           | 9E-6 | 3E-8  | 7E-5 | 7E-4 |
| Terbium-151              |      |                |      |       |      |      |
| W, all compounds         | 4E+3 | 9E+3           | 4E-6 | 1E-8  | 5E-5 | 5E-4 |
| Terbium-153              |      |                |      |       |      |      |
| W, all compounds         | 5E+3 | 7E+3           | 3E-6 | 1E-8  | 7E-5 | 7E-4 |
| Terbium-154              |      |                |      |       |      |      |
| W, all compounds         | 2E+3 | 4E+3           | 2E-6 | 6E-9  | 2E-5 | 2E-4 |
| Terbium-155              |      |                |      |       |      |      |
| W, all compounds         | 6E+3 | 8E+3           | 3E-6 | 1E-8  | 8E-5 | 8E-4 |

## Terbium-156m (5.0 h)

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

## Terbium-156m (24.4 h)

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 7E+3 | 8E+3 | 3E-6 | 1E-8 | 1E-4 | 1E-3 |
|------------------|------|------|------|------|------|------|

## Terbium-156

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+3 | 1E+3 | 6E-7 | 2E-9 | 1E-5 | 1E-4 |
|------------------|------|------|------|------|------|------|

## Terbium-157

|                  |               |                |      |       |      |      |
|------------------|---------------|----------------|------|-------|------|------|
| W, all compounds | 5E+4          | 3E+2           | 1E-7 | —     | —    | —    |
|                  | LLI<br>(5E+4) | Bone<br>(6E+2) | —    | 8E-10 | 7E-4 | 7E-3 |

## Terbium-158

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 1E+3 | 2E+1 | 8E-9 | 3E-11 | 2E-5 | 2E-4 |
|------------------|------|------|------|-------|------|------|

## Terbium-160

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 8E+2 | 2E+2 | 9E-8 | 3E-10 | 1E-5 | 1E-4 |
|------------------|------|------|------|-------|------|------|

## Terbium-161

|                  |               |      |      |      |      |      |
|------------------|---------------|------|------|------|------|------|
| W, all compounds | 2E+3          | 2E+3 | 7E-7 | 2E-9 | —    | —    |
|                  | LLI<br>(2E+3) | —    | —    | —    | 3E-5 | 3E-4 |

**AN 66**

## Dysprosium-155

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 9E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
|------------------|------|------|------|------|------|------|

## Dysprosium-157

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
|------------------|------|------|------|------|------|------|

## Dysprosium-159

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+4 | 2E+3 | 1E-6 | 3E-9 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

## Dysprosium-165

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+4 | 5E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

## Dysprosium-166

|                  |        |      |      |      |      |      |
|------------------|--------|------|------|------|------|------|
| W, all compounds | 6E+2   | 7E+2 | 3E-7 | 1E-9 | —    | —    |
| LLI              | (8E+2) | —    | —    | —    | 1E-5 | 1E-4 |

**AN 67**Holmium-155<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 4E+4 | 2E+5 | 6E-5 | 2E-7 | 6E-4 | 6E-3 |
|------------------|------|------|------|------|------|------|

Holmium-157<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 3E+5 | 1E+6 | 6E-4 | 2E-6 | 4E-3 | 4E-2 |
|------------------|------|------|------|------|------|------|

Holmium-159<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+5 | 1E+6 | 4E-4 | 1E-6 | 3E-3 | 3E-2 |
|------------------|------|------|------|------|------|------|

## Holmium-161

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 1E+5 | 4E+5 | 2E-4 | 6E-7 | 1E-3 | 1E-2 |
|------------------|------|------|------|------|------|------|

Holmium-162m<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 5E+4 | 3E+5 | 1E-4 | 4E-7 | 7E-4 | 7E-3 |
|------------------|------|------|------|------|------|------|

Holmium-162<sup>2</sup>

|                  |      |      |      |      |   |   |
|------------------|------|------|------|------|---|---|
| W, all compounds | 5E+5 | 2E+6 | 1E-3 | 3E-6 | — | — |
|------------------|------|------|------|------|---|---|

|                           |                |      |      |       |      |      |
|---------------------------|----------------|------|------|-------|------|------|
|                           | Stom<br>(8E+5) | —    | —    | —     | 1E-2 | 1E-1 |
| Holmium-164m <sup>2</sup> |                |      |      |       |      |      |
| W, all compounds          | 1E+5           | 3E+5 | 1E-4 | 4E-7  | 1E-3 | 1E-2 |
| Holmium-164 <sup>2</sup>  |                |      |      |       |      |      |
| W, all compounds          | 2E+5           | 6E+5 | 3E-4 | 9E-7  | —    | —    |
|                           | Stom<br>(2E+5) | —    | —    | —     | 3E-3 | 3E-2 |
| Holmium-166m              |                |      |      |       |      |      |
| W, all compounds          | 6E+2           | 7E+0 | 3E-9 | 9E-12 | 9E-6 | 9E-5 |
| Holmium-166               |                |      |      |       |      |      |
| W, all compounds          | 9E+2           | 2E+3 | 7E-7 | 2E-9  | —    | —    |
|                           | LLI<br>(9E+2)  | —    | —    | —     | 1E-5 | 1E-4 |
| Holmium-167               |                |      |      |       |      |      |
| W, all compounds          | 2E+4           | 6E+4 | 2E-5 | 8E-8  | 2E-4 | 2E-3 |
| <b>AN 68</b>              |                |      |      |       |      |      |
| Erbium-161                |                |      |      |       |      |      |
| W, all compounds          | 2E+4           | 6E+4 | 3E-5 | 9E-8  | 2E-4 | 2E-3 |
| Erbium-165                |                |      |      |       |      |      |
| W, all compounds          | 6E+4           | 2E+5 | 8E-5 | 3E-7  | 9E-4 | 9E-3 |
| Erbium-169                |                |      |      |       |      |      |
| W, all compounds          | 3E+3           | 3E+3 | 1E-6 | 4E-9  | —    | —    |

|                          |                |      |      |       |      |      |
|--------------------------|----------------|------|------|-------|------|------|
|                          | LLI<br>(4E+3)  | —    | —    | —     | 5E-5 | 5E-4 |
| Erbium-171               |                |      |      |       |      |      |
| W, all compounds         | 4E+3           | 1E+4 | 4E-6 | 1E-8  | 5E-5 | 5E-4 |
| Erbium-172               |                |      |      |       |      |      |
| W, all compounds         | 1E+3           | 1E+3 | 6E-7 | 2E-9  | —    | —    |
|                          | LLI (E+3)      | —    | —    | —     | 2E-5 | 2E-4 |
| <b>AN 69</b>             |                |      |      |       |      |      |
| Thulium-162 <sup>2</sup> |                |      |      |       |      |      |
| W, all compounds         | 7E+4           | 3E+5 | 1E-4 | 4E-7  | —    | —    |
|                          | Stom<br>(7E+4) | —    | —    | —     | 1E-3 | 1E-2 |
| Thulium-166              |                |      |      |       |      |      |
| W, all compounds         | 4E+3           | 1E+4 | 6E-6 | 2E-8  | 6E-5 | 6E-4 |
| Thulium-167              |                |      |      |       |      |      |
| W, all compounds         | 2E+3           | 2E+3 | 8E-7 | 3E-9  | —    | —    |
|                          | LLI<br>(2E+3)  | —    | —    | —     | 3E-5 | 3E-4 |
| Thulium-170              |                |      |      |       |      |      |
| W, all compounds         | 8E+2           | 2E+2 | 9E-8 | 3E-10 | —    | —    |
|                          | LLI<br>(1E+3)  | —    | —    | —     | 1E-5 | 1E-4 |
| Thulium-171              |                |      |      |       |      |      |
| W, all compounds         | 1E+4           | 3E+2 | 1E-7 | —     | —    | —    |

|                                              |                |                |      |       |      |      |
|----------------------------------------------|----------------|----------------|------|-------|------|------|
|                                              | LLI<br>(1E+4)  | Bone<br>(6E+2) | —    | 8E-10 | 2E-4 | 2E-3 |
| Thulium-172                                  |                |                |      |       |      |      |
| W, all compounds                             | 7E+2           | 1E+3           | 5E-7 | 2E-9  | —    | —    |
|                                              | LLI<br>(8E+2)  | —              | —    | —     | 1E-5 | 1E-4 |
| Thulium-173                                  |                |                |      |       |      |      |
| W, all compounds                             | 4E+3           | 1E+4           | 5E-6 | 2E-8  | 6E-5 | 6E-4 |
| Thulium-175 <sup>2</sup>                     |                |                |      |       |      |      |
| W, all compounds                             | 7E+4           | 3E+5           | 1E-4 | 4E-7  | —    | —    |
|                                              | Stom<br>(9E+4) | —              | —    | —     | 1E-3 | 1E-2 |
| <b>AN 70</b>                                 |                |                |      |       |      |      |
| Ytterbium-162 <sup>2</sup>                   |                |                |      |       |      |      |
| W, all compounds except<br>those given for Y | 7E+4           | 3E+5           | 1E-4 | 4E-7  | 1E-3 | 1E-2 |
| Y, oxides, hydroxides, and<br>fluorides      | —              | 3E+5           | 1E-4 | 4E-7  | —    | —    |
| Ytterbium-166                                |                |                |      |       |      |      |
| W, see <sup>162</sup> Yb                     | 1E+3           | 2E+3           | 8E-7 | 3E-9  | 2E-5 | 2E-4 |
| Y, see <sup>162</sup> Yb                     | —              | 2E+3           | 8E-7 | 3E-9  | —    | —    |
| Ytterbium-167 <sup>2</sup>                   |                |                |      |       |      |      |
| W, see <sup>162</sup> Yb                     | 3E+5           | 8E+5           | 3E-4 | 1E-6  | 4E-3 | 4E-2 |
| Y, see <sup>162</sup> Yb                     | —              | 7E+5           | 3E-4 | 1E-6  | —    | —    |
| Ytterbium-169                                |                |                |      |       |      |      |

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{162}\text{Yb}$ | 2E+3 | 8E+2 | 4E-7 | 1E-9 | 2E-5 | 2E-4 |
| Y, see $^{162}\text{Yb}$ | —    | 7E+2 | 3E-7 | 1E-9 | —    | —    |

## Ytterbium-175

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{162}\text{Yb}$ | 3E+3 | 4E+3 | 1E-6 | 5E-9 | —    | —    |
| LLI<br>(3E+3)            | —    | —    | —    | —    | 4E-5 | 4E-4 |
| Y, see $^{162}\text{Yb}$ | —    | 3E+3 | 1E-6 | 5E-9 | —    | —    |

Ytterbium-177<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{162}\text{Yb}$ | 2E+4 | 5E+4 | 2E-5 | 7E-8 | 2E-4 | 2E-3 |
| Y, see $^{162}\text{Yb}$ | —    | 5E+4 | 2E-5 | 6E-8 | —    | —    |

Ytterbium-178<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{162}\text{Yb}$ | 1E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| Y, see $^{162}\text{Yb}$ | —    | 4E+4 | 2E-5 | 5E-8 | —    | —    |

## AN 71

## Lutetium-169

|                                              |      |      |      |      |      |      |
|----------------------------------------------|------|------|------|------|------|------|
| W, all compounds except<br>those given for Y | 3E+3 | 4E+3 | 2E-6 | 6E-9 | 3E-5 | 3E-4 |
| Y, oxides, hydroxides, and<br>fluorides      | —    | 4E+3 | 2E-6 | 6E-9 | —    | —    |

## Lutetium-170

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 1E+3 | 2E+3 | 9E-7 | 3E-9 | 2E-5 | 2E-4 |
| Y, see $^{169}\text{Lu}$ | —    | 2E+3 | 8E-7 | 3E-9 | —    | —    |

## Lutetium-171

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 2E+3 | 2E+3 | 8E-7 | 3E-9 | 3E-5 | 3E-4 |
| Y, see $^{169}\text{Lu}$ | —    | 2E+3 | 8E-7 | 3E-9 | —    | —    |

## Lutetium-172

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 1E+3 | 1E+3 | 5E-7 | 2E-9 | 1E-5 | 1E-4 |
| Y, see $^{169}\text{Lu}$ | —    | 1E+3 | 5E-7 | 2E-9 | —    | —    |

## Lutetium-173

|                          |      |        |      |       |      |      |
|--------------------------|------|--------|------|-------|------|------|
| W, see $^{169}\text{Lu}$ | 5E+3 | 3E+2   | 1E-7 | —     | 7E-5 | 7E-4 |
|                          |      | Bone   |      |       |      |      |
|                          | —    | (5E+2) | —    | 6E-10 | —    | —    |
| Y, see $^{169}\text{Lu}$ | —    | 3E+2   | 1E-7 | 4E-10 | —    | —    |

## Lutetium-174m

|                          |        |        |      |       |      |      |
|--------------------------|--------|--------|------|-------|------|------|
| W, see $^{169}\text{Lu}$ | 2E+3   | 2E+2   | 1E-7 | —     | —    | —    |
|                          | LLI    | Bone   |      |       |      |      |
|                          | (3E+3) | (3E+3) | —    | 5E-10 | 4E-5 | 4E-4 |
| Y, see $^{169}\text{Lu}$ | —      | 2E+2   | 9E-8 | 3E-10 | —    | —    |

## Lutetium-174

|                          |      |        |      |       |      |      |
|--------------------------|------|--------|------|-------|------|------|
| W, see $^{169}\text{Lu}$ | 5E+3 | 1E+2   | 5E-8 | —     | 7E-5 | 7E-4 |
|                          |      | Bone   |      |       |      |      |
|                          | —    | (2E+2) | —    | 3E-10 | —    | —    |
| Y, see $^{176}\text{Lu}$ | —    | 2E+2   | 6E-8 | 2E-10 | —    | —    |

## Lutetium-176m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 8E+3 | 3E+4 | 1E-5 | 3E-8 | 1E-4 | 1E-3 |
| Y, see $^{169}\text{Lu}$ | —    | 2E+4 | 9E-6 | 3E-8 | —    | —    |

## Lutetium-176

|                          |      |        |      |       |      |      |
|--------------------------|------|--------|------|-------|------|------|
| W, see $^{169}\text{Lu}$ | 7E+2 | 5E+0   | 2E-9 | —     | 1E-5 | 1E-4 |
|                          |      | Bone   |      |       |      |      |
|                          | —    | (1E+1) | —    | 2E-11 | —    | —    |
| Y, see $^{169}\text{Lu}$ | —    | 8E+0   | 3E-9 | 1E-11 | —    | —    |

## Lutetium-177m

|                          |      |                |      |       |      |      |
|--------------------------|------|----------------|------|-------|------|------|
| W, see $^{169}\text{Lu}$ | 7E+2 | 1E+2           | 5E-8 | —     | 1E-5 | 1E-4 |
|                          |      | Bone<br>(1E+2) | —    | 2E-10 | —    | —    |
| Y, see $^{169}\text{Lu}$ | —    | 8E+1           | 3E-8 | 1E-10 | —    | —    |

## Lutetium-177

|                          |               |      |      |      |      |      |
|--------------------------|---------------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 2E+3          | 2E+3 | 9E-7 | 3E-9 | —    | —    |
|                          | LLI<br>(3E+3) | —    | —    | —    | 4E-5 | 4E-4 |
| Y, see $^{169}\text{Lu}$ | —             | 2E+3 | 9E-7 | 3E-9 | —    | —    |

Lutetium-178m<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 5E+4           | 2E+5 | 8E-5 | 3E-7 | —    | —    |
|                          | Stom<br>(6E+4) | —    | —    | —    | 8E-4 | 8E-3 |
| Y, see $^{169}\text{Lu}$ | —              | 2E+5 | 7E-5 | 2E-7 | —    | —    |

Lutetium-178<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 4E+4           | 1E+5 | 5E-5 | 2E-7 | —    | —    |
|                          | Stom<br>(4E+4) | —    | —    | —    | 6E-4 | 6E-3 |
| Y, see $^{169}\text{Lu}$ | —              | 1E+5 | 5E-5 | 2E-7 | —    | —    |

## Lutetium-179

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{169}\text{Lu}$ | 6E+3 | 2E+4 | 8E-6 | 3E-8 | 9E-5 | 9E-4 |
| Y, see $^{169}\text{Lu}$ | —    | 2E+4 | 6E-6 | 3E-8 | —    | —    |

## AN 72

## Hafnium-170

D, all compounds except  
those given for W

3E+3      6E+3      2E-6      8E-9      4E-5      4E-4

W, oxides, hydroxides,  
carbides, and nitrates

—      5E+3      2E-6      6E-9      —      —

#### Hafnium-172

D, see  $^{170}\text{Hf}$

1E+3      9E+0      4E-9      —      2E-5      2E-4

Bone

—      (2E+1)      —      3E-11      —      —

W, see  $^{170}\text{Hf}$

—      4E+1      2E-8      —      —      —

Bone

—      (6E+1)      —      8E-11      —      —

#### Hafnium-173

D, see  $^{170}\text{Hf}$

5E+3      1E+4      5E-6      2E-8      7E-5      7E-4

W, see  $^{170}\text{Hf}$

—      1E+4      5E-6      2E-8      —      —

#### Hafnium-175

D, see  $^{170}\text{Hf}$

3E+3      9E+2      4E-7      —      4E-5      4E-4

Bone

—      (1E+3)      —      1E-9      —      —

W, see  $^{170}\text{Hf}$

—      1E+3      5E-7      2E-9      —      —

#### Hafnium-177m<sup>2</sup>

D, see  $^{170}\text{Hf}$

2E+4      6E+4      2E-5      8E-8      3E-4      3E-3

W, see  $^{170}\text{Hf}$

—      9E+4      4E-5      1E-7      —      —

#### Hafnium-178m

D, see  $^{170}\text{Hf}$

3E+2      1E+0      5E-10      —      3E-6      3E-5

Bone

—      (2E+0)      —      3E-12      —      —

W, see  $^{170}\text{Hf}$

—      5E+0      2E-9      —      —      —

|                           |                |                |       |       |      |      |
|---------------------------|----------------|----------------|-------|-------|------|------|
|                           | —              | Bone<br>(9E+0) | —     | 1E-11 | —    | —    |
| Hafnium-179m              |                |                |       |       |      |      |
| D, see $^{170}\text{Hf}$  | 1E+3           | 3E+2           | 1E-7  | —     | 1E-5 | 1E-4 |
|                           | —              | Bone<br>(6E+2) | —     | 8E-10 | —    | —    |
| W, see $^{170}\text{Hf}$  | —              | 6E+2           | 3E-7  | 8E-10 | —    | —    |
| Hafnium-180m              |                |                |       |       |      |      |
| D, see $^{170}\text{Hf}$  | 7E+3           | 2E+4           | 9E-6  | 3E-8  | 1E-4 | 1E-3 |
| W, see $^{170}\text{Hf}$  | —              | 3E+4           | 1E-5  | 4E-8  | —    | —    |
| Hafnium-181               |                |                |       |       |      |      |
| D, see $^{170}\text{Hf}$  | 1E+3           | 2E+2           | 7E-8  | —     | 2E-5 | 2E-4 |
|                           | —              | Bone<br>(4E+2) | —     | 6E-10 | —    | —    |
| W, see $^{170}\text{Hf}$  | —              | 4E+2           | 2E-7  | 6E-10 | —    | —    |
| Hafnium-182m <sup>2</sup> |                |                |       |       |      |      |
| D, see $^{170}\text{Hf}$  | 4E+4           | 9E+4           | 4E-5  | 1E-7  | 5E-4 | 5E-3 |
| W, see $^{170}\text{Hf}$  | —              | 1E+5           | 6E-5  | 2E-7  | —    | —    |
| Hafnium-182               |                |                |       |       |      |      |
| D, see $^{170}\text{Hf}$  | 2E+2           | 8E-1           | 3E-10 | —     | —    | —    |
|                           | Bone<br>(4E+2) | Bone<br>(2E+0) | —     | 2E-12 | 5E-6 | 5E-5 |
| W, see $^{170}\text{Hf}$  | —              | 3E+0           | 1E-9  | —     | —    | —    |
|                           | —              | Bone<br>(7E+0) | —     | 1E-11 | —    | —    |
| Hafnium-183 <sup>2</sup>  |                |                |       |       |      |      |

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{170}\text{Hf}$ | 2E+4 | 5E+4 | 2E-5 | 6E-8 | 3E-4 | 3E-3 |
| W, see $^{170}\text{Hf}$ | —    | 6E+4 | 2E-5 | 8E-8 | —    | —    |

## Hafnium-184

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{170}\text{Hf}$ | 2E+3 | 8E+3 | 3E-6 | 1E-8 | 3E-5 | 3E-4 |
| W, see $^{170}\text{Hf}$ | —    | 6E+3 | 3E-6 | 9E-9 | —    | —    |

## AN 73

Tantalum-172<sup>2</sup>

|                                           |      |      |      |      |      |      |
|-------------------------------------------|------|------|------|------|------|------|
| W, all compounds except those given for Y | 4E+4 | 1E+5 | 5E-5 | 2E-7 | 5E-4 | 5E-3 |
|-------------------------------------------|------|------|------|------|------|------|

Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides

|   |      |      |      |   |   |
|---|------|------|------|---|---|
| — | 1E+5 | 4E-5 | 1E-7 | — | — |
|---|------|------|------|---|---|

## Tantalum-173

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 7E+3 | 2E+4 | 8E-6 | 3E-8 | 9E-5 | 9E-4 |
| Y, see $^{172}\text{Ta}$ | —    | 2E+4 | 7E-6 | 2E-8 | —    | —    |

Tantalum-174<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 3E+4 | 1E+5 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
| Y, see $^{172}\text{Ta}$ | —    | 9E+4 | 4E-5 | 1E-7 | —    | —    |

## Tantalum-175

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 6E+3 | 2E+4 | 7E-6 | 2E-8 | 8E-5 | 8E-4 |
| Y, see $^{172}\text{Ta}$ | —    | 1E+4 | 6E-6 | 2E-8 | —    | —    |

## Tantalum-176

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 4E+3 | 1E+4 | 5E-6 | 2E-8 | 5E-5 | 5E-4 |
| Y, see $^{172}\text{Ta}$ | —    | 1E+4 | 5E-6 | 2E-8 | —    | —    |

## Tantalum-177

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 1E+4 | 2E+4 | 8E-6 | 3E-8 | 2E-4 | 2E-3 |
| Y, see $^{172}\text{Ta}$ | —    | 2E+4 | 7E-6 | 2E-8 | —    | —    |

## Tantalum-178

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 2E+4 | 9E+4 | 4E-5 | 1E-7 | 2E-4 | 2E-3 |
| Y, see $^{172}\text{Ta}$ | —    | 7E+4 | 3E-5 | 1E-7 | —    | —    |

## Tantalum-179

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 2E+4 | 5E+3 | 2E-6 | 8E-9 | 3E-4 | 3E-3 |
| Y, see $^{172}\text{Ta}$ | —    | 9E+2 | 4E-7 | 1E-9 | —    | —    |

## Tantalum-180m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 2E+4 | 7E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| Y, see $^{172}\text{Ta}$ | —    | 6E+4 | 2E-5 | 8E-8 | —    | —    |

## Tantalum-180

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| W, see $^{172}\text{Ta}$ | 1E+3 | 4E+2 | 2E-7 | 6E-10 | 2E-5 | 2E-4 |
| Y, see $^{172}\text{Ta}$ | —    | 2E+1 | 1E-8 | 3E-11 | —    | —    |

Tantalum-182m<sup>2</sup>

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
| W, see $^{172}\text{Ta}$ | 2E+5           | 5E+5 | 2E-4 | 8E-7 | —    | —    |
|                          | Stom<br>(2E+5) | —    | —    | —    | 3E-3 | 3E-2 |
| Y, see $^{172}\text{Ta}$ | —              | 4E+5 | 2E-4 | 6E-7 | —    | —    |

## Tantalum-182

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| W, see $^{172}\text{Ta}$ | 8E+2 | 3E+2 | 1E-7 | 5E-10 | 1E-5 | 1E-4 |
| Y, see $^{172}\text{Ta}$ | —    | 1E+2 | 6E-8 | 2E-10 | —    | —    |

## Tantalum-183

|                          |      |      |      |      |   |   |
|--------------------------|------|------|------|------|---|---|
| W, see $^{172}\text{Ta}$ | 9E+2 | 1E+3 | 5E-7 | 2E-9 | — | — |
|--------------------------|------|------|------|------|---|---|

|                           |                |      |      |      |      |      |
|---------------------------|----------------|------|------|------|------|------|
|                           | LLI<br>(1E+3)  | —    | —    | —    | 2E-5 | 2E-4 |
| Y, see $^{172}\text{Ta}$  | —              | 1E+3 | 4E-7 | 1E-9 | —    | —    |
| Tantalum-184              |                |      |      |      |      |      |
| W, see $^{172}\text{Ta}$  | 2E+3           | 5E+3 | 2E-6 | 8E-9 | 3E-5 | 3E-4 |
| Y, see $^{172}\text{Ta}$  | —              | 5E+3 | 2E-6 | 7E-9 | —    | —    |
| Tantalum-185 <sup>2</sup> |                |      |      |      |      |      |
| W, see $^{172}\text{Ta}$  | 3E+4           | 7E+4 | 3E-5 | 1E-7 | 4E-4 | 4E-3 |
| Y, see $^{172}\text{Ta}$  | —              | 6E+4 | 3E-5 | 9E-8 | —    | —    |
| Tantalum-186 <sup>2</sup> |                |      |      |      |      |      |
| W, see $^{172}\text{Ta}$  | 5E+4           | 2E+5 | 1E-4 | 3E-7 | —    | —    |
|                           | Stom<br>(7E+4) | —    | —    | —    | 1E-3 | 1E-2 |
| Y, see $^{172}\text{Ta}$  | —              | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| <b>AN 74</b>              |                |      |      |      |      |      |
| Tungsten-176              |                |      |      |      |      |      |
| D, all compounds          | 1E+4           | 5E+4 | 2E-5 | 7E-8 | 1E-4 | 1E-3 |
| Tungsten-177              |                |      |      |      |      |      |
| D, all compounds          | 2E+4           | 9E+4 | 4E-5 | 1E-7 | 3E-4 | 3E-3 |
| Tungsten-178              |                |      |      |      |      |      |
| D, all compounds          | 5E+3           | 2E+4 | 8E-6 | 3E-8 | 7E-5 | 7E-4 |
| Tungsten-179 <sup>2</sup> |                |      |      |      |      |      |
| D, all compounds          | 5E+5           | 2E+6 | 7E-4 | 2E-6 | 7E-3 | 7E-2 |
| Tungsten-181              |                |      |      |      |      |      |

|                                              |      |      |      |      |      |      |
|----------------------------------------------|------|------|------|------|------|------|
| D, all compounds                             | 2E+4 | 3E+4 | 1E-5 | 5E-8 | 2E-4 | 2E-3 |
| Tungsten-185                                 |      |      |      |      |      |      |
| D, all compounds                             | 2E+3 | 7E+3 | 3E-6 | 9E-9 | —    | —    |
| LLI<br>(3E+3)                                | —    | —    | —    | —    | 4E-5 | 4E-4 |
| Tungsten-187                                 |      |      |      |      |      |      |
| D, all compounds                             | 2E+3 | 9E+3 | 4E-6 | 1E-8 | 3E-5 | 3E-4 |
| Tungsten-188                                 |      |      |      |      |      |      |
| D, all compounds                             | 4E+2 | 1E+3 | 5E-7 | 2E-9 | —    | —    |
| LLI<br>(5E+2)                                | —    | —    | —    | —    | 7E-6 | 7E-5 |
| <b>AN 75</b>                                 |      |      |      |      |      |      |
| Rhenium-177 <sup>2</sup>                     |      |      |      |      |      |      |
| D, all compounds except<br>those given for W | 9E+4 | 3E+5 | 1E-4 | 4E-7 | —    | —    |
| Stom<br>(1E+5)                               | —    | —    | —    | —    | 2E-3 | 2E-2 |
| W, oxides, hydroxides, and<br>nitrates       | —    | 4E+5 | 1E-4 | 5E-7 | —    | —    |
| Rhenium-178 <sup>2</sup>                     |      |      |      |      |      |      |
| D, see <sup>177</sup> Re                     | 7E+4 | 3E+5 | 1E-4 | 4E-7 | —    | —    |
| Stom<br>(1E+5)                               | —    | —    | —    | —    | 1E-3 | 1E-2 |
| W, see <sup>177</sup> Re                     | —    | 3E+5 | 1E-4 | 4E-7 | —    | —    |
| Rhenium-181                                  |      |      |      |      |      |      |
| D, see <sup>177</sup> Re                     | 5E+3 | 9E+3 | 4E-6 | 1E-8 | 7E-5 | 7E-4 |

|                          |                |                |      |       |      |      |
|--------------------------|----------------|----------------|------|-------|------|------|
| W, see $^{177}\text{Re}$ | —              | 9E+3           | 4E-6 | 1E-8  | —    | —    |
| Rhenium-182 (12.7 h)     |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 7E+3           | 1E+4           | 5E-6 | 2E-8  | 9E-5 | 9E-4 |
| W, see $^{177}\text{Re}$ | —              | 2E+4           | 6E-6 | 2E-8  | —    | —    |
| Rhenium-182 (64.0 h)     |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 1E+3           | 2E+3           | 1E-6 | 3E-9  | 2E-5 | 2E-4 |
| W, see $^{177}\text{Re}$ | —              | 2E+3           | 9E-7 | 3E-9  | —    | —    |
| Rhenium-184m             |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 2E+3           | 3E+3           | 1E-6 | 4E-9  | 3E-5 | 3E-4 |
| W, see $^{177}\text{Re}$ | —              | 4E+2           | 2E-7 | 6E-10 | —    | —    |
| Rhenium-184              |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 2E+3           | 4E+3           | 1E-6 | 5E-9  | 3E-5 | 3E-4 |
| W, see $^{177}\text{Re}$ | —              | 1E+3           | 6E-7 | 2E-9  | —    | —    |
| Rhenium-186m             |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 1E+3           | 2E+3           | 7E-7 | —     | —    | —    |
|                          | Stom<br>(2E+3) | Stom<br>(2E+3) | —    | 3E-9  | 2E-5 | 2E-4 |
| W, see $^{177}\text{Re}$ | —              | 2E+2           | 6E-8 | 2E-10 | —    | —    |
| Rhenium-186              |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 2E+3           | 3E+3           | 1E-6 | 4E-9  | 3E-5 | 3E-4 |
| W, see $^{177}\text{Re}$ | —              | 2E+3           | 7E-7 | 2E-9  | —    | —    |
| Rhenium-187              |                |                |      |       |      |      |
| D, see $^{177}\text{Re}$ | 6E+5           | 8E+5           | 4E-4 | —     | 8E-3 | 8E-2 |

|                                                    |      |        |      |      |      |      |
|----------------------------------------------------|------|--------|------|------|------|------|
|                                                    |      | Stom   |      |      |      |      |
|                                                    | —    | (9E+5) | —    | 1E-6 | —    | —    |
| W, see <sup>177</sup> Re                           | —    | 1E+5   | 4E-5 | 1E-7 | —    | —    |
| Rhenium-188m <sup>2</sup>                          |      |        |      |      |      |      |
| D, see <sup>177</sup> Re                           | 8E+4 | 1E+5   | 6E-5 | 2E-7 | 1E-3 | 1E-2 |
| W, see <sup>177</sup> Re                           | —    | 1E+5   | 6E-5 | 2E-7 | —    | —    |
| Rhenium-188                                        |      |        |      |      |      |      |
| D, see <sup>177</sup> Re                           | 2E+3 | 3E+3   | 1E-6 | 4E-9 | 2E-5 | 2E-4 |
| W, see <sup>177</sup> Re                           | —    | 3E+3   | 1E-6 | 4E-9 | —    | —    |
| Rhenium-189                                        |      |        |      |      |      |      |
| D, see <sup>177</sup> Re                           | 3E+3 | 5E+3   | 2E-6 | 7E-9 | 4E-5 | 4E-4 |
| W, see <sup>177</sup> Re                           | —    | 4E+3   | 2E-6 | 6E-9 | —    | —    |
| <b>AN 76</b>                                       |      |        |      |      |      |      |
| Osmium-180 <sup>2</sup>                            |      |        |      |      |      |      |
| D, all compounds except<br>those given for W and Y | 1E+5 | 4E+5   | 2E-4 | 5E-7 | 1E-3 | 1E-2 |
| W, halides and nitrates                            | —    | 5E+5   | 2E-4 | 7E-7 | —    | —    |
| Y, oxides and hydroxides                           | —    | 5E+5   | 2E-4 | 6E-7 | —    | —    |
| Osmium-181 <sup>2</sup>                            |      |        |      |      |      |      |
| D, see <sup>180</sup> Os                           | 1E+4 | 4E+4   | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see <sup>180</sup> Os                           | —    | 5E+4   | 2E-5 | 6E-8 | —    | —    |
| Y, see <sup>180</sup> Os                           | —    | 4E+4   | 2E-5 | 6E-8 | —    | —    |
| Osmium-182                                         |      |        |      |      |      |      |
| D, see <sup>180</sup> Os                           | 2E+3 | 6E+3   | 2E-6 | 8E-9 | 3E-5 | 3E-4 |
| W, see <sup>180</sup> Os                           | —    | 4E+3   | 2E-6 | 6E-9 | —    | —    |

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| Y, see $^{180}\text{Os}$ | — | 4E+3 | 2E-6 | 6E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

## Osmium-185

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{180}\text{Os}$ | 2E+3 | 5E+2 | 2E-7 | 7E-10 | 3E-5 | 3E-4 |
| W, see $^{180}\text{Os}$ | —    | 8E+2 | 3E-7 | 1E-9  | —    | —    |
| Y, see $^{180}\text{Os}$ | —    | 8E+2 | 3E-7 | 1E-9  | —    | —    |

## Osmium-189m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{180}\text{Os}$ | 8E+4 | 2E+5 | 1E-4 | 3E-7 | 1E-3 | 1E-2 |
| W, see $^{180}\text{Os}$ | —    | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| Y, see $^{180}\text{Os}$ | —    | 2E+5 | 7E-5 | 2E-7 | —    | —    |

## Osmium-191m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{180}\text{Os}$ | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| W, see $^{180}\text{Os}$ | —    | 2E+4 | 8E-6 | 3E-8 | —    | —    |
| Y, see $^{180}\text{Os}$ | —    | 2E+4 | 7E-6 | 2E-8 | —    | —    |

## Osmium-191

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{180}\text{Os}$ | 2E+3 | 2E+3 | 9E-7 | 3E-9 | —    | —    |
| LLI<br>(3E+3)            | —    | —    | —    | —    | 3E-5 | 3E-4 |
| W, see $^{180}\text{Os}$ | —    | 2E+3 | 7E-7 | 2E-9 | —    | —    |
| Y, see $^{180}\text{Os}$ | —    | 1E+3 | 6E-7 | 2E-9 | —    | —    |

## Osmium-193

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{180}\text{Os}$ | 2E+3 | 5E+3 | 2E-6 | 6E-9 | —    | —    |
| LLI<br>(2E+3)            | —    | —    | —    | —    | 2E-5 | 2E-4 |
| W, see $^{180}\text{Os}$ | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| Y, see $^{180}\text{Os}$ | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |

## Osmium-194

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{180}\text{Os}$ | 4E+2 | 4E+1 | 2E-8 | 6E-11 | —    | —    |
| LLI<br>(6E+2)            | —    | —    | —    | —     | 8E-6 | 8E-5 |
| W, see $^{180}\text{Os}$ | —    | 6E+1 | 2E-8 | 8E-11 | —    | —    |
| Y, see $^{180}\text{Os}$ | —    | 8E+0 | 3E-9 | 1E-11 | —    | —    |

**AN 77****Iridium-182<sup>2</sup>**

|                                                    |      |      |      |      |      |      |
|----------------------------------------------------|------|------|------|------|------|------|
| D, all compounds except<br>those given for W and Y | 4E+4 | 1E+5 | 6E-5 | 2E-7 | —    | —    |
| Stom<br>(4E+4)                                     | —    | —    | —    | —    | 6E-4 | 6E-3 |
| W, halides, nitrates, and<br>metallic iridium      | —    | 2E+5 | 6E-5 | 2E-7 | —    | —    |
| Y, oxides and hydroxides                           | —    | 1E+5 | 5E-5 | 2E-7 | —    | —    |

**Iridium-184**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 8E+3 | 2E+4 | 1E-5 | 3E-8 | 1E-4 | 1E-3 |
| W, see $^{182}\text{Ir}$ | —    | 3E+4 | 1E-5 | 5E-8 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |

**Iridium-185**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 5E+3 | 1E+4 | 5E-6 | 2E-8 | 7E-5 | 7E-4 |
| W, see $^{182}\text{Ir}$ | —    | 1E+4 | 5E-6 | 2E-8 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 1E+4 | 4E-6 | 1E-8 | —    | —    |

**Iridium-186**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 2E+3 | 8E+3 | 3E-6 | 1E-8 | 3E-5 | 3E-4 |
| W, see $^{182}\text{Ir}$ | —    | 6E+3 | 3E-6 | 9E-9 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 6E+3 | 2E-6 | 8E-9 | —    | —    |

**Iridium-187**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 1E+4 | 3E+4 | 1E-5 | 5E-8 | 1E-4 | 1E-3 |
| W, see $^{182}\text{Ir}$ | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |

## Iridium-188

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 2E+3 | 5E+3 | 2E-6 | 6E-9 | 3E-5 | 3E-4 |
| W, see $^{182}\text{Ir}$ | —    | 4E+3 | 1E-6 | 5E-9 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 3E+3 | 1E-6 | 5E-9 | —    | —    |

## Iridium-189

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 5E+3 | 5E+3 | 2E-6 | 7E-9 | —    | —    |
| LLI<br>(5E+3)            | —    | —    | —    | —    | 7E-5 | 7E-4 |
| W, see $^{182}\text{Ir}$ | —    | 4E+3 | 2E-6 | 5E-9 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 4E+3 | 1E-6 | 5E-9 | —    | —    |

Iridium-190m<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 2E+5 | 2E+5 | 8E-5 | 3E-7 | 2E-3 | 2E-2 |
| W, see $^{182}\text{Ir}$ | —    | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 2E+5 | 8E-5 | 3E-7 | —    | —    |

## Iridium-190

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 1E+3 | 9E+2 | 4E-7 | 1E-9 | 1E-5 | 1E-4 |
| W, see $^{182}\text{Ir}$ | —    | 1E+3 | 4E-7 | 1E-9 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 9E+2 | 4E-7 | 1E-9 | —    | —    |

## Iridium-192m

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{182}\text{Ir}$ | 3E+3 | 9E+1 | 4E-8 | 1E-10 | 4E-5 | 4E-4 |
| W, see $^{182}\text{Ir}$ | —    | 2E+2 | 9E-8 | 3E-10 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 2E+1 | 6E-9 | 2E-11 | —    | —    |

## Iridium-192

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{182}\text{Ir}$ | 9E+2 | 3E+2 | 1E-7 | 4E-10 | 1E-5 | 1E-4 |
| W, see $^{182}\text{Ir}$ | —    | 4E+2 | 2E-7 | 6E-10 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 2E+2 | 9E-8 | 3E-10 | —    | —    |

## Iridium-194m

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{182}\text{Ir}$ | 6E+2 | 9E+1 | 4E-8 | 1E-10 | 9E-6 | 9E-5 |
| W, see $^{182}\text{Ir}$ | —    | 2E+2 | 7E-8 | 2E-10 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 1E+2 | 4E-8 | 1E-10 | —    | —    |

## Iridium-194

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 1E+3 | 3E+3 | 1E-6 | 4E-9 | 1E-5 | 1E-4 |
| W, see $^{182}\text{Ir}$ | —    | 2E+3 | 9E-7 | 3E-9 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 2E+3 | 8E-7 | 3E-9 | —    | —    |

## Iridium-195m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 8E+3 | 2E+4 | 1E-5 | 3E-8 | 1E-4 | 1E-3 |
| W, see $^{182}\text{Ir}$ | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 2E+4 | 9E-6 | 3E-8 | —    | —    |

## Iridium-195

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{182}\text{Ir}$ | 1E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see $^{182}\text{Ir}$ | —    | 5E+4 | 2E-5 | 7E-8 | —    | —    |
| Y, see $^{182}\text{Ir}$ | —    | 4E+4 | 2E-5 | 6E-8 | —    | —    |

**AN 78**

## Platinum-186

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 1E+4 | 4E+4 | 2E-5 | 5E-8 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

## Platinum-188

|                            |      |      |      |      |      |      |
|----------------------------|------|------|------|------|------|------|
| D, all compounds           | 2E+3 | 2E+3 | 7E-7 | 2E-9 | 2E-5 | 2E-4 |
| Platinum-189               |      |      |      |      |      |      |
| D, all compounds           | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
| Platinum-191               |      |      |      |      |      |      |
| D, all compounds           | 4E+3 | 8E+3 | 4E-6 | 1E-8 | 5E-5 | 5E-4 |
| Platinum-193m              |      |      |      |      |      |      |
| D, all compounds           | 3E+3 | 6E+3 | 3E-6 | 8E-9 | —    | —    |
| LLI<br>(3E+4)              | —    | —    | —    | —    | 4E-5 | 4E-4 |
| Platinum-193               |      |      |      |      |      |      |
| D, all compounds           | 4E+4 | 2E+4 | 1E-5 | 3E-8 | —    | —    |
| LLI<br>(5E+4)              | —    | —    | —    | —    | 6E-4 | 6E-3 |
| Platinum-195m              |      |      |      |      |      |      |
| D, all compounds           | 2E+3 | 4E+3 | 2E-6 | 6E-9 | —    | —    |
| LLI<br>(2E+3)              | —    | —    | —    | —    | 3E-5 | 3E-4 |
| Platinum-197m <sup>2</sup> |      |      |      |      |      |      |
| D, all compounds           | 2E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| Platinum-197               |      |      |      |      |      |      |
| D, all compounds           | 3E+3 | 1E+4 | 4E-6 | 1E-8 | 4E-5 | 4E-4 |
| Platinum-199 <sup>2</sup>  |      |      |      |      |      |      |
| D, all compounds           | 5E+4 | 1E+5 | 6E-5 | 2E-7 | 7E-4 | 7E-3 |

## Platinum-200

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 1E+3 | 3E+3 | 1E-6 | 5E-9 | 2E-5 | 2E-4 |
|------------------|------|------|------|------|------|------|

## AN 79

## Gold-193

|                                                 |      |      |      |      |      |      |
|-------------------------------------------------|------|------|------|------|------|------|
| D, all compounds except those given for W and Y | 9E+3 | 3E+4 | 1E-5 | 4E-8 | 1E-4 | 1E-3 |
| W, halides and nitrates                         | —    | 2E+4 | 9E-6 | 3E-8 | —    | —    |
| Y, oxides and hydroxides                        | —    | 2E+4 | 8E-6 | 3E-8 | —    | —    |

## Gold-194

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>193</sup> Au | 3E+3 | 8E+3 | 3E-6 | 1E-8 | 4E-5 | 4E-4 |
| W, see <sup>193</sup> Au | —    | 5E+3 | 2E-6 | 8E-9 | —    | —    |
| Y, see <sup>193</sup> Au | —    | 5E+3 | 2E-6 | 7E-9 | —    | —    |

## Gold-195

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see <sup>193</sup> Au | 5E+3 | 1E+4 | 5E-6 | 2E-8  | 7E-5 | 7E-4 |
| W, see <sup>193</sup> Au | —    | 1E+3 | 6E-7 | 2E-9  | —    | —    |
| Y, see <sup>193</sup> Au | —    | 4E+2 | 2E-7 | 6E-10 | —    | —    |

## Gold-198m

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>193</sup> Au | 1E+3 | 3E+3 | 1E-6 | 4E-9 | 1E-5 | 1E-4 |
| W, see <sup>193</sup> Au | —    | 1E+3 | 5E-7 | 2E-9 | —    | —    |
| Y, see <sup>193</sup> Au | —    | 1E+3 | 5E-7 | 2E-9 | —    | —    |

## Gold-198

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>193</sup> Au | 1E+3 | 4E+3 | 2E-6 | 5E-9 | 2E-5 | 2E-4 |
| W, see <sup>193</sup> Au | —    | 2E+3 | 8E-7 | 3E-9 | —    | —    |
| Y, see <sup>193</sup> Au | —    | 2E+3 | 7E-7 | 2E-9 | —    | —    |

## Gold-199

|                                                           |      |      |      |      |      |      |
|-----------------------------------------------------------|------|------|------|------|------|------|
| D, see $^{193}\text{Au}$                                  | 3E+3 | 9E+3 | 4E-6 | 1E-8 | —    | —    |
| LLI<br>(3E+3)                                             | —    | —    | —    | —    | 4E-5 | 4E-4 |
| W, see $^{193}\text{Au}$                                  | —    | 4E+3 | 2E-6 | 6E-9 | —    | —    |
| Y, see $^{193}\text{Au}$                                  | —    | 4E+3 | 2E-6 | 5E-9 | —    | —    |
| Gold-200m                                                 |      |      |      |      |      |      |
| D, see $^{193}\text{Au}$                                  | 1E+3 | 4E+3 | 1E-6 | 5E-9 | 2E-5 | 2E-4 |
| W, see $^{193}\text{Au}$                                  | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| Y, see $^{193}\text{Au}$                                  | —    | 2E+4 | 1E-6 | 3E-9 | —    | —    |
| Gold-200 <sup>2</sup>                                     |      |      |      |      |      |      |
| D, see $^{193}\text{Au}$                                  | 3E+4 | 6E+4 | 3E-5 | 9E-8 | 4E-4 | 4E-3 |
| W, see $^{193}\text{Au}$                                  | —    | 8E+4 | 3E-5 | 1E-7 | —    | —    |
| Y, see $^{193}\text{Au}$                                  | —    | 7E+4 | 3E-5 | 1E-7 | —    | —    |
| Gold-201 <sup>2</sup>                                     |      |      |      |      |      |      |
| D, see $^{193}\text{Au}$                                  | 7E+4 | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| Stom<br>(9E+4)                                            | —    | —    | —    | —    | 1E-3 | 1E-2 |
| W, see $^{193}\text{Au}$                                  | —    | 2E+5 | 1E-4 | 3E-7 | —    | —    |
| Y, see $^{193}\text{Au}$                                  | —    | 2E+5 | 9E-5 | 3E-7 | —    | —    |
| <b>AN 80</b>                                              |      |      |      |      |      |      |
| Mercury-193m                                              |      |      |      |      |      |      |
| Vapor                                                     | —    | 8E+3 | 4E-6 | 1E-8 | —    | —    |
| Organic D                                                 | 4E+3 | 1E+4 | 5E-6 | 2E-8 | 6E-5 | 6E-4 |
| D, sulfates                                               | 3E+3 | 9E+3 | 4E-6 | 1E-8 | 4E-5 | 4E-4 |
| W, oxides, hydroxides,<br>halides, nitrates, and sulfides | —    | 8E+3 | 3E-6 | 1E-8 | —    | —    |

## Mercury-193

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Vapor                     | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |
| Organic D                 | 2E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| D, see <sup>193m</sup> Hg | 2E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see <sup>193m</sup> Hg | —    | 4E+4 | 2E-5 | 6E-8 | —    | —    |

## Mercury-194

|                           |      |      |      |       |      |      |
|---------------------------|------|------|------|-------|------|------|
| Vapor                     | —    | 3E+1 | 1E-8 | 4E-11 | —    | —    |
| Organic D                 | 2E+1 | 3E+1 | 1E-8 | 4E-11 | 2E-7 | 2E-6 |
| D, see <sup>193m</sup> Hg | 8E+2 | 4E+1 | 2E-8 | 6E-11 | 1E-5 | 1E-4 |
| W, see <sup>193m</sup> Hg | —    | 1E+2 | 5E-8 | 2E-10 | —    | —    |

## Mercury-195m

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Vapor                     | —    | 4E+3 | 2E-6 | 6E-9 | —    | —    |
| Organic D                 | 3E+3 | 6E+3 | 3E-6 | 8E-9 | 4E-5 | 4E-4 |
| D, see <sup>193m</sup> Hg | 2E+3 | 5E+3 | 2E-6 | 7E-9 | 3E-5 | 3E-4 |
| W, see <sup>193m</sup> Hg | —    | 4E+3 | 2E-6 | 5E-9 | —    | —    |

## Mercury-195

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Vapor                     | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |
| Organic D                 | 2E+4 | 5E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| D, see <sup>193m</sup> Hg | 1E+4 | 4E+4 | 1E-5 | 5E-8 | 2E-4 | 2E-3 |
| W, see <sup>193m</sup> Hg | —    | 3E+4 | 1E-5 | 5E-8 | —    | —    |

## Mercury-197m

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Vapor                     | —    | 5E+3 | 2E-6 | 7E-9 | —    | —    |
| Organic D                 | 4E+3 | 9E+3 | 4E-6 | 1E-8 | 5E-5 | 5E-4 |
| D, see <sup>193m</sup> Hg | 3E+3 | 7E+3 | 3E-6 | 1E-8 | 4E-5 | 4E-4 |
| W, see <sup>193m</sup> Hg | —    | 5E+3 | 2E-6 | 7E-9 | —    | —    |

## Mercury-197

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Vapor                     | —    | 8E+3 | 4E-6 | 1E-8 | —    | —    |
| Organic D                 | 7E+3 | 1E+4 | 6E-6 | 2E-8 | 9E-5 | 9E-4 |
| D, see <sup>193m</sup> Hg | 6E+3 | 1E+4 | 5E-6 | 2E-8 | 8E-5 | 8E-4 |
| W, see <sup>193m</sup> Hg | —    | 9E+3 | 4E-6 | 1E-8 | —    | —    |

Mercury-199m<sup>2</sup>

|                           |                |      |      |      |      |      |
|---------------------------|----------------|------|------|------|------|------|
| Vapor                     | —              | 8E+4 | 3E-5 | 1E-7 | —    | —    |
| Organic D                 | 6E+4           | 2E+5 | 7E-5 | 2E-7 | —    | —    |
|                           | Stom<br>(1E+5) | —    | —    | —    | 1E-3 | 1E-2 |
| D, see <sup>193m</sup> Hg | 6E+4           | 1E+5 | 6E-5 | 2E-7 | 8E-4 | 8E-3 |
| W, see <sup>193m</sup> Hg | —              | 2E+5 | 7E-5 | 2E-7 | —    | —    |

## Mercury-203

|                           |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|
| Vapor                     | —    | 8E+2 | 4E-7 | 1E-9 | —    | —    |
| Organic D                 | 5E+2 | 8E+2 | 3E-7 | 1E-9 | 7E-6 | 7E-5 |
| D, see <sup>193m</sup> Hg | 2E+3 | 1E+3 | 5E-7 | 2E-9 | 3E-5 | 3E-4 |
| W, see <sup>193m</sup> Hg | —    | 1E+3 | 5E-7 | 2E-9 | —    | —    |

**AN 81**Thallium-194m<sup>2</sup>

|                  |                |      |      |      |      |      |
|------------------|----------------|------|------|------|------|------|
| D, all compounds | 5E+4           | 2E+5 | 6E-5 | 2E-7 | —    | —    |
|                  | Stom<br>(7E+4) | —    | —    | —    | 1E-3 | 1E-2 |

Thallium-194<sup>2</sup>

|                  |                |      |      |      |      |      |
|------------------|----------------|------|------|------|------|------|
| D, all compounds | 3E+5           | 6E+5 | 2E-4 | 8E-7 | —    | —    |
|                  | Stom<br>(3E+5) | —    | —    | —    | 4E-3 | 4E-2 |

Thallium-195<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 6E+4 | 1E+5 | 5E-5 | 2E-7 | 9E-4 | 9E-3 |
|------------------|------|------|------|------|------|------|

Thallium-197

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 7E+4 | 1E+5 | 5E-5 | 2E-7 | 1E-3 | 1E-2 |
|------------------|------|------|------|------|------|------|

Thallium-198m<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 3E+4 | 5E+4 | 2E-5 | 8E-8 | 4E-4 | 4E-3 |
|------------------|------|------|------|------|------|------|

Thallium-198

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+4 | 3E+4 | 1E-5 | 5E-8 | 3E-4 | 3E-3 |
|------------------|------|------|------|------|------|------|

Thallium-199

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 6E+4 | 8E+4 | 4E-5 | 1E-7 | 9E-4 | 9E-3 |
|------------------|------|------|------|------|------|------|

Thallium-200

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 8E+3 | 1E+4 | 5E-6 | 2E-8 | 1E-4 | 1E-3 |
|------------------|------|------|------|------|------|------|

Thallium-201

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+4 | 2E+4 | 9E-6 | 3E-8 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

Thallium-202

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 4E+3 | 5E+3 | 2E-6 | 7E-9 | 5E-5 | 5E-4 |
|------------------|------|------|------|------|------|------|

Thallium-204

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 2E+3 | 2E+3 | 9E-7 | 3E-9 | 2E-5 | 2E-4 |
|------------------|------|------|------|------|------|------|

**AN 82**Lead-195m<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 6E+4 | 2E+5 | 8E-5 | 3E-7 | 8E-4 | 8E-3 |
|------------------|------|------|------|------|------|------|

Lead-198

|                       |                |                |       |       |      |      |
|-----------------------|----------------|----------------|-------|-------|------|------|
| D, all compounds      | 3E+4           | 6E+4           | 3E-5  | 9E-8  | 4E-4 | 4E-3 |
| Lead-199 <sup>2</sup> |                |                |       |       |      |      |
| D, all compounds      | 2E+4           | 7E+4           | 3E-5  | 1E-7  | 3E-4 | 3E-3 |
| Lead-200              |                |                |       |       |      |      |
| D, all compounds      | 3E+3           | 6E+3           | 3E-6  | 9E-9  | 4E-5 | 4E-4 |
| Lead-201              |                |                |       |       |      |      |
| D, all compounds      | 7E+3           | 2E+4           | 8E-6  | 3E-8  | 1E-4 | 1E-3 |
| Lead-202m             |                |                |       |       |      |      |
| D, all compounds      | 9E+3           | 3E+4           | 1E-5  | 4E-8  | 1E-4 | 1E-3 |
| Lead-202              |                |                |       |       |      |      |
| D, all compounds      | 1E+2           | 5E+1           | 2E-8  | 7E-11 | 2E-6 | 2E-5 |
| Lead-203              |                |                |       |       |      |      |
| D, all compounds      | 5E+3           | 9E+3           | 4E-6  | 1E-8  | 7E-5 | 7E-4 |
| Lead-205              |                |                |       |       |      |      |
| D, all compounds      | 4E+3           | 1E+3           | 6E-7  | 2E-9  | 5E-5 | 5E-4 |
| Lead-209              |                |                |       |       |      |      |
| D, all compounds      | 2E+4           | 6E+4           | 2E-5  | 8E-8  | 3E-4 | 3E-3 |
| Lead-210              |                |                |       |       |      |      |
| D, all compounds      | 6E-1           | 2E-1           | 1E-10 | —     | —    | —    |
|                       | Bone<br>(1E+0) | Bone<br>(4E-1) | —     | 6E-13 | 1E-8 | 1E-7 |
| Lead-211 <sup>2</sup> |                |                |       |       |      |      |

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| D, all compounds | 1E+4 | 6E+2 | 3E-7 | 9E-10 | 2E-4 | 2E-3 |
|------------------|------|------|------|-------|------|------|

## Lead-212

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| D, all compounds | 8E+1 | 3E+1 | 1E-8 | 5E-11 | —    | —    |
| Bone<br>(1E+2)   | —    | —    | —    | —     | 2E-6 | 2E-5 |

Lead-214<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 9E+3 | 8E+2 | 3E-7 | 1E-9 | 1E-4 | 1E-3 |
|------------------|------|------|------|------|------|------|

**AN 83**Bismuth-200<sup>2</sup>

|                        |      |      |      |      |      |      |
|------------------------|------|------|------|------|------|------|
| D, nitrates            | 3E+4 | 8E+4 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
| W, all other compounds | —    | 1E+5 | 4E-5 | 1E-7 | —    | —    |

Bismuth-201<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>200</sup> Bi | 1E+4 | 3E+4 | 1E-5 | 4E-8 | 2E-4 | 2E-3 |
| W, see <sup>200</sup> Bi | —    | 4E+4 | 2E-5 | 5E-8 | —    | —    |

Bismuth-202<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>200</sup> Bi | 1E+4 | 4E+4 | 2E-5 | 6E-8 | 2E-4 | 2E-3 |
| W, see <sup>200</sup> Bi | —    | 8E+4 | 3E-5 | 1E-7 | —    | —    |

## Bismuth-203

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>200</sup> Bi | 2E+3 | 7E+3 | 3E-6 | 9E-9 | 3E-5 | 3E-4 |
| W, see <sup>200</sup> Bi | —    | 6E+3 | 3E-6 | 9E-9 | —    | —    |

## Bismuth-205

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>200</sup> Bi | 1E+3 | 3E+3 | 1E-6 | 3E-9 | 2E-5 | 2E-4 |
| W, see <sup>200</sup> Bi | —    | 1E+3 | 5E-7 | 2E-9 | —    | —    |

## Bismuth-206

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see $^{200}\text{Bi}$ | 6E+2 | 1E+3 | 6E-7 | 2E-9 | 9E-6 | 9E-5 |
| W, see $^{200}\text{Bi}$ | —    | 9E+2 | 4E-7 | 1E-9 | —    | —    |

## Bismuth-207

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{200}\text{Bi}$ | 1E+3 | 2E+3 | 7E-7 | 2E-9  | 1E-5 | 1E-4 |
| W, see $^{200}\text{Bi}$ | —    | 4E+2 | 1E-7 | 5E-10 | —    | —    |

## Bismuth-210m

|                          |               |               |       |       |      |      |
|--------------------------|---------------|---------------|-------|-------|------|------|
| D, see $^{200}\text{Bi}$ | 4E+1          | 5E+0          | 2E-9  | —     | —    | —    |
|                          | Kid<br>(6E+1) | Kid<br>(6E+0) | —     | 9E-12 | 8E-7 | 8E-6 |
| W, see $^{200}\text{Bi}$ | —             | 7E-1          | 3E-10 | 9E-13 | —    | —    |

## Bismuth-210

|                          |      |               |      |       |      |      |
|--------------------------|------|---------------|------|-------|------|------|
| D, see $^{200}\text{Bi}$ | 8E+2 | 2E+2          | 1E-7 | —     | 1E-5 | 1E-4 |
|                          | —    | Kid<br>(4E+2) | —    | 5E-10 | —    | —    |
| W, see $^{200}\text{Bi}$ | —    | 3E+1          | 1E-8 | 4E-11 | —    | —    |

Bismuth-212<sup>2</sup>

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{200}\text{Bi}$ | 5E+3 | 2E+2 | 1E-7 | 3E-10 | 7E-5 | 7E-4 |
| W, see $^{200}\text{Bi}$ | —    | 3E+2 | 1E-7 | 4E-10 | —    | —    |

Bismuth-213<sup>2</sup>

|                          |      |      |      |       |      |      |
|--------------------------|------|------|------|-------|------|------|
| D, see $^{200}\text{Bi}$ | 7E+3 | 3E+2 | 1E-7 | 4E-10 | 1E-4 | 1E-3 |
| W, see $^{200}\text{Bi}$ | —    | 4E+2 | 1E-7 | 5E-10 | —    | —    |

Bismuth-214<sup>2</sup>

|                          |      |      |      |      |   |   |
|--------------------------|------|------|------|------|---|---|
| D, see $^{200}\text{Bi}$ | 2E+4 | 8E+2 | 3E-7 | 1E-9 | — | — |
|--------------------------|------|------|------|------|---|---|

|                          |                |      |      |      |      |      |
|--------------------------|----------------|------|------|------|------|------|
|                          | Stom<br>(2E+4) | —    | —    | —    | 3E-4 | 3E-3 |
| W, see <sup>200</sup> Bi | —              | 9E-2 | 4E-7 | 1E-9 | —    | —    |

**AN 84**Polonium-203<sup>2</sup>

|                                              |      |      |      |      |      |      |
|----------------------------------------------|------|------|------|------|------|------|
| D, all compounds except<br>those given for W | 3E+4 | 6E+4 | 3E-5 | 9E-8 | 3E-4 | 3E-3 |
| W, oxides, hydroxides, and<br>nitrates       | —    | 9E+4 | 4E-5 | 1E-7 | —    | —    |

Polonium-205<sup>2</sup>

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>203</sup> Po | 2E+4 | 4E+4 | 2E-5 | 5E-8 | 3E-4 | 3E-3 |
| W, see <sup>203</sup> Po | —    | 7E+4 | 3E-5 | 1E-7 | —    | —    |

## Polonium-207

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| D, see <sup>203</sup> Po | 8E+3 | 3E+4 | 1E-5 | 3E-8 | 1E-4 | 1E-3 |
| W, see <sup>203</sup> Po | —    | 3E+4 | 1E-5 | 4E-8 | —    | —    |

## Polonium-210

|                          |      |      |       |       |      |      |
|--------------------------|------|------|-------|-------|------|------|
| D, see <sup>203</sup> Po | 3E+0 | 6E-1 | 3E-10 | 9E-13 | 4E-8 | 4E-7 |
| W, see <sup>203</sup> Po | —    | 6E-1 | 3E-10 | 9E-13 | —    | —    |

**AN 85**Astatine-207<sup>2</sup>

|            |      |      |      |      |      |      |
|------------|------|------|------|------|------|------|
| D, halides | 6E+3 | 3E+3 | 1E-6 | 4E-9 | 8E-5 | 8E-4 |
| W          | —    | 2E+3 | 9E-7 | 3E-9 | —    | —    |

## Astatine-211

|            |      |      |      |       |      |      |
|------------|------|------|------|-------|------|------|
| D, halides | 1E+2 | 8E+1 | 3E-8 | 1E-10 | 2E-6 | 2E-5 |
| W          | —    | 5E+1 | 2E-8 | 8E-11 | —    | —    |

**AN 86**

## Radon-220

|                        |   |                                               |                                      |       |   |   |
|------------------------|---|-----------------------------------------------|--------------------------------------|-------|---|---|
| With daughters removed | — | 2E+4                                          | 7E-6                                 | 2E-8  | — | — |
|                        |   | 2E+1<br>(or 12<br>working<br>level<br>months) | 9E-9<br>(or 1.0<br>working<br>level) |       |   |   |
| With daughters present | — |                                               |                                      | 3E-11 | — | — |

## Radon-222

|                        |   |                                           |                                       |       |   |   |
|------------------------|---|-------------------------------------------|---------------------------------------|-------|---|---|
| With daughters removed | — | 1E+4                                      | 4E-6                                  | 1E-8  | — | — |
|                        |   | 1E+2 (or<br>4 working<br>level<br>months) | 3E-8<br>(or 0.33<br>working<br>level) |       |   |   |
| With daughters present | — |                                           |                                       | 1E-10 | — | — |

**AN 87**Francium-222<sup>2</sup>

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| D, all compounds | 2E+3 | 5E+2 | 2E-7 | 6E-10 | 3E-5 | 3E-4 |
|------------------|------|------|------|-------|------|------|

Francium-223<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| D, all compounds | 6E+2 | 8E+2 | 3E-7 | 1E-9 | 8E-6 | 8E-5 |
|------------------|------|------|------|------|------|------|

**AN 88**

## Radium-223

|                  |                |      |       |       |      |      |
|------------------|----------------|------|-------|-------|------|------|
| W, all compounds | 5E+0           | 7E-1 | 3E-10 | 9E-13 | —    | —    |
|                  | Bone<br>(9E+0) | —    | —     | —     | 1E-7 | 1E-6 |

## Radium-224

|                  |      |      |       |       |   |   |
|------------------|------|------|-------|-------|---|---|
| W, all compounds | 8E+0 | 2E+0 | 7E-10 | 2E-12 | — | — |
|------------------|------|------|-------|-------|---|---|

|                                                    |                |                |       |       |      |      |
|----------------------------------------------------|----------------|----------------|-------|-------|------|------|
|                                                    | Bone<br>(2E+1) | —              | —     | —     | 2E-7 | 2E-6 |
| Radium-225                                         |                |                |       |       |      |      |
| W, all compounds                                   | 8E+0           | 7E-1           | 3E-10 | 9E-13 | —    | —    |
|                                                    | Bone<br>(2E+1) | —              | —     | —     | 2E-7 | 2E-6 |
| Radium-226                                         |                |                |       |       |      |      |
| W, all compounds                                   | 2E+0           | 6E-1           | 3E-10 | 9E-13 | —    | —    |
|                                                    | Bone<br>(5E+0) | —              | —     | —     | 6E-8 | 6E-7 |
| Radium-227 <sup>2</sup>                            |                |                |       |       |      |      |
| W, all compounds                                   | 2E+4           | 1E+4           | 6E-6  | —     | —    | —    |
|                                                    | Bone<br>(2E+4) | Bone<br>(2E+4) | —     | 3E-8  | 3E-4 | 3E-3 |
| Radium-228                                         |                |                |       |       |      |      |
| W, all compounds                                   | 2E+0           | 1E+0           | 5E-10 | 2E-12 | —    | —    |
|                                                    | Bone<br>(4E+0) | —              | —     | —     | 6E-8 | 6E-7 |
| <b>AN 89</b>                                       |                |                |       |       |      |      |
| Actinium-224                                       |                |                |       |       |      |      |
| D, all compounds except<br>those given for W and Y | 2E+3           | 3E+1           | 1E-8  | —     | —    | —    |
|                                                    | LLI<br>(2E+3)  | Bone<br>(4E+1) | —     | 5E-11 | 3E-5 | 3E-4 |
| W, halides and nitrates                            | —              | 5E+1           | 2E-8  | 7E-11 | —    | —    |
| Y, oxides and hydroxides                           | —              | 5E+1           | 2E-8  | 6E-11 | —    | —    |
| Actinium-225                                       |                |                |       |       |      |      |

|                          |                |                |       |       |      |      |
|--------------------------|----------------|----------------|-------|-------|------|------|
| D, see $^{224}\text{Ac}$ | 5E+1           | 3E-1           | 1E-10 | —     | —    | —    |
|                          | LLI<br>(5E+1)  | Bone<br>(5E-1) | —     | 7E-13 | 7E-7 | 7E-6 |
| W, see $^{224}\text{Ac}$ | —              | 6E-1           | 3E-10 | 9E-13 | —    | —    |
| Y, see $^{224}\text{Ac}$ | —              | 6E-1           | 3E-10 | 9E-13 | —    | —    |
| Actinium-226             |                |                |       |       |      |      |
| D, see $^{224}\text{Ac}$ | 1E+2           | 3E+0           | 1E-9  | —     | —    | —    |
|                          | LLI<br>(1E+2)  | Bone<br>(4E+0) | —     | 5E-12 | 2E-6 | 2E-5 |
| W, see $^{224}\text{Ac}$ | —              | 5E+0           | 2E-9  | 7E-12 | —    | —    |
| Y, see $^{224}\text{Ac}$ | —              | 5E+0           | 2E-9  | 6E-12 | —    | —    |
| Actinium-227             |                |                |       |       |      |      |
| D, see $^{224}\text{Ac}$ | 2E-1           | 4E-4           | 2E-13 | —     | —    | —    |
|                          | Bone<br>(4E-1) | Bone<br>(8E-4) | —     | 1E-15 | 5E-9 | 5E-8 |
| W, see $^{224}\text{Ac}$ | —              | 2E-3           | 7E-13 | —     | —    | —    |
|                          | —              | Bone<br>(3E-3) | —     | 4E-15 | —    | —    |
| Y, see $^{224}\text{Ac}$ | —              | 4E-3           | 2E-12 | 6E-15 | —    | —    |
| Actinium-228             |                |                |       |       |      |      |
| D, see $^{224}\text{Ac}$ | 2E+3           | 9E+0           | 4E-9  | —     | 3E-5 | 3E-4 |
|                          | —              | Bone<br>(2E+1) | —     | 2E-11 | —    | —    |
| W, see $^{224}\text{Ac}$ | —              | 4E+1           | 2E-8  | —     | —    | —    |
|                          | —              | Bone<br>(6E+1) | —     | 8E-11 | —    | —    |
| Y, see $^{224}\text{Ac}$ | —              | 4E+1           | 2E-8  | 6E-11 | —    | —    |

**AN 90**Thorium-226<sup>2</sup>

W, all compounds except  
those given for Y

|                |      |      |       |      |      |
|----------------|------|------|-------|------|------|
| 5E+3           | 2E+2 | 6E-8 | 2E-10 | —    | —    |
| Stom<br>(5E+3) | —    | —    | —     | 7E-5 | 7E-4 |

Y, oxides and hydroxides

|   |      |      |       |   |   |
|---|------|------|-------|---|---|
| — | 1E+2 | 6E-8 | 2E-10 | — | — |
|---|------|------|-------|---|---|

## Thorium-227

W, see <sup>226</sup>Th

|      |      |       |       |      |      |
|------|------|-------|-------|------|------|
| 1E+2 | 3E-1 | 1E-10 | 5E-13 | 2E-6 | 2E-5 |
|------|------|-------|-------|------|------|

Y, see <sup>226</sup>Th

|   |      |       |       |   |   |
|---|------|-------|-------|---|---|
| — | 3E-1 | 1E-10 | 5E-13 | — | — |
|---|------|-------|-------|---|---|

## Thorium-228

W, see <sup>226</sup>Th

|      |      |       |   |   |   |
|------|------|-------|---|---|---|
| 6E+0 | 1E-2 | 4E-12 | — | — | — |
|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(1E+1) | Bone<br>(2E-2) | — | 3E-14 | 2E-7 | 2E-6 |
|----------------|----------------|---|-------|------|------|

Y, see <sup>226</sup>Th

|   |      |       |       |   |   |
|---|------|-------|-------|---|---|
| — | 2E-2 | 7E-12 | 2E-14 | — | — |
|---|------|-------|-------|---|---|

## Thorium-229

W, see <sup>226</sup>Th

|      |      |       |   |   |   |
|------|------|-------|---|---|---|
| 6E-1 | 9E-4 | 4E-13 | — | — | — |
|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(1E+0) | Bone<br>(2E-3) | — | 3E-15 | 2E-8 | 2E-7 |
|----------------|----------------|---|-------|------|------|

Y, see <sup>226</sup>Th

|   |      |       |   |   |   |
|---|------|-------|---|---|---|
| — | 2E-3 | 1E-12 | — | — | — |
|---|------|-------|---|---|---|

|   |                |   |       |   |   |
|---|----------------|---|-------|---|---|
| — | Bone<br>(3E-3) | — | 4E-15 | — | — |
|---|----------------|---|-------|---|---|

## Thorium-230

W, see <sup>226</sup>Th

|      |      |       |   |   |   |
|------|------|-------|---|---|---|
| 4E+0 | 6E-3 | 3E-12 | — | — | — |
|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(9E+0) | Bone<br>(2E-2) | — | 2E-14 | 1E-7 | 1E-6 |
|----------------|----------------|---|-------|------|------|

Y, see <sup>226</sup>Th

|   |      |       |   |   |   |
|---|------|-------|---|---|---|
| — | 2E-2 | 6E-12 | — | — | — |
|---|------|-------|---|---|---|

|                                              |                |                |       |       |      |      |
|----------------------------------------------|----------------|----------------|-------|-------|------|------|
|                                              | —              | Bone<br>(2E-2) | —     | 3E-14 | —    | —    |
| Thorium-231                                  |                |                |       |       |      |      |
| W, see <sup>226</sup> Th                     | 4E+3           | 6E+3           | 3E-6  | 9E-9  | 5E-5 | 5E-4 |
| Y, see <sup>226</sup> Th                     | —              | 6E+3           | 3E-6  | 9E-9  | —    | —    |
| Thorium-232                                  |                |                |       |       |      |      |
| W, see <sup>226</sup> Th                     | 7E-1           | 1E-3           | 5E-13 | —     | —    | —    |
|                                              | Bone<br>(2E+0) | Bone<br>(3E-3) | —     | 4E-15 | 3E-8 | 3E-7 |
| Y, see <sup>226</sup> Th                     | —              | 3E-3           | 1E-12 | —     | —    | —    |
|                                              | —              | Bone<br>(4E-3) | —     | 6E-15 | —    | —    |
| Thorium-234                                  |                |                |       |       |      |      |
| W, see <sup>226</sup> Th                     | 3E+2           | 2E+2           | 8E-8  | 3E-10 | —    | —    |
|                                              | LLI<br>(4E+2)  | —              | —     | —     | 5E-6 | 5E-5 |
| Y, see <sup>226</sup> Th                     | —              | 2E+2           | 6E-8  | 2E-10 | —    | —    |
| <b>AN 91</b>                                 |                |                |       |       |      |      |
| Protactinium-227 <sup>2</sup>                |                |                |       |       |      |      |
| W, all compounds except<br>those given for Y | 4E+3           | 1E+2           | 5E-8  | 2E-10 | 5E-5 | 5E-4 |
| Y, oxides and hydroxides                     | —              | 1E+2           | 4E-8  | 1E-10 | —    | —    |
| Protactinium-228                             |                |                |       |       |      |      |
| W, see <sup>227</sup> Pa                     | 1E+3           | 1E+1           | 5E-9  | —     | 2E-5 | 2E-4 |
|                                              | —              | Bone<br>(2E+1) | —     | 3E-11 | —    | —    |
| Y, see <sup>226</sup> Pa                     | —              | 1E+1           | 5E-9  | 2E-11 | —    | —    |

## Protactinium-230

|                          |                |      |      |       |      |      |
|--------------------------|----------------|------|------|-------|------|------|
| W, see $^{227}\text{Pa}$ | 6E+2           | 5E+0 | 2E-9 | 7E-12 | —    | —    |
|                          | Bone<br>(9E+2) | —    | —    | —     | 1E-5 | 1E-4 |
| Y, see $^{227}\text{Pa}$ | —              | 4E+0 | 1E-9 | 5E-12 | —    | —    |

## Protactinium-231

|                          |                |                |       |       |      |      |
|--------------------------|----------------|----------------|-------|-------|------|------|
| W, see $^{227}\text{Pa}$ | 2E-1           | 2E-3           | 6E-13 | —     | —    | —    |
|                          | Bone<br>(5E-1) | Bone<br>(4E-3) | —     | 6E-15 | 6E-9 | 6E-8 |
| Y, see $^{227}\text{Pa}$ | —              | 4E-3           | 2E-12 | —     | —    | —    |
|                          | —              | Bone<br>(6E-3) | —     | 8E-15 | —    | —    |

## Protactinium-232

|                          |      |                |      |       |      |      |
|--------------------------|------|----------------|------|-------|------|------|
| W, see $^{227}\text{Pa}$ | 1E+3 | 2E+1           | 9E-9 | —     | 2E-5 | 2E-4 |
|                          | —    | Bone<br>(6E+1) | —    | 8E-11 | —    | —    |
| Y, see $^{227}\text{Pa}$ | —    | 6E+1           | 2E-8 | —     | —    | —    |
|                          | —    | Bone<br>(7E+1) | —    | 1E-10 | —    | —    |

## Protactinium-233

|                          |               |      |      |       |      |      |
|--------------------------|---------------|------|------|-------|------|------|
| W, see $^{227}\text{Pa}$ | 1E+3          | 7E+2 | 3E-7 | 1E-9  | —    | —    |
|                          | LLI<br>(2E+3) | —    | —    | —     | 2E-5 | 2E-4 |
| Y, see $^{227}\text{Pa}$ | —             | 6E+2 | 2E-7 | 8E-10 | —    | —    |

## Protactinium-234

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see $^{227}\text{Pa}$ | 2E+3 | 8E+3 | 3E-6 | 1E-8 | 3E-5 | 3E-4 |
| Y, see $^{227}\text{Pa}$ | —    | 7E+3 | 3E-6 | 9E-9 | —    | —    |

**AN 92****Uranium-230**

|                                                                                                       |                |                |       |       |      |      |
|-------------------------------------------------------------------------------------------------------|----------------|----------------|-------|-------|------|------|
| D, UF <sub>6</sub> , UO <sub>2</sub> F <sub>2</sub> , UO <sub>2</sub> (NO <sub>3</sub> ) <sub>2</sub> | 4E+0           | 4E-1           | 2E-10 | —     | —    | —    |
|                                                                                                       | Bone<br>(6E+0) | Bone<br>(6E-1) | —     | 8E-13 | 8E-8 | 8E-7 |
| W, UO <sub>3</sub> , UF <sub>4</sub> , UCl <sub>4</sub>                                               | —              | 4E-1           | 1E-10 | 5E-13 | —    | —    |
| Y, UO <sub>2</sub> , U <sub>3</sub> O <sub>8</sub>                                                    | —              | 3E-1           | 1E-10 | 4E-13 | —    | —    |

**Uranium-231**

|                         |               |      |      |      |      |      |
|-------------------------|---------------|------|------|------|------|------|
| D, see <sup>230</sup> U | 5E+3          | 8E+3 | 3E-6 | 1E-8 | —    | —    |
|                         | LLI<br>(4E+3) | —    | —    | —    | 6E-5 | 6E-4 |
| W, see <sup>230</sup> U | —             | 6E+3 | 2E-6 | 8E-9 | —    | —    |
| Y, see <sup>230</sup> U | —             | 5E+3 | 2E-6 | 6E-9 | —    | —    |

**Uranium-232**

|                         |                |                |       |       |      |      |
|-------------------------|----------------|----------------|-------|-------|------|------|
| D, see <sup>230</sup> U | 2E+0           | 2E-1           | 9E-11 | —     | —    | —    |
|                         | Bone<br>(4E+0) | Bone<br>(4E-1) | —     | 6E-13 | 6E-8 | 6E-7 |
| W, see <sup>230</sup> U | —              | 4E-1           | 2E-10 | 5E-13 | —    | —    |
| Y, see <sup>230</sup> U | —              | 8E-3           | 3E-12 | 1E-14 | —    | —    |

**Uranium-233**

|                         |                |                |       |       |      |      |
|-------------------------|----------------|----------------|-------|-------|------|------|
| D, see <sup>230</sup> U | 1E+1           | 1E+0           | 5E-10 | —     | —    | —    |
|                         | Bone<br>(2E+1) | Bone<br>(2E+0) | —     | 3E-12 | 3E-7 | 3E-6 |
| W, see <sup>230</sup> U | —              | 7E-1           | 3E-10 | 1E-12 | —    | —    |
| Y, see <sup>230</sup> U | —              | 4E-2           | 2E-11 | 5E-14 | —    | —    |

**Uranium-234<sup>3</sup>**

|                         |      |      |       |   |   |   |
|-------------------------|------|------|-------|---|---|---|
| D, see <sup>230</sup> U | 1E+1 | 1E+0 | 5E-10 | — | — | — |
|-------------------------|------|------|-------|---|---|---|

|                          |                |                |       |       |      |      |
|--------------------------|----------------|----------------|-------|-------|------|------|
|                          | Bone<br>(2E+1) | Bone<br>(2E+0) | —     | 3E-12 | 3E-7 | 3E-6 |
| W, see $^{230}\text{U}$  | —              | 7E-1           | 3E-10 | 1E-12 | —    | —    |
| Y, see $^{230}\text{U}$  | —              | 4E-2           | 2E-11 | 5E-14 | —    | —    |
| Uranium-235 <sup>3</sup> |                |                |       |       |      |      |
| D, see $^{230}\text{U}$  | 1E+1           | 1E+0           | 6E-10 | —     | —    | —    |
|                          | Bone<br>(2E+1) | Bone<br>(2E+0) | —     | 3E-12 | 3E-7 | 3E-6 |
| W, see $^{230}\text{U}$  | —              | 8E-1           | 3E-10 | 1E-12 | —    | —    |
| Y, see $^{230}\text{U}$  | —              | 4E-2           | 2E-11 | 6E-14 | —    | —    |
| Uranium-236              |                |                |       |       |      |      |
| D, see $^{230}\text{U}$  | 1E+1           | 1E+0           | 5E-10 | —     | —    | —    |
|                          | Bone<br>(2E+1) | Bone<br>(2E+0) | —     | 3E-12 | 3E-7 | 3E-6 |
| W, see $^{230}\text{U}$  | —              | 8E-1           | 3E-10 | 1E-12 | —    | —    |
| Y, see $^{230}\text{U}$  | —              | 4E-2           | 2E-11 | 6E-14 | —    | —    |
| Uranium-237              |                |                |       |       |      |      |
| D, see $^{230}\text{U}$  | 2E+3           | 3E+3           | 1E-6  | 4E-9  | —    | —    |
|                          | LLI<br>(2E+3)  | —              | —     | —     | 3E-5 | 3E-4 |
| W, see $^{230}\text{U}$  | —              | 2E+3           | 7E-7  | 2E-9  | —    | —    |
| Y, see $^{230}\text{U}$  | —              | 2E+3           | 6E-7  | 2E-9  | —    | —    |
| Uranium-238 <sup>3</sup> |                |                |       |       |      |      |
| D, see $^{230}\text{U}$  | 1E+1           | 1E+0           | 6E-10 | —     | —    | —    |
|                          | Bone<br>(2E+1) | Bone<br>(2E+0) | —     | 3E-12 | 3E-7 | 3E-6 |
| W, see $^{230}\text{U}$  | —              | 8E-1           | 3E-10 | 1E-12 | —    | —    |
| Y, see $^{230}\text{U}$  | —              | 4E-2           | 2E-11 | 6E-14 | —    | —    |

Uranium-239<sup>2</sup>

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>230</sup> U | 7E+4 | 2E+5 | 8E-5 | 3E-7 | 9E-4 | 9E-3 |
| W, see <sup>230</sup> U | —    | 2E+5 | 7E-5 | 2E-7 | —    | —    |
| Y, see <sup>230</sup> U | —    | 2E+5 | 6E-5 | 2E-7 | —    | —    |

## Uranium-240

|                         |      |      |      |      |      |      |
|-------------------------|------|------|------|------|------|------|
| D, see <sup>230</sup> U | 1E+3 | 4E+3 | 2E-6 | 5E-9 | 2E-5 | 2E-4 |
| W, see <sup>230</sup> U | —    | 3E+3 | 1E-6 | 4E-9 | —    | —    |
| Y, see <sup>230</sup> U | —    | 2E+3 | 1E-6 | 3E-9 | —    | —    |

Uranium-natural<sup>3</sup>

|                         |                |                |       |       |      |      |
|-------------------------|----------------|----------------|-------|-------|------|------|
| D, see <sup>230</sup> U | 1E+1           | 1E+0           | 5E-10 | —     | —    | —    |
|                         | Bone<br>(2E+1) | Bone<br>(2E+0) | —     | 3E-12 | 3E-7 | 3E-6 |
| W, see <sup>230</sup> U | —              | 8E-1           | 3E-10 | 9E-13 | —    | —    |
| Y, see <sup>230</sup> U | —              | 5E-2           | 2E-11 | 9E-14 | —    | —    |

**AN 93**Neptunium-232<sup>2</sup>

|                  |      |                |      |      |      |      |
|------------------|------|----------------|------|------|------|------|
| W, all compounds | 1E+5 | 2E+3           | 7E-7 | —    | 2E-3 | 2E-2 |
|                  | —    | Bone<br>(5E+2) | —    | 6E-9 | —    | —    |

Neptunium-233<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 8E+5 | 3E+6 | 1E-3 | 4E-6 | 1E-2 | 1E-1 |
|------------------|------|------|------|------|------|------|

## Neptunium-234

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+3 | 3E+3 | 1E-6 | 4E-9 | 3E-5 | 3E-4 |
|------------------|------|------|------|------|------|------|

## Neptunium-235

|                            |                |                |       |       |      |      |
|----------------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds           | 2E+4           | 8E+2           | 3E-7  | —     | —    | —    |
|                            | LLI<br>(2E+4)  | Bone<br>(1E+3) | —     | 2E-9  | 3E-4 | 3E-3 |
| Neptunium-236 (1.15E+5 y)  |                |                |       |       |      |      |
| W, all compounds           | 3E+0           | 2E-2           | 9E-12 | —     | —    | —    |
|                            | Bone<br>(6E+0) | Bone<br>(5E-2) | —     | 8E-14 | 9E-8 | 9E-7 |
| Neptunium-236 (22.5 h)     |                |                |       |       |      |      |
| W, all compounds           | 3E+3           | 3E+1           | 1E-8  | —     | —    | —    |
|                            | Bone<br>(4E+3) | Bone<br>(7E+1) | —     | 1E-10 | 5E-5 | 5E-4 |
| Neptunium-237              |                |                |       |       |      |      |
| W, all compounds           | 5E-1           | 4E-3           | 2E-12 | —     | —    | —    |
|                            | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 1E-14 | 2E-8 | 2E-7 |
| Neptunium-238              |                |                |       |       |      |      |
| W, all compounds           | 1E+3           | 6E+1           | 3E-8  | —     | 2E-5 | 2E-4 |
|                            | —              | Bone<br>(2E+2) | —     | 2E-10 | —    | —    |
| Neptunium-239              |                |                |       |       |      |      |
| W, all compounds           | 2E+3           | 2E+3           | 9E-7  | 3E-9  | —    | —    |
|                            | LLI<br>(2E+3)  | —              | —     | —     | 2E-5 | 2E-4 |
| Neptunium-240 <sup>2</sup> |                |                |       |       |      |      |
| W, all compounds           | 2E+4           | 8E+4           | 3E-5  | 1E-7  | 3E-4 | 3E-3 |

**AN 94****Plutonium-234**

W, all compounds except

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| PuO <sub>2</sub> | 8E+3 | 2E+2 | 9E-8 | 3E-10 | 1E-4 | 1E-3 |
|------------------|------|------|------|-------|------|------|

|                     |   |      |      |       |   |   |
|---------------------|---|------|------|-------|---|---|
| Y, PuO <sub>2</sub> | — | 2E+2 | 8E-8 | 3E-10 | — | — |
|---------------------|---|------|------|-------|---|---|

**Plutonium-235<sup>2</sup>**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see <sup>234</sup> Pu | 9E+5 | 3E+6 | 1E-3 | 4E-6 | 1E-2 | 1E-1 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| Y, see <sup>234</sup> Pu | — | 3E+6 | 1E-3 | 3E-6 | — | — |
|--------------------------|---|------|------|------|---|---|

**Plutonium-236**

|                          |      |      |       |   |   |   |
|--------------------------|------|------|-------|---|---|---|
| W, see <sup>234</sup> Pu | 2E+0 | 2E-2 | 8E-12 | — | — | — |
|--------------------------|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(4E+0) | Bone<br>(4E-2) | — | 5E-14 | 6E-8 | 6E-7 |
|----------------|----------------|---|-------|------|------|

|                          |   |      |       |       |   |   |
|--------------------------|---|------|-------|-------|---|---|
| Y, see <sup>234</sup> Pu | — | 4E-2 | 2E-11 | 6E-14 | — | — |
|--------------------------|---|------|-------|-------|---|---|

**Plutonium-237**

|                          |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|
| W, see <sup>234</sup> Pu | 1E+4 | 3E+3 | 1E-6 | 5E-9 | 2E-4 | 2E-3 |
|--------------------------|------|------|------|------|------|------|

|                          |   |      |      |      |   |   |
|--------------------------|---|------|------|------|---|---|
| Y, see <sup>234</sup> Pu | — | 3E+3 | 1E-6 | 4E-9 | — | — |
|--------------------------|---|------|------|------|---|---|

**Plutonium-238**

|                          |      |      |       |   |   |   |
|--------------------------|------|------|-------|---|---|---|
| W, see <sup>234</sup> Pu | 9E-1 | 7E-3 | 3E-12 | — | — | — |
|--------------------------|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(2E+0) | Bone<br>(1E-2) | — | 2E-14 | 2E-8 | 2E-7 |
|----------------|----------------|---|-------|------|------|

|                          |   |      |       |       |   |   |
|--------------------------|---|------|-------|-------|---|---|
| Y, see <sup>234</sup> Pu | — | 2E-2 | 8E-12 | 2E-14 | — | — |
|--------------------------|---|------|-------|-------|---|---|

**Plutonium-239**

|                          |      |      |       |   |   |   |
|--------------------------|------|------|-------|---|---|---|
| W, see <sup>234</sup> Pu | 8E-1 | 6E-3 | 3E-12 | — | — | — |
|--------------------------|------|------|-------|---|---|---|

|                |                |   |       |      |      |
|----------------|----------------|---|-------|------|------|
| Bone<br>(1E+0) | Bone<br>(1E-2) | — | 2E-14 | 2E-8 | 2E-7 |
|----------------|----------------|---|-------|------|------|

|                          |   |      |       |   |   |   |
|--------------------------|---|------|-------|---|---|---|
| Y, see <sup>234</sup> Pu | — | 2E-2 | 7E-12 | — | — | — |
|--------------------------|---|------|-------|---|---|---|

|                          |                |                |       |       |      |      |
|--------------------------|----------------|----------------|-------|-------|------|------|
|                          | —              | Bone<br>(2E-2) | —     | 2E-14 | —    | —    |
| Plutonium-240            |                |                |       |       |      |      |
| W, see $^{234}\text{Pu}$ | 8E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                          | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |
| Y, see $^{234}\text{Pu}$ | —              | 2E-2           | 7E-12 | —     | —    | —    |
|                          | —              | Bone<br>(2E-2) | —     | 2E-14 | —    | —    |
| Plutonium-241            |                |                |       |       |      |      |
| W, see $^{234}\text{Pu}$ | 4E+1           | 3E-1           | 1E-10 | —     | —    | —    |
|                          | Bone<br>(7E+1) | Bone<br>(6E-1) | —     | 8E-13 | 1E-6 | 1E-5 |
| Y, see $^{234}\text{Pu}$ | —              | 8E-1           | 3E-10 | —     | —    | —    |
|                          | —              | Bone<br>(1E+0) | —     | 1E-12 | —    | —    |
| Plutonium-242            |                |                |       |       |      |      |
| W, see $^{234}\text{Pu}$ | 8E-1           | 7E-3           | 3E-12 | —     | —    | —    |
|                          | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |
| Y, see $^{234}\text{Pu}$ | —              | 2E-2           | 7E-12 | —     | —    | —    |
|                          | —              | Bone<br>(2E-2) | —     | 2E-14 | —    | —    |
| Plutonium-243            |                |                |       |       |      |      |
| W, see $^{234}\text{Pu}$ | 2E+4           | 4E+4           | 2E-5  | 5E-8  | 2E-4 | 2E-3 |
| Y, see $^{234}\text{Pu}$ | —              | 4E+4           | 2E-5  | 5E-8  | —    | —    |
| Plutonium-244            |                |                |       |       |      |      |

|                            |                |                |       |       |      |           |
|----------------------------|----------------|----------------|-------|-------|------|-----------|
| 121                        | REVISOR        |                |       |       |      | 4731.2750 |
| W, see <sup>234</sup> Pu   | 8E-1           | 7E-3           | 3E-12 | —     | —    | —         |
|                            | Bone<br>(2E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7      |
| Y, see <sup>234</sup> Pu   | —              | 2E-2           | 7E-12 | —     | —    | —         |
|                            | —              | Bone<br>(2E-2) | —     | 2E-14 | —    | —         |
| Plutonium-245              |                |                |       |       |      |           |
| W, see <sup>234</sup> Pu   | 2E+3           | 5E+3           | 2E-6  | 6E-9  | 3E-5 | 3E-4      |
| Y, see <sup>234</sup> Pu   | —              | 4E+3           | 2E-6  | 6E-9  | —    | —         |
| Plutonium-246              |                |                |       |       |      |           |
| W, see <sup>234</sup> Pu   | 4E+2           | 3E+2           | 1E-7  | 4E-10 | —    | —         |
|                            | LLI<br>(4E+2)  | —              | —     | —     | 6E-6 | 6E-5      |
| Y, see <sup>234</sup> Pu   | —              | 3E+2           | 1E-7  | 4E-10 | —    | —         |
| <b>AN 95</b>               |                |                |       |       |      |           |
| Americium-237 <sup>2</sup> |                |                |       |       |      |           |
| W, all compounds           | 8E+4           | 3E+5           | 1E-4  | 4E-7  | 1E-3 | 1E-2      |
| Americium-238 <sup>2</sup> |                |                |       |       |      |           |
| W, all compounds           | 4E+4           | 3E+3           | 1E-6  | —     | 5E-4 | 5E-3      |
|                            | —              | Bone<br>(6E+3) | —     | 9E-9  | —    | —         |
| Americium-239              |                |                |       |       |      |           |
| W, all compounds           | 5E+3           | 1E+4           | 5E-6  | 2E-8  | 7E-5 | 7E-4      |
| Americium-240              |                |                |       |       |      |           |
| W, all compounds           | 2E+3           | 3E+3           | 1E-6  | 4E-9  | 3E-5 | 3E-4      |

## Americium-241

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 8E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |

## Americium-242m

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 8E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |

## Americium-242

|                  |      |                |      |       |      |      |
|------------------|------|----------------|------|-------|------|------|
| W, all compounds | 4E+3 | 8E+1           | 4E-8 | —     | 5E-5 | 5E-4 |
|                  | —    | Bone<br>(9E+1) | —    | 1E-10 | —    | —    |

## Americium-243

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 8E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |

Americium-244m<sup>2</sup>

|                  |                |                |      |      |      |      |
|------------------|----------------|----------------|------|------|------|------|
| W, all compounds | 6E+4           | 4E+3           | 2E-6 | —    | —    | —    |
|                  | Stom<br>(8E+4) | Bone<br>(7E+3) | —    | 1E-8 | 1E-3 | 1E-2 |

## Americium-244

|                  |      |                |      |       |      |      |
|------------------|------|----------------|------|-------|------|------|
| W, all compounds | 3E+3 | 2E+2           | 8E-8 | —     | 4E-5 | 4E-4 |
|                  | —    | Bone<br>(3E+2) | —    | 4E-10 | —    | —    |

## Americium-245

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 3E+4 | 8E+4 | 3E-5 | 1E-7 | 4E-4 | 4E-3 |
|------------------|------|------|------|------|------|------|

Americium-246m<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 5E+4 | 2E+5 | 8E-5 | 3E-7 | —    | —    |
| Stom<br>(6E+4)   | —    | —    | —    | —    | 8E-4 | 8E-3 |

Americium-246<sup>2</sup>

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 3E+4 | 1E+5 | 4E-5 | 1E-7 | 4E-4 | 4E-3 |
|------------------|------|------|------|------|------|------|

**AN 96**

## Curium-238

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+4 | 1E+3 | 5E-7 | 2E-9 | 2E-4 | 2E-3 |
|------------------|------|------|------|------|------|------|

## Curium-240

|                  |      |                |       |       |      |      |
|------------------|------|----------------|-------|-------|------|------|
| W, all compounds | 6E+1 | 6E-1           | 2E-10 | —     | —    | —    |
| Bone<br>(8E+1)   | —    | Bone<br>(6E-1) | —     | 9E-13 | 1E-6 | 1E-5 |

## Curium-241

|                  |      |                |      |       |      |      |
|------------------|------|----------------|------|-------|------|------|
| W, all compounds | 1E+3 | 3E+1           | 1E-8 | —     | 2E-5 | 2E-4 |
| —                | —    | Bone<br>(4E+1) | —    | 5E-11 | —    | —    |

## Curium-242

|                  |      |                |       |       |      |      |
|------------------|------|----------------|-------|-------|------|------|
| W, all compounds | 3E+1 | 3E-1           | 1E-10 | —     | —    | —    |
| Bone<br>(5E+1)   | —    | Bone<br>(3E-1) | —     | 4E-13 | 7E-7 | 7E-6 |

## Curium-243

|                  |      |                |       |       |      |      |
|------------------|------|----------------|-------|-------|------|------|
| W, all compounds | 1E+0 | 9E-3           | 4E-12 | —     | —    | —    |
| Bone<br>(2E+0)   | —    | Bone<br>(2E-2) | —     | 2E-14 | 3E-8 | 3E-7 |

## Curium-244

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 1E+0           | 1E-2           | 5E-12 | —     | —    | —    |
|                  | Bone<br>(3E+0) | Bone<br>(2E-2) | —     | 3E-14 | 3E-8 | 3E-7 |

## Curium-245

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 7E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |

## Curium-246

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 7E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |

## Curium-247

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 8E-1           | 6E-3           | 3E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(1E-2) | —     | 2E-14 | 2E-8 | 2E-7 |

## Curium-248

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 2E-1           | 2E-3           | 7E-13 | —     | —    | —    |
|                  | Bone<br>(4E-1) | Bone<br>(3E-3) | —     | 4E-15 | 5E-9 | 5E-8 |

Curium-249<sup>2</sup>

|                  |      |                |      |      |      |      |
|------------------|------|----------------|------|------|------|------|
| W, all compounds | 5E+4 | 2E+4           | 7E-6 | —    | 7E-4 | 7E-3 |
|                  | —    | Bone<br>(3E+4) | —    | 4E-8 | —    | —    |

## Curium-250

|                  |                |                |       |       |       |      |
|------------------|----------------|----------------|-------|-------|-------|------|
| W, all compounds | 4E-2           | 3E-4           | 1E-13 | —     | —     | —    |
|                  | Bone<br>(6E-2) | Bone<br>(5E-4) | —     | 8E-16 | 9E-10 | 9E-9 |

**AN 97**

## Berkelium-245

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 2E+3 | 1E+3 | 5E-7 | 2E-9 | 3E-5 | 3E-4 |
|------------------|------|------|------|------|------|------|

## Berkelium-246

|                  |      |      |      |      |      |      |
|------------------|------|------|------|------|------|------|
| W, all compounds | 3E+3 | 3E+3 | 1E-6 | 4E-9 | 4E-5 | 4E-4 |
|------------------|------|------|------|------|------|------|

## Berkelium-247

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 5E-1           | 4E-3           | 2E-12 | —     | —    | —    |
|                  | Bone<br>(1E+0) | Bone<br>(9E-0) | —     | 1E-14 | 2E-8 | 2E-7 |

## Berkelium-249

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 2E+2           | 2E+0           | 7E-10 | —     | —    | —    |
|                  | Bone<br>(5E+2) | Bone<br>(4E+0) | —     | 5E-12 | 6E-6 | 6E-5 |

## Berkelium-250

|                  |      |                |      |      |      |      |
|------------------|------|----------------|------|------|------|------|
| W, all compounds | 9E+3 | 3E+2           | 1E-7 | —    | 1E-4 | 1E-3 |
|                  | —    | Bone<br>(7E+2) | —    | 1E-9 | —    | —    |

**AN 98**Californium-244<sup>2</sup>

|                                              |                |      |      |       |      |      |
|----------------------------------------------|----------------|------|------|-------|------|------|
| W, all compounds except<br>those given for Y | 3E+4           | 6E+2 | 2E-7 | 8E-10 | —    | —    |
|                                              | Stom<br>(3E+4) | —    | —    | —     | 4E-4 | 4E-3 |

|                          |                |                |        |       |      |      |
|--------------------------|----------------|----------------|--------|-------|------|------|
| Y, oxides and hydroxides | —              | 6E+2           | 2E-7   | 8E-10 | —    | —    |
| Californium-246          |                |                |        |       |      |      |
| W, see <sup>244</sup> Cf | 4E+2           | 9E+0           | 4E-9   | 1E-11 | 5E-6 | 5E-5 |
| Y, see <sup>244</sup> Cf | —              | 9E+0           | 4E-9   | 1E-11 | —    | —    |
| Californium-248          |                |                |        |       |      |      |
| W, see <sup>244</sup> Cf | 8E+0           | 6E-2           | 3E-11  | —     | —    | —    |
|                          | Bone<br>(2E+1) | Bone<br>(1E-1) | —      | 2E-13 | 2E-7 | 2E-6 |
| Y, see <sup>244</sup> Cf | —              | 1E-1           | 4E-11  | 1E-13 | —    | —    |
| Californium-249          |                |                |        |       |      |      |
| W, see <sup>244</sup> Cf | 5E-1           | 4E-3           | 24E-12 | —     | —    | —    |
|                          | Bone<br>(1E+0) | Bone<br>(9E-3) | —      | 1E-14 | 2E-8 | 2E-7 |
| Y, see <sup>244</sup> Cf | —              | 1E-2           | 4E-12  | —     | —    | —    |
|                          | —              | Bone<br>(1E-2) | —      | 2E-14 | —    | —    |
| Californium-250          |                |                |        |       |      |      |
| W, see <sup>244</sup> Cf | 1E+0           | 9E-3           | 4E-12  | —     | —    | —    |
|                          | Bone<br>(2E+0) | Bone<br>(2E-2) | —      | 3E-14 | 3E-8 | 3E-7 |
| Y, see <sup>244</sup> Cf | —              | 3E-2           | 1E-11  | 4E-14 | —    | —    |
| Californium-251          |                |                |        |       |      |      |
| W, see <sup>244</sup> Cf | 5E-1           | 4E-3           | 2E-12  | —     | —    | —    |
|                          | Bone<br>(1E+0) | Bone<br>(9E-3) | —      | 1E-14 | 2E-8 | 2E-7 |
| Y, see <sup>244</sup> Cf | —              | 1E-2           | 4E-12  | —     | —    | —    |

|                          |                |                |       |       |      |      |
|--------------------------|----------------|----------------|-------|-------|------|------|
|                          | —              | Bone<br>(1E-2) | —     | 2E-14 | —    | —    |
| Californium-252          |                |                |       |       |      |      |
| W, see <sup>244</sup> Cf | 2E+0           | 2E-2           | 8E-12 | —     | —    | —    |
|                          | Bone<br>(5E+0) | Bone<br>(4E-2) | —     | 5E-14 | 7E-8 | 7E-7 |
| Y, see <sup>244</sup> Cf | —              | 3E-2           | 1E-11 | 5E-14 | —    | —    |
| Californium-253          |                |                |       |       |      |      |
| W, see <sup>244</sup> Cf | 2E+2           | 2E+0           | 8E-10 | 3E-12 | —    | —    |
|                          | Bone<br>(4E+2) | —              | —     | —     | 5E-6 | 5E-5 |
| Y, see <sup>244</sup> Cf | —              | 2E+0           | 7E-10 | 2E-12 | —    | —    |
| Californium-254          |                |                |       |       |      |      |
| W, see <sup>244</sup> Cf | 2E+0           | 2E-2           | 9E-12 | 3E-14 | 3E-8 | 3E-7 |
| Y, see <sup>244</sup> Cf | —              | 2E-2           | 7E-12 | 2E-14 | —    | —    |
| <b>AN 99</b>             |                |                |       |       |      |      |
| Einsteinium-250          |                |                |       |       |      |      |
| W, all compounds         | 4E+4           | 5E+2           | 2E-7  | —     | 6E-4 | 6E-3 |
|                          | —              | Bone<br>(1E+3) | —     | 2E-9  | —    | —    |
| Einsteinium-251          |                |                |       |       |      |      |
| W, all compounds         | 7E+3           | 9E+2           | 4E-7  | —     | 1E-4 | 1E-3 |
|                          | —              | Bone<br>(1E+3) | —     | 2E-9  | —    | —    |
| Einsteinium-253          |                |                |       |       |      |      |
| W, all compounds         | 2E+2           | 1E+0           | 6E-10 | 2E-12 | 2E-6 | 2E-5 |

## Einsteinium-254m

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 3E+2 | 1E+1 | 4E-9 | 1E-11 | —    | —    |
| LLI<br>(3E+2)    | —    | —    | —    | —     | 4E-6 | 4E-5 |

## Einsteinium-254

|                  |                |      |       |       |      |      |
|------------------|----------------|------|-------|-------|------|------|
| W, all compounds | 8E+0           | 7E-2 | 3E-11 | —     | —    | —    |
| Bone<br>(2E+1)   | Bone<br>(1E-1) | —    | —     | 2E-13 | 2E-7 | 2E-6 |

**AN 100**

## Fermium-252

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 5E+2 | 1E+1 | 5E-9 | 2E-11 | 6E-6 | 6E-5 |
|------------------|------|------|------|-------|------|------|

## Fermium-253

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 1E+3 | 1E+1 | 4E-9 | 1E-11 | 1E-5 | 1E-4 |
|------------------|------|------|------|-------|------|------|

## Fermium-254

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 3E+3 | 9E+1 | 4E-8 | 1E-10 | 4E-5 | 4E-4 |
|------------------|------|------|------|-------|------|------|

## Fermium-255

|                  |      |      |      |       |      |      |
|------------------|------|------|------|-------|------|------|
| W, all compounds | 5E+2 | 2E+1 | 9E-9 | 3E-11 | 7E-6 | 7E-5 |
|------------------|------|------|------|-------|------|------|

## Fermium-257

|                  |                |      |       |       |      |      |
|------------------|----------------|------|-------|-------|------|------|
| W, all compounds | 2E+1           | 2E-1 | 7E-11 | —     | —    | —    |
| Bone<br>(4E+1)   | Bone<br>(2E-1) | —    | —     | 3E-13 | 5E-7 | 5E-6 |

**AN 101**

## Mendelevium-257

|                  |      |                |      |       |      |      |
|------------------|------|----------------|------|-------|------|------|
| W, all compounds | 7E+3 | 8E+1           | 4E-8 | —     | 1E-4 | 1E-3 |
|                  | —    | Bone<br>(9E+1) | —    | 1E-10 | —    | —    |

## Mendelevium-258

|                  |                |                |       |       |      |      |
|------------------|----------------|----------------|-------|-------|------|------|
| W, all compounds | 3E+1           | 2E-1           | 1E-10 | —     | —    | —    |
|                  | Bone<br>(5E+1) | Bone<br>(3E-1) | —     | 5E-13 | 6E-7 | 6E-6 |

—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

|                         |   |      |      |      |   |   |
|-------------------------|---|------|------|------|---|---|
| Submersion <sup>1</sup> | — | 2E+2 | 1E-7 | 1E-9 | — | — |
|-------------------------|---|------|------|------|---|---|

—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

|  |   |      |       |       |      |      |
|--|---|------|-------|-------|------|------|
|  | — | 2E-1 | 1E-10 | 1E-12 | 1E-8 | 1E-7 |
|--|---|------|-------|-------|------|------|

—Any single radionuclide not listed above that decays by alpha emission or spontaneous fission or any mixture for which either the identity or the concentration of any radionuclide in the mixture is not known

|  |   |      |       |       |      |      |
|--|---|------|-------|-------|------|------|
|  | — | 4E-4 | 2E-13 | 1E-15 | 2E-9 | 2E-8 |
|--|---|------|-------|-------|------|------|

## FOOTNOTES:

<sup>1</sup> "Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material.

<sup>2</sup> These radionuclides have radiological half-lives of less than two hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The DAC values for all radionuclides, other than those designated Class "Submersion," are based upon the committed effective dose equivalent due to the intake of the radionuclide into the body and do not include potentially significant contributions to dose equivalent from external exposures. The licensee may substitute  $1\text{E-}7$   $\mu\text{Ci/ml}$  for the listed DAC to account for the submersion dose prospectively, but must use individual monitoring devices or other radiation measuring instruments that measure external exposure to demonstrate compliance with the limits according to part 4731.2040.

<sup>3</sup> For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor according to part 4731.2020, subpart 5. If the percent by weight (enrichment) of U-235 is not greater than five, the concentration value for a 40-hour work week is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour work week must not exceed  $8\text{E-}3$  (SA)  $\mu\text{Ci-hr/ml}$ , where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is  $6.77\text{E-}7$  curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, is:

$$\text{SA} = 3.6\text{E-}7 \text{ curies/gram U U-depleted}$$

$$\text{SA} = [0.4 + 0.38 (\text{enrichment}) + 0.0034 (\text{enrichment})^2] \text{E-}6, \text{ enrichment} > 0.72$$

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

**Subp. 8. Additional explanations.**

A. If the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture is the most restrictive DAC of any radionuclide in the mixture.

B. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this part are not present in the mixture, the inhalation ALI, DAC, and effluent and sewage concentrations for the mixture are the lowest values specified in this part for any radionuclide that is not known to be absent from the mixture; or

| Radionuclide and Class | Table<br>1 |   |   | Table<br>2 |   | Table<br>3 |
|------------------------|------------|---|---|------------|---|------------|
|                        | 1          | 2 | 3 | 1          | 2 | 3          |

If it is known that Ac-227-D and Cm-250-W  
are not present

— 7E-4 3E-13 — — —

If, in addition, it is known that Ac-227-W,  
Y; Th-229-W, Y; Th-230-W; Th-232-W,  
Y; Pa-231-W, Y; Np-237-W; Pu-239-W;  
Pu-240-W; Pu-242-W; Am-241-W;  
Am-242m-W; Am-243-W; Cm-245-W;  
Cm-246-W; Cm-247-W; Cm-248-W;  
Bk-247-W; Cf-249-W; and Cf-251-W are  
not present

— 7E-3 3E-12 — — —

If, in addition, it is known that Sm-146-W;  
Sm-147-W; Gd-148-D, W; Gd-152-D,  
W; Th-228-W, Y; Th-230-Y; U-232-Y;  
U-233-Y; U-234-Y; U-235-Y; U-236-Y;  
U-238-Y; Np-236-W; Pu-236-W, Y;  
Pu-238-W, Y; Pu-239-Y; Pu-240-Y;  
Pu-242-Y; Pu-244-W, Y; Cm-243-W;  
Cm-244-W; Cf-248-W; Cf-249-Y;  
Cf-250-W, Y; Cf-251-Y; Cf-252-W, Y; and  
Cf-254-W, Y are not present

— 7E-2 3E-11 — — —

If, in addition, it is known that Pb-210-D;  
Bi-210m-W; Po-210-D, W; Ra-223-W;  
Ra-225-W; Ra-226-W; Ac-225-D, W, Y;  
Th-227-W, Y; U-230-D, W, Y; U-232-D,  
W; Pu-241-W; Cm-240-W; Cm-242-W;  
Cf-248-Y; Es-254-W; Fm-257-W; and  
Md-258-W are not present

— 7E-1 3E-10 — — —

If, in addition, it is known that Si-32-Y;  
Ti-44-Y; Fe-60-D; Sr-90-Y; Zr-93-D;  
Cd-113m-D; Cd-113-D; In-115-D, W;  
La-138-D; Lu-176-W; Hf-178m-D, W;  
Hf-182-D, W; Bi-210m-D; Ra-224-W;  
Ra-228-W; Ac-226-D, W, Y; Pa-230-W,  
Y; U-233-D, W; U-234-D, W; U-235-D,  
W; U-236-D, W; U-238-D, W; Pu-241-Y;

— 7E-0 3E-9 — — —

Bk-249-W; Cf-253-W, Y; and Es-253-W  
are not present

If it is known that Ac-227-D, W, Y;  
Th-229-W, Y; Th-232-W, Y; Pa-231-W, Y;  
Cm-248-W; and Cm-250-W are not present — — — 1E-14 — —

If, in addition, it is known that Sm-146-W;  
Gd-148-D, W; Gd-152-D; Th-228-W, Y;  
Th-230-W, Y; U-232-Y; U-233-Y; U-234-Y;  
U-235-Y; U-236-Y; U-238-Y; U-Nat-Y;  
Np-236-W; Np-237-W; Pu-236-W, Y;  
Pu-238-W, Y; Pu-239-W, Y; Pu-240-W, Y;  
Pu-242-W, Y; Pu-244-W, Y; Am-241-W;  
Am-242m-W; Am-243-W; Cm-243-W;  
Cm-244-W; Cm-245-W; Cm-246-W;  
Cm-247-W; Bk-247-W; Cf-249-W, Y;  
Cf-250-W, Y; Cf-251-W, Y; Cf-252-W, Y;  
and Cf-254-W, Y are not present — — — 1E-13 — —

If, in addition, it is known that Sm-147-W;  
Gd-152-W; Pb-210-D; Bi-210m-W;  
Po-210-D, W; Ra-223-W; Ra-225-W;  
Ra-226-W; Ac-225-D, W, Y; Th-227-W, Y;  
U-230-D, W, Y; U-232-D, W; U-Nat-W;  
Pu-241-W; Cm-240-W; Cf-242-W;  
Cf-248-W, Y; Es-254-W; Fm-257-W; and  
Md-258-W are not present — — — 1E-12 — —

If, in addition, it is known that Fe-60; Sr-90;  
Cd-113m; Cd-113; In-115; I-129; Cs-134;  
Sm-145; Sm-147; Gd-148; Gd-152;  
Hg-194 (organic); Bi-210m; Ra-223;  
Ra-224; Ra-225; Ac-225; Th-228; Th-230;  
U-233; U-234; U-235; U-236; U-238;  
U-Nat; Cm-242; Cf-248; Es-254; Fm-257;  
and Md-258 are not present — — — — 1E-6 1E-5

C. If a mixture of radionuclides consists of uranium and its daughters in ore dust  
(10 µm AMAD particle distribution assumed) prior to chemical separation of the uranium

from the ore, the following values may be used for the DAC of the mixture: 6E-11  $\mu\text{Ci}$  of gross alpha activity from uranium-238, uranium-234, thorium-230, and radium-226 per milliliter of air; 3E-11  $\mu\text{Ci}$  of natural uranium per milliliter of air; or 45 micrograms of natural uranium per cubic meter of air.

D. If the identity and concentration of each radionuclide in a mixture are known, the limiting values should be derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in this part for the specific radionuclide when not in a mixture. The sum of such ratios for all of the radionuclides in the mixture may not exceed one.

Example: If radionuclides A, B, and C are present in concentrations  $C_A$ ,  $C_B$ ,  $C_C$ , and if the applicable DACs are  $\text{DAC}_A$ ,  $\text{DAC}_B$ , and  $\text{DAC}_C$ , respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{\text{DAC}_A} + \frac{C_B}{\text{DAC}_B} + \frac{C_C}{\text{DAC}_C} < 1$$

**Statutory Authority:** *MS s 144.1202; 144.1203*

**History:** *29 SR 755; 33 SR 1440*

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