

Radiation unit conversions

Units

The SI unit for radiation is the Bq (Becquerel) and equals the number of atoms inside a source that decay per second. Often, source strength is given in Bq per mass unit (Bq/kg). For natural radiation, other units like ppm, % or even pCi/g are used. One should be careful translating from Bq/kg to ppm's. Often people overlook whether the conversion was done assuming pure radionuclides or oxides.

Conversion from Bq/kg to ppm and %

The following table lists the conversion between Bq/kg to ppms

Nuclide	To %/ppm	To %/ppm oxides
40-K	1 Bq/kg = 1/316%	1 Bq/kg = 1/262% K ₂ O
238-U	1 Bq/kg = 1/12.3 ppm	1 Bq/kg = 1/10.4 ppm U ₃ O ₈
232-Th	1 Bq/kg = 1/4.1 ppm	1 Bq/kg = 1/3.55 ppm ThO ₂

To Curies

For conversion between becquerel (Bq) and the (much older) curie (Ci) the following holds:

$$1 \text{ Bq} = 27 \text{ pCi} = 2.7 \times 10^{-11} \text{ Ci}$$

$$1 \text{ pCi} = 0.037 \text{ Bq}$$

Interestingly, the Bq has the same SI unit (s^{-1}) as the Hertz (Hz). However, the difference being that 1 Hz describes a truly periodic phenomenon whereas the Bq is purely stochastic.

To gray or sievert

There is a difference between radioactivity of a radioactive source and the radiation dose which may result from this source. The radiation dose depends on the following factors:

- Activity of the source, in units Bq or Bq/kg;
- Type of radiation;
- Time;
- Distance;
- Shielding.

Converting becquerel (Bq) or becquerel per kilogram (Bq/kg) to gray (Gy) or sievert (Sv) is therefore not straightforward and often not possible. Becquerel is a unit for radiation, while gray and sievert are both units for absorbed radiation dose. The gray is a physical quantity, where 1 Gy is the deposit of 1 joule of radiation energy in 1 kg of matter or tissue. The sievert represents the equivalent biological effect of the deposit of 1 joule of radiation energy in 1 kilogram of human tissue.