

Radiation Terms and Units

There are different but interrelated units for measuring radioactivity and estimating health effects.

Radioactivity

Radioactivity

Radioactivity is the **release of radiation** by a material.

Radioactivity is the release of ionizing radiation when the nucleus of a radioactive atom decays. Activity refers to the frequency of radioactive decay produced by a radioactive material. Different types of ionizing radiation have the potential to damage human tissue.

Use

Measuring soil, water and air samples

Units

Bq | becquerels international unit
 Ci | curies U.S. unit
 1 becquerel (Bq) = 2.703×10^{-11} curie (Ci)
 1 curie (Ci) = 3.7×10^{10} becquerel (Bq)
 1 kilobecquerel (kBq) = 1,000 Bq
 1 picocurie (pCi) = 0.000 000 000 001 Ci

Examples

Surface water natural radium-226 level: 0.0037 to 0.0185 Bq per liter (L) or 0.1 to 0.5 pCi/L
 Drinking water radium limit for daily consumption: 0.185 Bq/L or 5.0 pCi/L



Absorbed Dose

Absorbed dose measures ionizing **radiation absorbed**.

RADIATION PASSES THROUGH A HUMAN

SOME RADIATION DEPOSITED IN HUMAN TISSUE

Absorbed dose describes the amount of energy deposited per unit mass in an object or person.

Use

Measuring dose from medical equipment

Units

Gy | gray international unit
 rad | rad U.S. unit
 1 milligray (mGy) = 0.001 Gy
 1 rad = 0.01 gray (Gy)
 1 milligray (mGy) = 0.001 Gy

Examples

Dose to the lens of eyes from a brain CT scan: about 60 mGy or 6 rad
 Dose to the thyroid from a chest CT scan: about 10 mGy or 1 rad



Effective Dose

Effective dose indicates radiation **health effects** for a population.

ABSORBED DOSE

FACTOR IN

TYPE OF RADIATION
 α β γ etc...
 alpha beta gamma

ORGAN SENSITIVE
 lungs colon stomach etc...

EFFECTIVE DOSE

Effective dose takes the absorbed dose (see above) and adjusts it for radiation type and relative organ sensitivity. The result is an **indicator for the potential for long-term health effects** (i.e., cancer and hereditary effects) from an exposure. It is **used to set regulatory limits** that protect against long-term health effects in a population. It also allows experts to compare anticipated health effects from different exposure situations. Because this value is a calculated approximation, not a physical quantity, it cannot be used to predict individual health effects.

Use

Used to set protective levels for groups of people

Units

Sv | sievert international unit
 rem | rem U.S. unit
 1 sievert (Sv) = 100 rem
 1 rem = 0.01 sievert (Sv)
 1 millisievert (mSv) = 0.001 Sv
 1 microsievert (μ Sv) = 0.000 001 Sv
 1 millirem (mrem) = 0.001 rem

Examples

Worker radiation limit annual dose limit: 0.05 Sv or 5 rem

Evacuate/shelter in place guidance for emergencies: needed if projected dose exceeds 10-50 mSv or 1-5 rem over four days



Reference Material

Sources for Radioactivity Unit Examples



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