

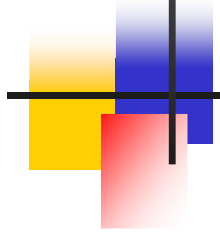
Activity of Radiation

The **activity** of a radioactive source is the average **number of nuclei decaying per unit time**.

$$A = \frac{N}{t}$$

activity (Bq) number of nuclei decaying (no unit) time (s)

1 becquerel (Bq) = 1 decay per second



Absorbed Dose

When tissue is exposed to radiation, the **absorbed dose** is the **energy absorbed per unit mass** of tissue.

$$D = \frac{E}{m}$$

absorbed dose (Gray, Gy)

energy (J)

mass (kg)

1 gray (Gy) = 1 joule per kilogram

The risk of biological **harm** to tissue depends on

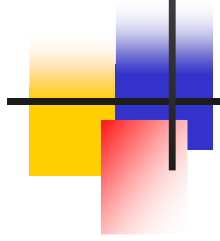
- absorbed **dose**
- **type** of radiation
- body organ / **tissue** exposed.

Weighting Factor

The radiation weighting factor (W_R) is a measure of the biological effect of the radiation.

<u>Radiation</u>	<u>Weighting Factor</u>
α particle	20
fast neutrons	10
gamma rays	1

Weighting factor has **no unit**.



Equivalent Dose

The **equivalent dose** is a measure of the **biological damage** caused by radiation on living tissue.

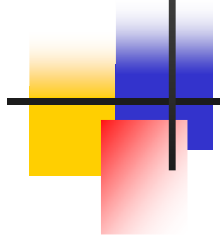
Equivalent dose is the **product** of **absorbed dose** and **radiation weighting factor**.

$$H = D W_R$$

equivalent dose
(Sievert, Sv)

weighting factor

absorbed dose
(Gray, Gy)



Equivalent Dose Rate

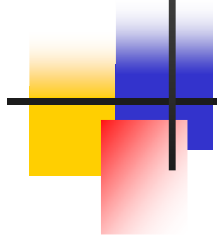
Equivalent dose rate is the **dose** per unit **time**.

$$\dot{H} = \frac{H}{t}$$

equivalent dose rate
(Sv s⁻¹, Sv h⁻¹)

equivalent dose
(Sievert, Sv)

time
(s, mins, h)



Background Radiation

Every day we are exposed to small amounts of radiation known as background radiation.

The average annual effective dose for people in the UK is 2 mSv.

<u>Background Radiation</u>	<u>Effective Dose</u>
Cosmic rays from space.	0.3 mSv
Radioactivity from rocks & soil	0.3 mSv
Radioactivity from human body	0.4 mSv
Inhaled radon gas	1.0 mSv

Exposure Limits

For the **general public**, the limit is **5 mSv** per year in addition to background radiation.

Workers who are exposed to **radiation** during their employment, the limit is **50 mSv** per year in addition to background radiation.



Reducing Exposure

The **equivalent dose rate** from a radioactive source is **reduced** by

- **shielding** (placing an absorber in the path of radiation)
- **increasing distance** from the source.

The **reduction** in equivalent dose rate **depends** on the **material** and **thickness** of absorber used.