



# Ionising Radiation

**There are several types of ionising radiation:**

**Alpha particles** consist of two protons and two neutrons, in the form of atomic nuclei. They thus have a positive electrical charge and are emitted from naturally occurring heavy elements such as uranium and radium, as well as from

some man-made elements. Because of their relatively large size, alpha particles collide readily with matter and lose their energy quickly. They therefore have little penetrating power and can be stopped by the first layer of skin or a sheet of paper.

However, if alpha sources are taken into the body, for example by breathing or swallowing radioactive dust, alpha particles can affect the body's cells. Inside the body, because they give up their energy over a relatively short distance, alpha particles can inflict more severe biological damage than other radiations.

**Beta particles** are fast-moving electrons ejected from the nuclei of atoms. These particles are much smaller than alpha particles and can penetrate up to 1 to 2 centimetres of water or human flesh. Beta particles are emitted from many radioactive elements. They can be stopped by a sheet of aluminium a few millimetres thick.

**X-rays and gamma rays**, like light, represent energy transmitted in a wave without the movement of material, just as heat and light from a fire or the sun travels through space. X-rays and gamma rays are virtually identical except that X-rays are generally produced artificially rather than coming from the atomic nucleus. Unlike light, X-rays and gamma rays have great penetrating power and can pass through the human body. Thick barriers of concrete, lead or water are used as protection from them.

**Cosmic radiation** consists of very energetic particles including protons which bombard the earth from outer space. It is more intense at higher altitudes than at sea level where the earth's atmosphere is most dense and gives the greatest protection.

**Neutrons** are particles which are also very penetrating. On Earth they mostly come from the splitting, or fissioning, of certain atoms inside a nuclear reactor. Water and concrete are the most commonly used shields against neutron radiation from the core of the nuclear reactor.

It is important to understand that alpha, beta, gamma and X-radiation does not cause the body to become radioactive. However, most materials in their natural state (including body tissue) contain measurable amounts of radioactivity.

