Radiation in Daily Life

Security Bureau

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What is radiation?

Radiation is a way of energy transfer between matters. It is a fact of life. Since the start of time, lives on the Earth have been exposed to radiation in the natural environment. Most radiation cannot be felt, smelled, seen, heard or tasted. However, with the use of instruments, it can be detected and measured.

There are two types of radiation:

- non-ionising radiation – e.g. visible light, signals from mobile phones, and radio waves;

- ionising radiation - e.g. radiation emissions from uranium ore, and high-frequency waves in the electromagnetic spectrum such as x-rays.

Each type of ionising radiation is capable of disrupting stable atoms and causing them to have an imbalance of charge (ionisation). This can cause chemical changes in the cells of living matter, which can cause harm to people's health depending on the radiation dose received.

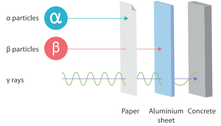
In general, the most common types of ionising radiation are:

Alpha (α) particles have little power of penetration and can be easily stopped by a sheet of paper or the outer layer of the skin. However, alpha emitting materials are harmful to health if they enter the body by inhalation or along with food or drinks.

Beta (β) particles are generally high speed electrons and are more penetrating than alpha particles. A sheet of aluminium of a few mm thick can stop beta particles.

X-rays and gamma (γ) rays are both very penetrating and can pass right through human body. Dense materials such as lead or concrete are more effective in absorbing these rays.

Neutrons do not carry any electric charge and are constituents of atomic nuclei. Hydrogen-rich materials, such as water or paraffin can help shield against these highly penetrating particles.



What are the sources of ionising radiation to human?

There are two sources of ionising radiation: natural and artificial (man-made).

Sources of natural radiation include radioactivity in the rocks and soil of the Earth's crust; radon, a radioactive gas given out by many volcanic rocks and uranium ore; cosmic radiation; and radioactivity in food and drinks. Natural radiation accounts for about 80 per cent of the radiation doses to which we are subjected. It may vary from place to place.

Artificial (man-made) radiation: Medical use of radiation is the most significant source of man-made radiation. This includes diagnostic radiology, nuclear medicine imaging and radiation therapy. Radiation arising from human activities typically accounts for about 20 per cent of public exposure. Exposures due to fallout and nuclear discharges constitute very little.

How are radiation doses measured?

The radiation dose unit quantifying the impact of ionising radiation to human is Sievert (Sv). Since 1 Sv is a large quantity, radiation doses normally encountered are expressed in the millisievert (mSv) or microsievert (μSv) units, which are one-thousandth or one-millionth of a sievert respectively.

On average globally, an individual receives an annual dose of 3 mSv. Natural sources make up about 2.4 mSv of this dose, with the remainder coming from a variety of artificial sources.

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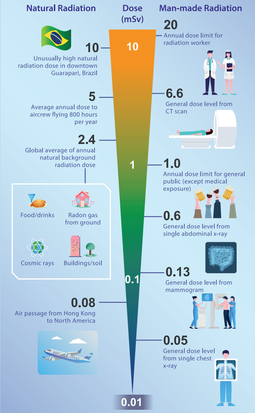


What are the medical applications of radiation?

Radioactive materials, when administered internally to the body, provide images of the function of body organs and tissue. And x-rays, when applied externally, can provide images for the identification of abnormal changes in body organs and tissue.

Radiation is also a major tool in the treatment of certain kinds of cancer. Irradiating tissue affected by a tumour has proved to be effective in inhibiting the tumour's growth or destroying it.

How does radiation affect people?

When a human body receives a high radiation dose of more than 1,000 millisieverts (mSv) in a short time, acute radiation effects, such as nausea, vomiting, fatigue and loss of hair may occur. Whole body radiation dose of above 10,000 mSv is life threatening even with medical treatment.

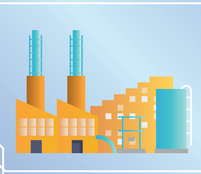
There will be no immediate health effects if the dose level is below a few hundred mSv. In the long-term, radiation can increase the risk of cancer. For every additional mSv of radiation exposure, the risk may increase by about 1 in 20,000.

According to international standards, the generic criteria of projected effective dose for evacuation or sheltering during a nuclear accident is 100 mSv in the first 7 days and that for thyroid blocking is 50 mSv to the thyroid in the first 7 days.

What are the risks and benefits?

We all face risks of some kind in everyday life. It is impossible to eliminate them all, but it is possible to reduce them. The use of radiation and nuclear technologies in medicine, industry, agriculture, energy and other scientific and technological fields has brought tremendous benefits to society. The benefits in medicine for diagnosis and treatment in terms of human lives saved are enormous.

No human activity or practice is totally devoid of associated risks. Radiation should be viewed from the perspective of its benefits as well as harmful effects to mankind.



Where can I get more information?

To find out more about radiation and nuclear safety, please visit:

www.dbcp.gov.hk

www.hko.gov.hk

www.rhd.gov.hk