What is (ionising) radiation

Radiation is energy that is moving around us. Sunlight, microwaves and radio waves are well-known examples of radiation.

This fact sheet deals with a particular category of radiation: ionising radiation. Ionising radiation can cause serious damage to our health by causing changes in our molecules – the small particles that humans, along with other living and non-living things, are made from. Ionising radiation can damage our own health, our children's health, and the health of future generations.

(For short, here "radiation" means "ionising radiation").

A new international ionising radiation hazard symbol was introduced in 2007 to convey danger

How is radiation bad for us?

Very high doses of ionising radiation can result in death, organ failure, and make people infertile: for example, after nuclear bomb explosions and nuclear industry accidents.

Radiation can alter and damage the DNA – the instructions for building and mending our bodies. This damage can harm our health, and can be passed on to our children.

Cancer is the major hazard from smaller doses of ionising radiation, although it may not develop for many years. The risk is higher for children and young adults, and for women.

There is no "safe level" of radiation without a risk of cancer. Changes to our DNA can happen at any dose, although the risk is greater if the dose of radiation is higher.

Where does radiation come from?

- The single largest source comes from medical procedures (48%)
- Radiation from the environment (from space, rocks, and from the atmosphere) accounts for most of the rest. This is often called "background radiation"
- Only a small amount of total radiation received by humans comes from the nuclear industry.

(These are average proportions which apply overall to the world's people[1], but may not be true for every group. Nuclear industry workers, for example, receive higher doses of radiation.)

Measuring radiation

For humans, radiation dose is measured in milliSieverts (mSv).

The average Australian receives around 4.0 mSv of ionising radiation per year

Australian safety standards say that no Australian should receive more than 1 mSv in addition to background radiation, in a year. For people working in the nuclear industry (such as uranium mine workers) the limit is 20 mSv over background.

How safe is safe?

For most of us, the risks we face from exposure to radiation are low compared to many risks of daily life.

Having a CT scan of the abdomen (dose 12mSv) adds one chance in a thousand to our risk of developing fatal cancer. We already face a one-in-four chance of developing fatal cancer in our lifetime.

But the risk adds up across our life, so any additional radiation dose adds to the risk (double the dose means double the risk).

Reducing our dose of radiation lessens the risk of radiation causing cancer but does not remove it. No dose is absolutely "safe".

Radiation protection is all about avoiding exposure, or minimising it. 'Permissible" exposure levels are a last resort, if avoidance and minimisation procedures fail. Just meeting 'permissable" thresholds is not good safety practice.

written by Ronald Li with Dr Bill Williams and Dr Peter Karamoskos / March 2010 / available on www.mapw.org.au

Medical Association for Prevention of War (Australia)
www.mapw.org.au

New evidence links nuclear power and childhood leukaemia

What is a half-life?

A half-life is a measurement which tells us several things about a radioactive substance. A half-life is the time taken for half an amount of the substance to decay and turn into a lower energy "daughter" substance. While it is decaying, the radioactive substance continuously releases radiation into the environment.

A half-life tells us how fast a radioactive substance is losing its energy. The shorter the half-life, the more intense the radiation.

On the other hand, a substance with a longer half-life will be around and releasing its radiation for longer. It will take around ten half lives to completely decay.

(The impact of the radiation also depends on the type of radiation released.)

Nuclear industry and health

Nuclear power plants generate electricity from turbines driven by the heat produced when uranium or plutonium atoms are split apart.

Small amounts of radiation are released into the environment as part of normal nuclear power station function.

Recent research in Germany found that children living in the vicinity of nuclear power plants have double the chance of developing leukaemia.

Uranium miners have an increased rate of lung cancer due to exposure to the radioactive gas radon.[2] Overall, people in the nuclear industry face higher rates of cancer than the general population.[3]

The International Atomic Energy Agency records accidents and incidents in the nuclear industry. Accidents and incidents have occurred in a wide range of countries, and in every decade since the 1950s.

Nuclear power plants also produce lots of radioactive waste. There is currently no safe way to permanently store this waste.

REFERENCES

General reference: Biological Effects of Ionising Radiation, Phase II. National Academy of Sciences. 2006

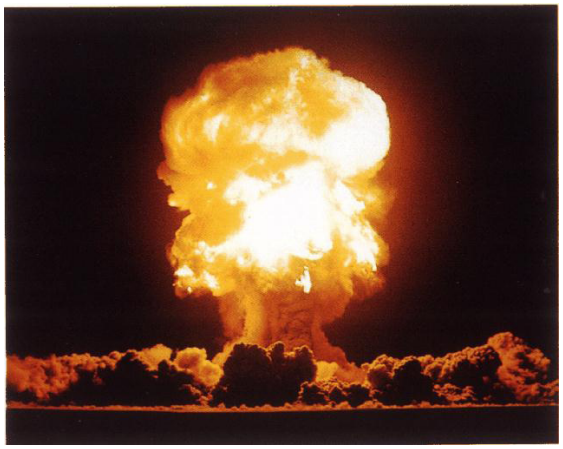
1. National Council on Radiation, Protection and Measurements. Report No. 160 - Ionizing Radiation Exposure of the Population of the United States (2009)

2. WHO handbook on indoor radon. 2009

3. The 15-Country Collaborative Study of Cancer Risk among Radiation Workers in the Nuclear Industry: estimates of radiation-related cancer risks." (Radiat Res. 2007 Apr;167(4):396-416)

Positive uses for radiation

Radiation is used to cure many types of cancer. X-rays (including mammograms) and CT scans are used to diagnose many illnesses, often avoiding surgery.



Nuclear weapons

Nuclear bombs explode through nuclear fission or fusion. Nuclear bombs today are 100 times as powerful as those used in Hiroshima and Nagasaki. An atomic blast could kill thousands or even millions of people.

The high levels of radiation emitted and left behind by bombs are also deadly. Exposed people are likely to experience radiation sickness, irregular bleeding and have dysfunctional immune systems. In the longer term, many will develop cancers.

Nuclear bombs have been tested in Australia, Polynesia and Kiribati as well as in many other countries, causing wide-spread illness to nuclear workers and local people. Residual radiation from these explosions remain, contaminating water, plants and animals. Survivors are still fighting for recognition of their diseases.

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