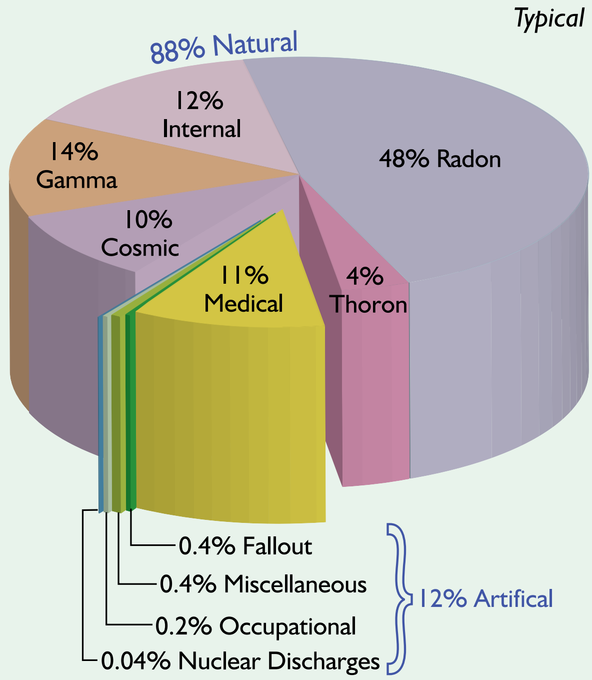
What is Background Radiation?

Naturally-occurring background radiation is the main source of exposure for most people. Levels typically range from about 1.5 to 3.5 millisievert per year but can be more than 50 mSv/yr. The highest known level of background radiation affecting a substantial population is in Kerala and Madras States in India where some 140,000 people receive doses which average over 15 millisievert per year from gamma radiation in addition to a similar dose from radon. Comparable levels occur in Brazil and Sudan, with average exposures up to about 40 mSv/yr to many people.

Several places are known in Iran, India and Europe where natural background radiation gives an annual dose of more than 50 mSv and up to 260 mSv (at Ramsar in Iran). Lifetime doses from natural radiation range up to several thousand millisievert. However, there is no evidence of increased cancers or other health problems arising from these high natural levels.



MAN-MADE RADIATION

Ionising radiation is also generated in a range of medical, commercial and industrial activities. The most familiar and, in national terms, the largest of these sources of exposure is medical X-rays. A typical breakdown between natural background and artificial sources of radiation is shown in the pie chart. Natural radiation contributes about 88% of the annual dose to the population and medical procedures most of the remaining 12%. Natural and most artificial radiations are not different in kind or effect.

PROTECTION FROM RADIATION

Because exposure to high levels of ionising radiation carries a risk, should we attempt to avoid it entirely? Even if we wanted to, this would be impossible. Radiation has always been present in the environment and in our bodies. However, we can and should minimise unnecessary exposure to significant levels of man-made radiation. Radiation is very easily detected. There is a range of simple, sensitive instruments capable of detecting minute amounts of radiation from natural and man-made sources. There are four ways in which people are protected from identified radiation sources:

Limiting time: For people who are exposed to radiation (in addition to natural background radiation) through their work, the dose is reduced and the risk of illness essentially eliminated by limiting exposure time.

Distance: In the same way that heat from a fire is less the further away you are, the intensity of radiation decreases with distance from its source.

Shielding: Barriers of lead, concrete or water give good protection from penetrating radiation such as gamma rays. Highly radioactive materials are therefore often stored or handled under water, or by remote control in rooms constructed of thick concrete or lined with lead.

Containment: Radioactive materials are confined and kept out of the environment. Radioactive isotopes for medical use, for example, are dispensed in closed handling facilities, while nuclear reactors operate within closed systems with multiple barriers which keep the radioactive materials contained. Rooms have a reduced air pressure so that any leaks occur into the room and not out from the room.

STANDARDS AND REGULATION

Radiation protection standards are based on the conservative assumption that the risk is directly proportional to the dose, even at the lowest levels, though there is no evidence of risk at low levels. This assumption, called the 'linear no-threshold (LNT) hypothesis', is recommended for radiation protection purposes only, such as setting allowable levels of radiation exposure of individuals. It cannot properly be used for predicting the consequences of an actual exposure to low levels of radiation. For example, it suggests that, if the dose is halved from a high level where effects have been observed, there will be half the effect, and so on. This could be very misleading if applied to a large group of people exposed to trivial levels of radiation and could lead to inappropriate actions to avert the doses.

Much of the evidence which has led to today's standards derives from the atomic bomb survivors in 1945, who were exposed to high doses incurred in a very short time. In setting occupational risk estimates, some allowance has been made for the body's ability to repair damage from small exposures, but for low-level radiation exposure the degree of protection may be unduly conservative.

In any country, radiation protection standards are set by government authorities, generally in line with recommendations by the International Commission on Radiological Protection (ICRP), and coupled with the requirement to keep exposure as low as reasonably achievable - taking into account social and economic factors.

The authority of the ICRP comes from the scientific standing of its members and the merit of its recommendations. The three key points of the ICRP's recommendations are:

Justification: No practice should be adopted unless its introduction produces a positive net benefit.

Optimisation: All exposures should be kept as low as reasonably achievable, economic and social factors being taken into account.

Limitation: The exposure of individuals should not exceed the limits recommended for the appropriate circumstances.

National radiation protection standards are framed for both Occupational and Public exposure categories.

The ICRP recommends that the maximum permissible dose for occupational exposure should be 20 millisievert per year averaged over five years (ie 100 millisievert in 5 years) with a maximum of 50 millisievert in any one year. For public exposure, 1 millisievert per year averaged over five years is the limit. In both categories, the figures are over and above background levels, and exclude medical exposure.