What are health risks from Ionising Radiation?

World Nuclear Association

It has been known for many years that large doses of ionising radiation, very much larger than background levels, can cause a measurable increase in cancers and leukemias ('cancer of the blood') after some years delay. It must also be assumed, because of experiments on plants and animals, that ionising radiation can also cause genetic mutations that affect future generations, although there has been no evidence of radiation-induced mutation in humans. At very high levels, radiation can cause sickness and death within weeks of exposure.

The degree of damage caused by radiation depends on many factors – dose, dose rate, type of radiation, the part of the body exposed, age and health, for example. Embryos including the human fetus are particularly sensitive to radiation damage.

But what are the chances of developing cancer from low doses of radiation? The prevailing assumption is that any dose of radiation, no matter how small, involves a possibility of risk to human health. However there is no scientific evidence of risk at doses below about 50 millisievert in a short time or about 100 millisievert per year. Dose rates greater than 50 mSv/yr arise from natural background levels in several parts of the world but do not cause any discernible harm to local populations. At lower doses and dose rates, up to at least 10 millisievert per year, the evidence suggests that beneficial effects are as likely as adverse ones.

Above about 100 mSv, the probability of cancer (rather than the severity of illness) increases with dose. The estimated risk of fatal cancer is 5 of every 100 persons exposed to a short-term dose of 1000 mSv (ie. if the normal incidence of fatal cancer were 25%, this dose would increase it to 30%).If doses greater than 1000 mSv occur over a long period they are less likely to have early health effects but they create a definite risk that cancer will develop many years later.

Higher accumulated doses of radiation might produce a cancer which would only be observed several – up to twenty – years after the radiation exposure. This delay makes it impossible to say with any certainty which of many possible agents were the cause of a particular cancer. In western countries, about a quarter of people die from cancers, with smoking, dietary factors, genetic factors and strong sunlight being among the main causes. Radiation is a weak carcinogen, but undue exposure could certainly increase health risks.

The body has defence mechanisms against damage induced by radiation as well as by chemical and other carcinogens. These can be stimulated by low levels of exposure, or overwhelmed by very high levels.

On the other hand, large doses of radiation directed specifically at a tumour are used in radiation therapy to kill cancerous cells, and thereby often save lives (usually in conjunction with chemotherapy or surgery). Much larger doses are used to kill harmful bacteria in food, and to sterilise bandages and other medical equipment. Radiation has become a valuable tool in our modern world.

RADIATION LEVELS AND THEIR EFFECTS

– an indication of the likely effects of a range of whole-body radiation doses and dose rates to individuals: