Risks from **Radiation**

Effects of ionising radiation

A very high dose of ionising radiation over a short period of time to the whole body can cause death within a period of days or weeks. If the same dose were received over a limited part of the body, it might not prove fatal but severe damage to the local area could occur. If the same dose were received over a prolonged period of weeks or months, there would be more opportunity for the body to repair itself and there may be no early signs of injury. However, the damage to the tissue may only become apparent later in life or in the person's descendents. The most important of these 'late effects' is cancer.

Risk assessments

The additional risk of cancer is obtained from observing the number of excess cancers in groups that have been exposed to ionising radiation, including:

- The survivors of the atomic bombs dropped on Hiroshima and Nagasaki in 1945
- Patients exposed to external radiation for the treatment or diagnosis of certain diseases
- Marshall Islanders exposed to severe fallout from atmospheric nuclear weapons tests
- Miners exposed to radon and its decay products
- Residents exposed to radon in the home
- Workers exposed to radium-226 in luminous paint
- Patients exposed to radium-224 for bone disease.

Risk factors for cancer

Cancer risks derived from these groups, particularly the atomic bomb survivors, are largely based on high doses received during short periods. Most people, however, are exposed to low levels over long periods. The central assumption in radiation protection is that there is a proportional relationship between dose and risk. Essentially, this means that a low dose of radiation carries a low risk of fatal cancer and a high dose of radiation carries a corresponding high risk of fatal cancer.

Based on the direct relationship between dose and risk, we can estimate that a dose of 10 μSv may increase the lifetime risk of fatal cancer by about one in 2,000,000. This compares with the existing lifetime risk of fatal cancer of approximately one in four. This means that in a population of four million, one million can be expected to eventually die of cancer. If all four million people were exposed to an additional 10 μSv of ionising radiation, an additional 2 cancer deaths could be expected.

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Putting doses into perspective

The following list gives the radiation doses commonly received every year by the average person in Ireland. Also given, at certain doses, is the lifetime risk of a fatal cancer.

- 1 microsievert (μSv) – the average annual dose to a 'heavy' consumer of seafood from the Irish Sea
- 8 μSv – the dose received on a return flight from Dublin to London
- 20 μSv – the dose from a single chest X-ray
- **20 μSv - 1 in 1,000,000 lifetime risk of fatal cancer**
- 45 μSv – the annual average dose from airline travel
- 240 μSv – the annual average dose from radioactivity in food
- 300 μSv – the annual average dose from gamma radiation from the ground
- 350 μSv – the annual average dose from cosmic radiation
- 540 μSv – the annual average dose from medical examinations
- **1000 μSv (1 mSv) - 1 in 20,000 lifetime risk of fatal cancer**
- 2230 μSv (2.23 mSv)– the annual average dose from radon in the home and workplace
- 3950 μSv (3.95 mSv) – the average total annual dose from all sources of ionising radiation
- **10,000 μSv (10 mSv) – 1 in 2000 lifetime risk of fatal cancer**

Doses at and above 1,000,000 μSv (1Sv) received over a short period of time are given below to illustrate the doses at which immediate harm to the body is evident.

- **1,000,000 μSv (1 Sv) – Onset of early radiation effects**
- 2,000,000 μSv (2 Sv) – Threshold for early death
- 4,000,000 μSv (4Sv) – 50 per cent chance of survival
- **6,000,000 μSv (6Sv) – Early death.**