

## Radon basics

Radon ( $^{222}\text{Rn}$ ) is a odourless and colourless, naturally occurring gas formed during the radioactive breakdown of uranium ( $^{238}\text{U}$ ). Trace amounts of uranium occur in all rocks and soils and low concentrations of radon are found everywhere, even in outdoor air. Radon levels are generally higher indoors because of the restricted ventilation and small underpressure in buildings. Much higher levels are found in some buildings due to a combination of several complex factors.

Radon levels vary significantly between otherwise similar buildings and within the same building with time. The changes are linked to the variable underpressure in a building; underpressure is the force that sucks the radon from the ground. Other important factors are the porosity of ground and the amount of uranium in local soil and rocks.

The principle source of radon is usually the ground beneath the building, however, in some areas increased indoor radon concentrations can also be caused by building materials containing significant concentrations of uranium and its decay series radionuclides. These include radium ( $^{226}\text{Ra}$ ) and its decay product radon. This activity concentration can be of natural or artificial origin.

Natural materials that are used in building include the Italian tuff and pozzolana, materials of volcanic origin, or the Swedish alum shale, which both are also sources of high gamma absorbed dose rate in air indoors. Artificial sources include the by-products of industrial activities (e.g. coal ashes, phosphogypsum, zircon sands) that are frequently added to cement or other materials and can be the cause of significant concentrations of

radon indoor and possibly of gamma dose rate. Building materials, in particular cases, can also be a source of thoron ( $^{220}\text{Rn}$ ) indoors.

High radon levels are a hazard to the health of individuals exposed over a long period. This is because radon is also radioactive and itself decays to give other radioactive elements. Once breathed in these radioactive elements can be retained in the lung and expose the tissue to radiation. This increases the risk of lung cancer.

To counter this hazard, the International Commission on Radiation Protection have provided guidance on the setting of Action Levels in homes. Their advice suggests that the Action Level should be set in the range  $200 \text{ Bq m}^{-3}$  to  $600 \text{ Bq m}^{-3}$ .

Further information on radon is available in the published literature. Information is also available from the web sites listed in the section 'Links to other interesting web sites'.