



Radon in Homes

Radon is a naturally occurring radioactive gas which can accumulate in enclosed places, including houses and other buildings.

The radon levels in Australian houses vary quite a lot but are generally lower than in other countries.

There is an association between radon levels and the risk of lung cancer and it is best to keep radon levels low. State and territory radiation health authorities are the best contact if you are concerned about radon levels in your home. Contact details for radiation health authorities are available on ARPANSA's website at www.arpansa.gov.au/Regulation/regulators/index.cfm.

What is Radon? Where Does it Come From?

Radon is a naturally occurring radioactive gas. It comes from the radioactive decay of uranium, which is present in small amounts almost everywhere in the Earth's crust. When a radioactive atom decays, its nucleus, which is unstable, breaks down, turning into the nucleus of another element, called a daughter product. At the same time, a small burst of radiation is released in the form of an alpha particle or a beta particle or one or more gamma rays. Uranium breaks down through a series of radioactive daughter products, which usually remain chemically attached to the material containing the uranium, until radon is formed. Radon, being chemically inert, does not combine with the atoms of its host material; instead it works its way through the tiny cracks and voids in the ground and into the atmosphere, where it can be inhaled in the air we breathe. Radon is thus a natural fact of life.

How Does Radon Affect Health?

The daughter products of radon are also radioactive. When we breathe in radon and its daughters, some radioactive decays take place inside our lungs. The alpha particles produced can cause damage to lung tissue. Such damage can lead to lung cancer. There is a delay of many years between the initiation of a cancer by radiation and its growth to a size which can be observed clinically. The risk of developing lung cancer from exposure to radon depends on how much radon we breathe in. The more radon there is in the air, the bigger the risk. Similarly, the longer we spend breathing in that radon, the bigger the risk.



How is Radon Measured?

The quantity of radon present in the air can be measured by using sensitive equipment to detect and count the radiations emitted when radon and its daughter atoms decay. Because radon concentrations in homes are low and variable, radon measurements are usually made using a monitor that accumulates information over a long period, typically 3 months to 1 year. The measurement is made in terms of activity, which is the rate at which radioactive decays are occurring, and which is proportional to the number of radon atoms present. Activity is measured in units called becquerels (Bq). If the air contains one becquerel of radon per cubic metre (1 Bq m⁻³), it means that, on average, there will be one radioactive decay of a radon atom per second for every cubic metre of air.

Where is Radon a Problem?

In outdoor air, radon concentrations are low. If we collected one hundred million, million, million molecules of air (about a teaspoonful) we might expect to find about ten radon atoms amongst them. Indoors, however, the concentration of radon can be higher, as buildings have the effect of trapping radon for a while. Radon levels are typically very variable, depending on the flow of air through the home. There are places where radon levels can be very high: in some caves, for example, or in a poorly ventilated underground uranium mine.

How Serious are the Health Risks?

The assessment of health risk is based largely on evidence of the incidence of lung cancer among uranium miners in the past. Modern mines are well ventilated to keep radon concentrations low but, in earlier times, uranium miners received quite high radiation doses from the radon they inhaled. On the basis of the available evidence, risk factors have been estimated which relate the risk of developing lung cancer to the concentration of radon in air. Because the problem is a very difficult one to study, there are several different estimates by different scientific research teams, but they are generally consistent with a range of about one to two in a million per Bq m^{-3} . This means that if one million people were exposed for a year to radon in air at a concentration of 1 Bq m^{-3} in the home, one or two of them might be expected to die, eventually, from radiation-induced lung cancer.

What are the Radon Levels in Australian Homes?

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has conducted a nationwide survey of radon in homes. The results show that the average concentration of radon in Australian homes is about 11 Bq m^{-3} . This is less than in many other countries and is not much larger than radon levels in outside air. Consequently, there is little cause for concern that the health of the population is at undue risk from radon in homes. However, the survey also found a very wide range of radon levels, from one or two becquerels per cubic metre to over four hundred. For those homes having very high concentrations of radon, it may be desirable to take action to reduce the radon levels, in order to reduce the risk of the occupants contracting lung cancer.

When Should Action Be Taken To Reduce Radon Levels?

The National Health and Medical Research Council (NHMRC) has reviewed the evidence available and the results of the ARPANSA survey, and has recommended that if the annual average radon concentration in a home exceeds 200 Bq m^{-3} , the householder should contact the appropriate state or territory radiation health authority for advice. The ARPANSA survey found very few homes in this category (less than one in a thousand), so the vast majority of homes are unlikely to require any remedial action. For those few homes that exceed this Action Level, there are some simple measures that can be taken to bring radon levels down.

How Can Radon Levels Be Reduced?

Most of the radon inside a home, where the concentration is high, usually gets in through the floor. The radon diffuses out of the ground and into the home. One way to reduce the

levels indoors is to increase the ventilation of the under-floor space. It may be possible to do this by enlarging the ventilation holes in the walls, and allowing natural air movement to do the job. In the case of load-bearing walls, this should only be done in accordance with the appropriate building codes.

In some cases, however, it might be necessary to use forced ventilation. Homes built on concrete slabs may require more elaborate remedies. Each home is different, and the need for remedial action and the action to be taken must be determined individually.

What Should I Do?

If you have a timber home, or one built on stumps, and if your home is well ventilated, it is unlikely that there will be a problem from high radon levels. If you have a brick home built on a concrete slab and you tend to keep all your doors and windows closed, it is possible that the radon levels in your home may be higher than average. If you are concerned that there may be a problem, contact your state or territory radiation health authority for advice. Alternatively, radon monitors are available, for a small fee, from the Australian Radiation Protection and Nuclear Safety Agency.

Does Smoking Affect The Risk From Radon?

There is some scientific evidence that smoking increases the risk from exposure to radon. Stopping smoking and discouraging smoking in your home should reduce the risk that you or members of your family will develop lung cancer from inhalation of radon. In any case, as smoking is by far the major cause of lung cancer, if you are at all concerned about the risks from radon, you should certainly be concerned about the risk from smoking. If you stop smoking in your home, you will reduce the risk of you and members of your family developing lung cancer.

ARPANSA Recommendation

ARPANSA recommends that an annual average radon concentration of 200 Bq m^{-3} be established as an Action Level for simple remedial action in Australian homes. Where the concentration exceeds this level, householders should consult the appropriate state, territory or Commonwealth radiation health authority for advice. Remedial action is not considered necessary where the annual average radon concentration in a dwelling is below 200 Bq m^{-3} .

The ARPANSA recommendation is contained in the *Annex C, Recommendations for Limiting Exposure to Ionizing Radiation, Radiation Protection Series No. 1* (available from ARPANSA at www.arpansa.gov.au/Publications/codes/rps1.cfm).