Radon is a radioactive gas that has no colour, odour or taste and comes from the natural radioactive breakdown of uranium in the ground. You can be exposed to radon by two main sources:

1. Radon in the air.
2. Radon in drinking water.

Radon can get into the air you breathe and into the water you drink. Radon is also found in small quantities in outdoor air.

Most of the radon in indoor air comes from soil underneath properties. As uranium breaks down, radon gas forms and seeps into the property. Radon from soil can get into any type of building, homes, workplaces and schools and build up to high levels in the air inside the building.

Radon gas can also dissolve and accumulate in water from underground sources such as wells, springs or boreholes. When water that contains radon is used for showering, washing dishes and cooking, radon gas escapes from the water and goes into the air. It is similar to carbonated soda drinks where carbon dioxide is dissolved in a drink and is released when you open the bottle. Some radon also stays in the water.

Radon is not a concern in water that comes from lakes, rivers and reservoirs because the radon is released into the air before it arrives at the tap.

Only about 1 to 2% of radon in the air comes from drinking water. However, breathing radon released to air from tap water increases the risk of lung cancer over the course of your lifetime. Some radon stays in the water. Drinking water containing radon also presents a risk of developing internal organ cancers, primarily stomach cancer. However, this risk is smaller than the risk of developing lung cancer from radon released to air from tap water because fewer people are exposed to equivalent levels.

The Government’s recommended action level for radon in air in domestic houses is 200 becquerels per cubic metre of air (Bq/m³). This is the level at which it is suggested you ought to take some remediation action. In workplaces employers have a duty to comply with the Ionising Radiation Regulations 1999: here the compliance level is compulsory and action has to be taken at radon concentrations greater than 400 Bq/m³.

There is currently a European Union standard for radon in drinking water which has been adopted as advisory in the UK. Because the way in which radon irradiates the body is quite different from when it is swallowed in water than if it is inhaled in air, the action level for radon in water is not the same as for radon in air. It has been set so that the risk to a typical person drinking water with radon at this concentration is similar to the risk which would arise from breathing air which contained radon at the action level in homes of 200 Bq/m³ per cubic metre. The European Union recommendation is:

- For private water supplies that are part of a commercial or public activity, e.g. hotels or bed & breakfast, remedial action should always be taken when the radon concentration exceeds an action level of 1,000 becquerels per litre (Bq/l).
- For individual water supplies (no commercial or public activity), consideration should be given to taking remedial action when the radon concentration exceeds an action level of 1,000 Bq/l.

These levels have been agreed by the Government’s Independent Advisors on radiation matters, the Committee on the medical aspects of radiation in the environment (COMARE). In considering this issue in December 2000, COMARE tried to put the risks from radon in water in some sort of perspective and noted that the action level of 1,000 Bq/l per litre for radon in water would result in annual doses of 7 to 11 mSv for adults and 9 to 23 mSv for infants. These doses include a not insignificant contribution from
radon that escapes from water into room air and is subsequently inhaled. These doses are of course in
addition to those doses received from background radiation which in the UK are on average about 2 to 3
mSv a year from all sources of radiation. For comparison the dose limit for exposure of the general public
from regulated practices (which does not apply to naturally occurring radon) is 1 mSv.

In Workplaces the Ionising Radiation Regulations 1999 establish an action level for radon concentration
in air of 400 Bq/m³. As this will not cover radon in water, the application of the Regs will therefore be
determined by whether the provision of drinking water by an employer comes within the definition of “work
with ionising radiation”. Having sought legal advice, HSE is of the opinion that unless the work covers
processes involving the use of water, it does not come within the meaning and IRR 99 will therefore not
apply to radon in water. Where the work process does involve the use of radon rich water, the process is
likely to result in the radon in the water outgassing and thus contributing to the concentration in the air
(which is covered by IRR 99). Employers in radon prone areas should already be considering this issue
and deciding what appropriate measures need to be taken in order to reduce exposure by carrying out
risk assessments.

Removal of radon from private water supplies can be achieved by one of 3 methods:

1. Decay storage by storing the water for a length of time so that all the radon decays. This
   would typically require two 10 cubic metre tanks used alternately and is impractically large
   for most locations.
2. Granular activated carbon is popular in the United States. Costs are typically £500 to £1,000
   per household and they can achieve a 95% radon removal. There are problems, however,
   with disposal and maintenance.
3. Aeration has been tried successfully in the UK with costs of between £1,000 and £2,000. It is
   99% effective and appears to be the best solution in the UK.

Further information on treatments can be obtained from WS Atkins Consultants report entitled
Removal of Radon and Uranium from Private Water Supplies available at
www.defra.gov.uk/environment/radioactivity/research/complete.

Key facts

- Radon in water is measured in becquerels per litre of water (Bq/l).
- Radon in mains water is not an issue at the customer’s tap.
- Radon in water action level for private supplies is 1,000 Bq/l.
- For private water supplies that are part of a commercial or public activity, e.g. hotels, remedial
  action should always be taken when radon exceeds the action level.
- For individual water supplies, consideration should be given to taking action when radon
  exceeds the action level.
- When sampling private water supplies for radon, consideration should be given to sampling for
  uranium as elevated levels of uranium have been found in high radon areas and there are issues
  concerning the chemical toxicity of Uranium.

The World Health Organisation (WHO) standard for U is 2µg/l.

Links to other sources of information on radon in water:
http://www.comare.org.uk/statements/comare_statement_radon.htm
http://www.nrpbo.org.radon_radon_in_drinking_water.htm

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