

Radon – Guidance for Local Authorities

Description and Background

Radon is an odourless, colourless, radioactive gas that occurs naturally. It is released from certain rocks and the risk of occurrence varies according to geology. Although direct ingestion of radon in water is largely thought to be harmless, prolonged exposure to radon in air by inhalation has been linked to an increased risk of lung cancer. It is likely that any radon dissolved in water will readily gas off upon exposure to atmospheric pressure, adding to the total radon contact of the air. The amending Regulations have been introduced to transpose the requirements of the EU Directive 2013/59 (Euratom) into Scottish legislation. The purpose of the drinking water elements of this directive is to limit the contribution that radon in drinking water makes to the total concentration of airborne radon.

Health Significance

A report by the World Health Organisation¹ contains the following information on the health effects of radon:

- Epidemiological studies confirm that radon in homes increases the risk of lung cancer in the general population. Other health effects of radon have not consistently been demonstrated.
- The proportion of all lung cancers linked to radon is estimated to lie between 3% and 14%, depending on the average radon concentration in the country and on the method of calculation.
- Radon is the second most important cause of lung cancer after smoking in many countries. Radon is much more likely to cause lung cancer in people who smoke, or who have smoked in the past, than in lifelong non-smokers. However, it is the primary cause of lung cancer among people who have never smoked.
- There is no known threshold concentration below which radon exposure presents no risk. Even low concentrations of radon can result in a small increase in the risk of lung cancer.
- The majority of radon-induced lung cancers are caused by low and moderate radon concentrations rather than by high radon concentrations, because in general less people are exposed to high indoor radon concentrations.

Inhalation of airborne radon is thought to present by far the greatest risk to health. It is unlikely that direct ingestion of radon dissolved in water is a significant health risk, at the concentrations found in the UK at least. A case-control study of stomach cancer in an area where there were high concentrations of natural uranium and other radionuclides in drinking water gave no indication of an increased risk.²

¹World Health Organisation (2009); WHO handbook on indoor radon: a public health perspective

²Auvinen A et al. (2005). Radon and other natural radionuclides in drinking water and risks of stomach cancer: a case-cohort study in Finland. *Int J Cancer*, 10:109-113.

Risk Assessment and Monitoring

Monitoring for radon in Regulated private water supplies is required at the audit monitoring frequency, unless:

- a) evidence shows that the concentration of radon is likely to be stable and
- b) Scottish Ministers are satisfied that concentrations of radon, tritium and calculated indicative dose will remain below the PCV for each parameter.

Scottish Ministers will issue notices indicating those supplies that meet these criteria and need not be sampled. In practice, this will be for the following circumstances, where:

- 1) The supply is a surface water, or
- 2) The supply is not in an area with a known high risk for radon in air, or
- 3) The supply is a groundwater in a high risk area but the previous radon sample has shown the radon concentration to be less than half the PCV of 100 Bq/l.

Sampling for radon needs to be undertaken carefully and in accordance with the technique prescribed by the laboratory undertaking the analysis. With all methods care needs to be taken to ensure that as little radon as possible escapes from the water during the sampling process. In practice this means sampling from an appropriate location, minimising the amount of turbulence in the stream of water and leaving no headspace in the sample bottle. Radon has a half-life of 3.8 days, so a significant delay in a sample reaching a lab can mean that the results from analysis are artificially low.

What if it fails?

A "Parametric value" of 100 Bq/l has been set for radon in drinking water in Scotland. Although this is effectively the PCV, it serves primarily as a trigger for further investigation and advice. It is not a "failure" as such. An exceedence of the PCV of 100 Bq/l does not in itself automatically necessitate a requirement to install treatment. Action need only be taken if, following investigation, the supply is considered to be a risk to health.

A further "Action value" of 1000 Bq/l has been set. If a water sample contains radon above this concentration, immediate action must be taken to reduce concentrations of radon in water. Survey work indicates that it is unlikely that this concentration will be exceeded in Scottish private water supplies.

Where a sample exceeds the radon PCV of 100 Bq/l in a private water supply, and a resample confirms this to be a representative result, the local authority must undertake further investigation to identify the source of the high radon value.

Advice should be provided to the users of the supply, including the suggestion that they may wish to monitor radon in air concentrations within buildings. Advice to owners and users should include that:

- their water supply has been identified as a source of radon;
- radon is a naturally occurring gas that is released from certain rocks;
- radon is radioactive and prolonged exposure to radon by inhalation has been linked to increased instances of lung cancer;
- radon ingested directly within the water is unlikely to be a health issue itself, but this radon may contribute to the total amount of airborne radon within the building;
- radon in air monitoring within the buildings served by the supply may be appropriate;

- further information on radon may be obtained at <http://www.ukradon.org/>

If levels are significantly above 100 Bq/l it may be appropriate for the local authority to consult with the NHS Board to agree whether this advice needs to be modified, or additional measures are required. If radon in air monitoring is required, simple to use measurement kits may be ordered from Public Health England:

<http://www.ukradon.org/information/measuringradon> . They cost approximately £50, including analysis. Measurement of radon in air involves placing small, inert, radon detectors in the property for a specified period, before sending these off for analysis.

What if it is decided that action is required?

Options for resolving at source

Radon is a gas and is relatively easy to remove from a water supply. Increasing the amount of turbulence and aeration the water receives at the source may significantly reduce the amount of radon present at the point where the water is consumed. In some supplies radon concentrations can vary with time, so care needs to be taken that any reduction measures are effective under all conditions.

Treatment

Aeration should probably be considered in that first instance for radon reduction, due to its simplicity and ease of control. Where necessary, removal rates can be enhanced via the use of special aeration towers with natural or forced air ventilation.

Radon can also be adsorbed onto GAC filters, which are available as simple cartridges and may therefore be suitable for point of use treatment, where this is appropriate. These will need to be periodically replaced, with the replacement interval depending upon the flow rate and concentration of radon in the water. Clearly, careful monitoring will be required, which may prove difficult on a private water supply. Care may be needed in disposal of spent filters as they will have accumulated radon. This is an additional drawback of adsorption treatment.

Radon – What You Need to Know – FAQ

What is radon?

Radon is a colourless, odourless radioactive gas. It is formed by the radioactive decay of the small amounts of uranium that occur naturally in all rocks and soils. Some rocks and soils contain more uranium than others.

Where it is present, most radon is found in air, but a small amount can be dissolved in water. When the water comes into contact with air, the radon naturally gasses off into the atmosphere. In some areas of Scotland, radon is found at higher levels due of the type of rock under the ground.

Exposure to radon in air can increase the risk of developing certain types of cancer.

Why is the sampling being done?

There is new Scottish legislation which has been introduced to comply with an EU Directive on radiation. The legislation compels local authorities to test for radon in private water supplies where it could increase risk by significantly adding to the amount of radon already present in the air. Local authorities have made every effort to ensure that only the supplies most at risk have to be tested.

Initial research and sampling has been taken across Scotland to determine where there is an increased level of radon in water.

Who pays for the sampling?

Every effort has been made to minimise the numbers of water supplies that need to be sampled. Where sampling is required it becomes part of the regulatory sampling programme for that supply, and the cost must be borne by the person responsible for that supply.

Risk Assessments

Your local authority will risk assess all the private water supplies in its area to exclude all supplies which are not at risk. This includes areas where the rocks and soil produce little radon, and water sources which are exposed to the air prior to consumption, enabling any radon to escape.

What happens if my supply is assessed as at risk?

If the risk assessment shows that there may be a risk from your water – because of the underlying rock type and the way you obtain your water (e.g. from a borehole) – a sample will be taken to find out how much (if any) radon is present in your water supply. It does not mean there is a problem with your supply, and you should continue to use your water as normal.

What happens after the sample is taken?

Your sample will be sent for analysis by a specialist laboratory and your local authority will contact you with the results when they receive them. They will let you know if any radon is present in the sample and what you should do next. If radon concentrations are low, the supply will not need to be sampled again for five years.

What happens if I have radon in my water?

Your local authority will give you advice on what to do if you have a high level of radon in your water – this does not necessarily mean that your water is unsafe to drink or use in the normal way.

If the level of radon is over 100 becquerels per litre (Bq/l), further investigation will take place. You may be advised to monitor the concentration of radon in the air inside the premises if you have not previously done this.

If the level is over 1000Bq/l you will be required to take remediation measures to reduce the amount of radon in your water supply. However initial survey work indicates that it is unlikely that any private water supply in Scotland will breach this 1000Bq/l action value.

Where remediation work is required on your water supply, this is relatively straightforward and grant funding may be available to help you with this.

The risk from exposure to radon is primarily from long term exposure, so there is no need to be unduly concerned until the results of any investigation are known. You should continue to use your water as normal unless advised otherwise.

Further information

You can ask your local authority environmental health department for more information on radon in water, or from the UK Radon website:

<http://www.ukradon.org/information/privatewater>