

Information note on Regulation 12 and 13 (Wales)



Radioactivity

1. Introduction to radioactivity

Radioactivity substances are present in the environment from several naturally occurring and/or man-made sources. In most circumstances, the potential risk to human health from consuming radioactive drinking water is very low. Raw water can contain small and variable concentrations of naturally occurring radioactivity arising from the decay of uranium, thorium and potassium-40. Man-made elements, for example Tritium, Carbon 14. Plutonium can also be released into the environment and are detectable (see Annex 1).

Radioactivity monitoring is a requirement of the Private Water Supply Regulations and is determined by a local authorities' risk assessment (see Annex 2).

2 For relevant private water supplies the regulations require that a risk assessment is made:

- Risk assess supply every five years.
- If radioactivity has not been previously detected and the risk assessment confirms it is unlikely to be detected, then monitoring for indicative dose, tritium and radon is not required; but the local authority must provide the Drinking Water Inspectorate with evidence for that decision.
- If radioactivity is found, or the risk assessment indicates it is likely to be detected, then the local authority should conduct further monitoring.
- If radioactivity is naturally occurring and stable, then monitoring may be reduced.

3 Monitoring requirements

The Drinking Water Inspectorate risk assessment tool has been revised to include hazard identification for tritium, radon and Indicative Dose (ID) to help local authorities ask the right questions to inform their risk assessments. We have also recently reviewed radioactivity data submitted and made some changes to the tool intended to improve the accuracy of the information supplied:

<http://www.dwi.gov.uk/private-water-supply/local-auth/risk-assessment.html>.

Where a risk assessment determines that monitoring is required, the frequency of sampling must comply with the Group B monitoring frequency shown in schedule 2 for regulation 9 supplies. Regulation 10 supplies should be sampled every five years and single domestic dwellings are monitored on request in line with

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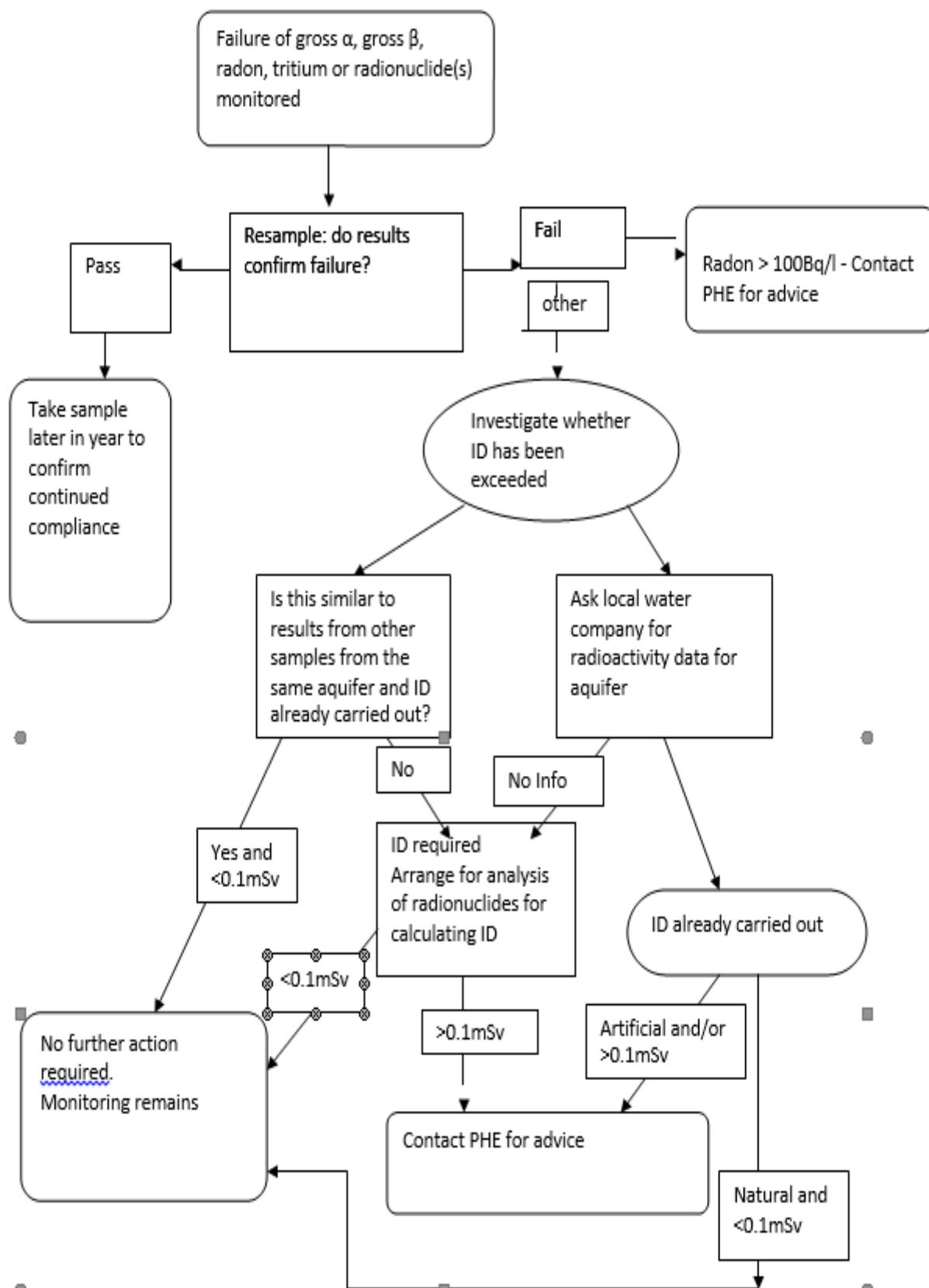
standard practice (see Annex 3 for more details).

If a sample fails, the actions required are set out in the figure below and in more detail in for each radioactive indicator or actual parameter in Annex 3.

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Flow diagram for radioactive parameter failures



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4 Radon

Radon occurs naturally in some British waters, mostly dissolved as radon-222. Radon dissipates as gas from water and presents a potential health risk from inhalation. It can be removed by remedial modifications made to any building where it is found.

It is only necessary to monitor for radon in water where the risk is assessed as potentially high, for example groundwater supplies in high and moderate hazard areas. Surface waters (springs) and ground water supplies in low risk areas **do not require monitoring** (see Annex 4).

Public Health England and Public Health Wales have written specific advice for radon and local authorities should consult this when making their risk assessments; <https://www.ukradon.org/information/privatewater>. This document contains links to agreed advice for making the initial risk assessment and if necessary, actions to take for reducing radon concentrations found in water samples. Further background information is set out in Annex 4.

5 Tritium

Tritium present in the UK environment is of man-made origin. Tritium is mobile in the environment and so is used as a screening parameter for the presence of contamination by man-made radionuclides.

Monitoring for tritium, or other man-made radionuclides must be carried out where:

- a) There is a source of tritium or other man-made radionuclides present in the catchment. (Natural Resources Wales can advise where there have been radioactive spills containing this); and
- b) The risk assessment and other surveillance or investigations indicate that there is a risk of exceeding, the specified value. The local water company or the Natural Resources Wales may be able to provide information to be considered during the risk assessment.

When required, monitoring should be carried out at the frequency specified in table 3 in part 2 of schedule 2 of the Private Water Supply Regulations.

It is known that typically concentrations of tritium in drinking water in the UK are below the current method limit of detection (10Bq/l). Exceeding 100Bq/l requires the local authority to make an investigation to identify the source and further risk assessment. They should undertake monitoring for individual man-made radionuclides. Advice may be taken from Public Health Wales as to whether it is a risk to health and therefore a regulation 20 notice is required.

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6 Indicative dose (ID)

When radiation interacts with body tissues and organs, the radiation dose received depends on factors such as the type of radiation, the part of the body affected, the exposure pathway and time. This means that one Becquerel (Bq) of radiation will not always deliver the same radiation dose, therefore the idea of 'indicative dose' (ID) has been developed to assess the risk posed to human health from exposure to radioactive substances.

It is most practical to screen drinking water for its radionuclide risk, by assessing general radioactivity. This is carried out by analysing for gross alpha (α) and gross beta (β) emissions present. The total radiation present in the sample is expressed in summation as Becquerels per litre, (Bq/l). This measure takes account of the differences in radiation (excepting radon and tritium see 4 and 5 above) from constituent radionuclides and express them over time of exposure. The unit of ID is Millisieverts per year (mSv/y).

Calculating ID is not required if this is unlikely to exceed 0.1mSv/y regardless of the source of the radioactivity.

If the calculated ID exceeds 0.1mSv, or if the concentration of any radionuclide being monitored is detected at greater than 20% of the derived concentration, then further advice should be sought from Public Health Wales. If it is necessary to calculate ID, this is done as the radioactivity (based on an intake of two litres of water per day of drinking water for one year) that results in an effective dose of 0.1 mSv/y for members of the public.

If the level of radioactivity increases, then the ID should be reassessed. More detail can be found in Annex 6.

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Annex 1 – Sources of radioactivity in the environment

Drinking water may contain radionuclides at activity concentrations which could present a risk to human health. To assess the quality of drinking water with respect to its radionuclide content and to provide guidance on reducing health risks, water resources and drinking water are monitored for their radioactivity content:

- Natural radionuclides, including potassium-40, carbon-14 and those originating from the uranium and thorium decay series, radium-226, radium-228, uranium-234, uranium-238, lead-210 and radon-222, can be found in raw water.
- Man-made radionuclides, such as the trans-uranium elements (americium, plutonium, neptunium, curium), tritium, carbon-14, strontium-90 and some gamma emitting radionuclides, can also be found in natural waters. These are usually caused by consented discharges in the effluent from nuclear fuel cycle facilities. They are also released into the environment following their use in unsealed form for medical and industrial applications. Exceptionally they are also found in the water because of past fallout contamination resulting from nuclear accidents, for example Chernobyl (which affected the UK).

Annex 2 – Local Authority Risk Assessment

When considering the risk from radionuclides it is necessary to assess the local geology and any man-made sources that could lead to an increase in natural background radioactivity. The most comprehensive source of monitoring data is in the Radioactivity in Food and the Environment (RIFE) report, available on the FSA website <https://www.food.gov.uk/research/radioactivity-in-food-and-the-environment/radioactivity-in-food-and-the-environment-rife-report-2019>.

Other sources of information include:

- The report produced for the Inspectorate by AEA Ricardo discussed below;
- Existing monitoring results (including any taken by the local water company and National Resources Wales if from the same water body);
- Where a water company or other water supplier has a source in the same water body, details of notices authorising them not to monitor; geological data;
- Evidence from historic pollution events; and relevant Environment Agency or National Resources Wales permitting information (radioactive discharges).

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Annex 3 Regulatory monitoring requirements

If a sample fails a parametric value set in the Regulations, a local authority should collect at least two further samples at three-monthly intervals to check the validity of the original result and ensure that sampling is representative of an average activity concentration for a full year. If all the repeat samples are within 20% of the mean of the set of numbers, then the averaging method is suitable and will give a representative average throughout the year, or period covered by the repeat samples.

In the event of exceeding any of the individual radiation standards (Radon, Tritium, gross alpha and gross beta), a local authority should conduct an investigation (see information note on guidance for regulation 18).

The sample location points and the number of investigational samples should be proportionate to the likely cause and magnitude of the failure. It is recommended that the Public Health England UK Recovery Handbooks for Radiation Incidents 2015, Drinking Water Supplies Handbook should be followed for the investigation of exceedances in tritium or indicative dose (gross alpha and gross beta).

A further option available, where radioactivity is naturally occurring and the concentrations are stable, is provided in part 4 of schedule 4 in which local authorities may exclude from their Group B monitoring suite any parameters which they consider are unlikely to be present at concentrations of values which pose a risk of that supply failing the standards set out for radioactive parameters, taking account of any risk assessment and following guidance from the Drinking Water Inspectorate. If concentrations of natural radioactivity are stable, a reduced frequency of monitoring for those parameters of up to 50% can be applied. If it can be demonstrated that detections of gross alpha and/or gross beta activities are attributable to a specific radionuclide, the local authority may monitor for this radionuclide instead, at the Group B monitoring frequency.

Risk assessments should be kept under continuous review if there are changes identified, and as a minimum at least every five years as required in the Regulations contingent on the regulatory classification (regulation 9, regulation 10, or regulation 11).

If radioactivity has not previously been detected in a water supply source, and the risk assessment carried out by the local authority confirms that it is unlikely to be detected, then monitoring for ID, tritium and radon is not required until such a time as information becomes available which would materially affect the risk classification, based on the risk assessment review process.

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Annex 4 Radon risk assessment considerations and monitoring requirements

The main route of radon entering the body and hence risk to human health is through inhalation of the gas and not in drinking water, nevertheless a standard exists for water and is set out in the Private Water Supply Regulations and a risk assessment is necessary.

In 2016 water companies assessed their sources for radon risk in public supplies and where evidence supported that risk was low, the monitoring was stopped. Where water for a private water supply is taken from the same aquifer used by the local water company, this can assist in the risk assessment consideration.

A representative survey will include reliable information from a variety of geological or, hydrogeological sources. *We suggest local authorities read the Inspectorate's information letter 05/2015.*

Local authorities have been provided with hazard scores for all the groundwater supplies reported.

In summary:

Surface waters **do not require** monitoring for radon.

Groundwater supplies in low hazard areas that **do not require** monitoring for radon.

Groundwater supplies in high and moderate hazard areas may require monitoring for radon depending on the outcome of the risk assessed.

Where there is a need to monitor:

Regulation 12(2) prescribes the monitoring requirements for radon which has a specified value (ie the value above which an investigation must be carried out) of 100Bq/l.

Regulation 12(3) requires that a local authority must ensure that a representative survey is carried out to determine the likelihood of radon exceeding the specified value.

Measuring radon-in-air as a surrogate for radon in water is not advised as a method of determining **compliance with the PCV**. However, when assessing the public health risk in the first instance Public Health Wales guidance should be central to the risk assessment of need for monitoring in water:

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

Monitoring of private supplies that serve single domestic dwellings that are not used as part of a commercial or public activity **is not required** unless the authority is requested by the owner or occupier, or the authority considers it is necessary to fulfil its general duty under section 77 of the Water Industry Act. Public Health England/Public Health Wales has published advice for householders whose property has a high radon-in-air level and is served by a private water supply

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

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The parametric value for radon of 100 Bq/l applies at consumers' taps. Although this is effectively the prescribed concentration value (PCV), it serves primarily as a trigger for further investigation and advice. An exceedance 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 a risk to health. Advice should be sought from Public Health Wales if there is any concern. Further information on radon may be obtained at <http://www.ukradon.org/>.

The Regulations specify an upper maximum limit for radon of 1,000 Bq/l. If this concentration is exceeded, then appropriate remedial action must be taken. More information on small supplies is available on the Drinking Water Inspectorate's website and contains guidance on remediation options for radon. <http://www.euro.who.int/en/health-topics/environment-and-health/water-and-sanitation/publications/2014/water-safety-plan-a-field-guide-to-improving-drinking-water-safety-in-small-communities>. Local authorities **must serve** a regulation 18 notice in this circumstance to ensure that the potential risk to human health is mitigated.

Radon analysis of a water sample must be carried out within a specified time after collection as the half-life of radon is only 3.8 days. The laboratory will be able to confirm this timescale depending on the method they are using. Therefore, if this timescale cannot be met due to the location of the nearest accredited laboratory, local authorities are advised to use laboratories which carry out non-accredited radon analysis in preference to exceeding the required timescale.

Annex 6 Indicative dose

Schedule 4, part 3 of the Regulations give details of which radionuclides should be analysed and provides the relevant limits for them.

The local authority should note whether any environmental changes have occurred that might lead to an increase in the concentrations of gross alpha and gross beta. Where changes do occur then an additional investigation should be carried out to review whether the ID remains below 0.1mSv. Local authorities should use all relevant information about likely sources of radioactivity when deciding which radionuclides to monitor.

If the calculated ID exceeds 0.1mSv, or if the concentration of any individual radionuclide being monitored is detected at greater than 20% of the derived concentration, then advice should be sought from Public Health Wales or Public Health England depending on the location of the supply. If the level of radioactivity increases, then the ID should be reassessed.

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The Inspectorate will review local authority's data where the existing gross alpha and/or gross beta screening values are regularly exceeded to determine whether moving to more relaxed screening values may be appropriate, depending on ID and risk to public health. The Inspectorate will consider whether a screening value of up to 0.5Bq/l for gross alpha activity, consistent with the World Health Organisation guideline value, may be more appropriate. Where necessary further guidance will be provided in consultation with Public Health Wales.