

GUIDANCE ON THE IMPLEMENTATION OF THE WATER SUPPLY (WATER QUALITY) REGULATIONS 2016 (as amended) IN ENGLAND AND THE WATER SUPPLY (WATER QUALITY) REGULATIONS (WALES) 2018

The Regulations

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PART 4 – MONITORING OF WATER SUPPLIES

Regulation 5 – Interpretation and Application of Part 4

- 5.1 The changes introduced by the 2018 amendment regulations in England and the 2018 regulations in Wales transposed the new requirements of revised Annex II of the Drinking Water Directive. These changes allow water suppliers to change monitoring frequencies for parameters based on risk. This change provides an option to perform drinking water monitoring in a more flexible way, provided that a risk assessment is performed ensuring full protection of public health. It follows the principle of 'hazard analysis and critical control point' (HACCP) used already in food legislation, and the water safety plan approach laid down in the WHO Guidelines for Drinking Water Quality.
- 5.2 In transposing these requirements, parameters that formerly required check monitoring are now categorised as Group A parameters, and those that required audit monitoring are now categorised as Group B parameters.
- 5.3 Regulation 5 sets out the difference between Group A and Group B monitoring.
- 5.4 The purpose of Group A monitoring is twofold:
- to ensure that parameters which give an indication of the effectiveness of treatment (in particular disinfection) and the acceptability of water to consumers (for example taste, odour and discolouration parameters) are monitored at regular intervals at an appropriate frequency and
 - To ensure that indicator parameters comply with the specifications set out in Schedule 2 of the Regulations.

Parameters covered and requirements for each are listed in Table 1 of Schedule 3 of the Regulations.

- 5.5 Group A monitoring for aluminium and/or iron is required where these metals may be present in the water by virtue of the coagulant chemical used in the water treatment process.
- 5.6 Group A monitoring for iron and aluminium is required, along with manganese, if the water supply is derived from surface water, or is influenced by surface water (Table 1 of Schedule 3).
- 5.7 Group A monitoring for ammonium, nitrate and nitrite is required where chloramination is practised.
- 5.8 The purpose of Group B monitoring is to demonstrate that water supplies comply with regulation 4 – Wholesomeness, and with the standards specified in Schedules 1 and 2 of the Regulations, which cover national requirements and indicator parameters.
- 5.9 Regulation 5(5) specifies that regulations 6 to 10 apply where a wholesale licensee (supplementary licensee in Wales) introduces water into a water supply licensee's (supplier's) supply system. The water supplier receiving a wholesale or supplementary supply retains responsibility for carrying out the monitoring of its own supply system. If the point at which the wholesaler's supply enters the supplier's system is designated as a supply point for monitoring purposes, the supply licensee holder is responsible for carrying out that monitoring. In these circumstances the wholesale licensee and the supplier are jointly responsible for managing any risks to quality and sufficiency, and should have documented agreements in place covering management of drinking water quality, sufficiency and emergency procedures. Wholesale licensees and

supplementary licensees are responsible for monitoring their own treated waters (regulation 13 [12]) and service reservoir outlets (regulation 14 [13]) – see Part 5 of the Guidance covering regulations 13 [12] and 14 [13].

Regulation 6 – Monitoring: general provisions

- 6.1 Regulation 6 specifies that the minimum number of samples water suppliers must take in each of their water supply zones for compliance purposes must be in accordance with Schedule 3 of the Regulations unless the supplier has a notice in place permitting them to reduce the sample numbers.
- 6.2 It is recognised that water suppliers take additional samples for operational purposes that are over and above those taken to demonstrate compliance with the Regulations. Water suppliers may carry out sampling for both compliance and operational purposes on the same sampling occasion provided that the samples taken are identified by separate unique sample numbers or other auditable process (with the appropriate sample reason).
- 6.3 Parameters for which Group A monitoring is required are listed in Table 1 of Schedule 3. As explained in section 5 above, some of the parameters have conditions specified. If the conditions for those parameters are met then Group A monitoring must be carried out for that parameter. Otherwise the Group B monitoring frequency applies.
- 6.4 Other parameters listed in Table 1 of Schedule 3 which do not have conditions specified must be monitored at the annual Group A monitoring frequency. These are divided into Groups A1, A2, A3 and A4 and the sampling frequencies, which depend on either the population of the supply zone or the works' or supply point's output, are specified in Tables 8, 10, 11 and 12 of Schedule 3.
- 6.5 Minimum annual sampling frequencies for Group B monitoring, where Group A monitoring is not a requirement, are given in Tables 9 and 13 of Schedule 3. Parameters included in Group A do not need additional Group B samples, because the Group A monitoring frequencies specified cover both purposes.
- 6.6 Regulation 6(5) [6(7)] requires sampling at consumers' taps for copper, lead and nickel. The sampling point should be selected from the random consumer tap (supply zone) sampling programme and the sample should be the first one litre of water drawn from the tap without flushing beforehand.

6.7 Monitoring for Pesticides

- 6.7.1 Pesticides and related products are defined as any organic insecticide, herbicide, fungicide, nematocide, acaricide, algicide, rodenticide, slimicide, molluscicide and any product related to any of these including any growth regulator, and their relevant metabolites, degradation and reaction products. "Relevant" should be taken to mean any metabolites, degradation and reaction products that have similar pesticidal properties to their parent pesticides.
- 6.7.2 The standard for pesticides applies to each individual pesticide, excluding aldrin, dieldrin, heptachlor and heptachlor epoxide which each have their own standard of 0.03µg/l. The Total Pesticides parameter relates to the sum of all detected concentrations of the individual pesticides (including aldrin, dieldrin, heptachlor and heptachlor epoxide) detected and quantified in the samples taken on a particular sampling occasion from a sampling point. It is recognised that more than

one sample container may be filled on a particular sampling occasion to enable all the pesticides of interest to be determined for a given sampling point.

- 6.7.3 It is not practical or necessary for compliance purposes to monitor every pesticide that is used within the catchment of a water source. Water suppliers should develop pesticide monitoring strategies based on risk, and include pesticides likely to be detected as a result of their properties and usage in the raw water catchment for any given treatment works. On the basis of that strategy, the treated water leaving each treatment works should be monitored at the frequency specified in Table 13 (supply points) of Schedule 3 of the Regulations. The treatment works sampling point should be designated as the supply point for the zones supplied. To reflect this practice, with the exception of aldrin, dieldrin, heptachlor and heptachlor epoxide, the DWI would not expect to receive compliance sample results for individual pesticides, where there is a low risk of their presence in the raw water, and the results of all operational and compliance samples of treated water for the last three years are less than 30% of 0.1µg/l. The Inspectorate may issue monitoring variations for the total pesticides parameter where appropriate.
- 6.7.4 Any relevant metabolites, degradation and reaction products which may be active pesticides and/or a risk to health should be included in companies' monitoring strategies, based on risk assessment.
- 6.7.5 The majority of pesticide monitoring should take place in the raw water to inform companies' risk assessments and to assess the need for treated water pesticide monitoring.
- 6.7.6 Suppliers should monitor treated drinking water for any pesticide which is identified as a residual inadequately controlled risk, for example where there is no treatment capable of removing the pesticide. Where there is treatment such as granular activated carbon (GAC) in place to remove pesticides, or blending is in place to achieve compliance, then the treated or blended water monitoring should include individual pesticides that are likely to be present in the raw water in concentrations greater than 0.1µg/l.
- 6.7.7 Suppliers should keep their monitoring strategies for pesticides under continual review, particularly for any new and emerging pesticides and related products, and ensure that they are current and relevant. A useful point of reference is the European Chemicals Agency website (<http://echa.europa.eu/>), which maintains a current list of registered biocidal products.

6.8 Radioactive parameters:

General provisions

- 6.8.1 Regulation 6, paragraphs 7 to 15 [8 to 14] cover the monitoring requirements for the Schedule 2 (indicator) radioactivity parameters Indicative Dose (ID), radon and tritium (radioactivity monitoring). All of them are in Group B for monitoring purposes, and monitoring frequencies are specified in Table 9 (zones) and Table 13 (supply points) of Schedule 3. Supply point monitoring is encouraged (see 6.8.5.2 below).
- 6.8.2 Radioactivity monitoring should be initially informed by companies' catchment risk assessments, taking into account the geology and any artificial sources that could lead to an increase in natural background levels of radioactivity. There are a variety of reference sources available to facilitate this, but the most comprehensive source of monitoring data is a joint publication issued annually by the Environment Agency (EA), the Food Standards Agency (FSA), the Scottish

Environment Protection Agency (SEPA) and the Northern Ireland Environment Agency (NIEA) called the *Radioactivity in Food and the Environment* (RIFE) report, available on the FSA website. Additional information can be found in the [EA's Radionuclides Handbook](#) and the DWI-commissioned report on radon ([DWI 70/2/301 Understanding the implication of the EC's proposals relating to Radon in drinking water for the UK](#)). A table of common radioactive isotopes and their sources is included in [Appendix 6.1 – Radioactivity Monitoring](#).

- 6.8.3 If radioactivity has not been detected in a water supply source, and the catchment risk assessment confirms that it is unlikely to be detected, then monitoring for ID, tritium and radon is not required. This is allowed under regulation 6(12) [6(14)] – see paragraph 6.8.8 below for further guidance.
- 6.8.4 The Inspectorate considers that it is good practice to monitor radioactivity at treatment works, on the basis that levels should not deteriorate (i.e. become worse) in distribution. For the purposes of reporting data to the Inspectorate, each treatment works sampling point should be designated as the supply point for the zones it supplies. The zones supplied should also be recorded in applications for notices issued under regulations 6(7)(d) and 6(12) [6(14)].

Indicative Dose

- 6.8.5 Regulation 6(7) [6(9)] covers the monitoring requirements for **Indicative Dose (ID)**, which has a specified value of 0.1mSv:
 - 6.8.5.1 Monitoring for ID is not required if it is unlikely to exceed 0.1mSv. ID is normally monitored by proxy through measurement of gross alpha and gross beta activity. Gross alpha activity has a recommended screening value of 0.1Bq/l, whilst gross beta activity has a recommended screening value of 1.0Bq/l.
 - 6.8.5.2 Where there is no historic data to confirm ID, or where there is no regulation 6(12) [6(14)] notice in place (see under 6.8.8 below), monitoring for gross alpha and gross beta activity must be carried out, at the treatment works at the monitoring frequency specified in Table 13 of Schedule 3 (Group B2 parameters). The treatment works must be designated as a supply point for the zones supplied. The ID should be reassessed at appropriate intervals, based on risk. If the radioactivity is naturally derived, and the levels of gross alpha and gross beta activity are reasonably stable, then a minimum interval of 10 years is suggested as good practice. The supply may qualify for a regulation 6(7)(d) [6(9)(d)] notice (see under 6.8.5.10 below).
 - 6.8.5.3 If it can be demonstrated that detected gross alpha and/or gross beta activities are attributable to a specific radionuclide, the water company may monitor for this radionuclide instead, at the treatment works at the monitoring frequency specified in Table 13 of Schedule 3.
 - 6.8.5.4 Some low energy emitters, for example carbon (^{14}C), sulphur (^{35}S) and plutonium (^{241}Pu) will not be detected by screening for gross beta activity. A risk assessment is therefore critical to determine whether there are any likely sources of radioactivity that may not be detected through routine screening. Monitoring for these individual radionuclides should therefore be conducted, based on risk assessment.
 - 6.8.5.5 If the level of radioactivity appears to be increasing and/or new information becomes available which indicates that the risk is increasing, ID should be reassessed.

- 6.8.5.6 If gross alpha and/or gross beta activity is detected above its screening value, and/or risk assessment indicates that ID could exceed 0.1mSv, monitoring must be carried out. Following an initial exceedance, investigatory samples should be collected every few days, at least once per week, for a minimum period of one month, to confirm the level of activity.
- 6.8.5.7 Gross alpha and gross beta activity (with regard to the points made in 6.8.5.2 above) should then be monitored at the appropriate monitoring frequency for the supply point (Table 3 of Schedule 3). ID should be determined in accordance with Schedule 4 of the Regulations, based on the derived concentrations (previously known as reference levels) given for the radionuclides listed. Companies should use all relevant information about likely sources of radioactivity when deciding which radionuclides to monitor. The Inspectorate may, if necessary and based on advice from UK Health Security Agency (UKHSA) or the Office for Nuclear Regulation (ONR), vary the radionuclides and/or derived concentrations of radionuclides required for the calculation of ID. Companies will be consulted on any changes to the requirements and this guidance will be updated accordingly.
- 6.8.5.8 If the calculated ID exceeds 0.1mSv, or if the concentration of any radionuclide detected is greater than 20% of the derived concentration, then further monitoring for the radionuclide(s) should be undertaken to confirm the ID.
- 6.8.5.9 If at any time the ID is found to exceed 0.1mSv, then this should be reported to the Inspectorate as an event, as required by regulation 35(6), and the source of the radioactivity identified. If action is required to protect public health, the Inspectorate may decide to issue a regulation 20(4) notice.
- 6.8.5.10 Where it can be demonstrated that the source of the radioactivity is naturally derived and the monitoring shows that the concentration of the radionuclides is stable (i.e. the levels of gross alpha and gross beta activity are stable and are representative of a stable ID), an application for a regulation 6(7)(d) [6(9)(d)] notice can be made. The Inspectorate will prescribe the minimum monitoring frequency required in the notice.
- 6.8.5.11 If the source of the radioactivity is suspected to be an artificial source, then companies should carry out a risk assessment and monitor for radionuclides most likely to be present, based on the risk assessment. ID should then be calculated. Companies may need to seek professional advice to assist with radioactivity risk assessments.
- 6.8.5.12 Schedule 4 paragraph 3(4) includes a provision for the Secretary of State/Welsh Ministers to set alternative screening values for gross alpha activity and gross beta activity where it can be demonstrated that the alternative values are in compliance with an ID of 0.1mSv. Further guidance will be provided to companies about this at a future date.

Radon

- 6.8.6 Regulations 6(8) and (9) [6(10) and (11)] cover the monitoring requirements for **Radon**, which has a specified value of 100Bq/l:
- 6.8.6.1 Regulation 6(8) [6(10)] requires that water companies must ensure that a representative survey is carried out to determine the likelihood of radon exceeding the specified value. The report referred to in paragraph 6.8.2 above, *DWI 70/2/301 Understanding the implication of the EC's proposals relating to Radon in drinking water for the UK* is the report on a national representative

survey undertaken to fulfil this requirement. In this report, areas of England and Wales have been mapped and delineated based on whether the geology, existing sample result data and radon-in-air hazards are indicative of a high, moderate or low risk of radon being present as a drinking water quality hazard. Whilst EC proposals are not authoritative in the UK following its exit from the EU, the guidance document remains relevant to managing levels of radon.

6.8.6.2 Companies should use the data provided in this report to inform their catchment risk assessments. Companies should complete a risk assessment for every source catchment and determine an appropriate monitoring strategy for radon, based on the risk of radon being present in treated water, as follows:

i. Surface waters do not require monitoring for radon.

ii. Groundwaters in low hazard areas do not require monitoring for radon.

iii. Groundwater supplies in high and moderate hazard areas: Under regulation 6(12) [6(14)], see under 6.8.8 below, companies may apply to the Inspectorate for a notice granting an exemption from monitoring, supported with appropriate evidence.

6.8.6.3 Companies should carry out catchment risk assessments to confirm that sources geographically located in the low hazard areas identified in the report referred in paragraph 6.8.2 are not at risk of exceeding the specified value for radon.

6.8.6.4 The specified value for radon of 100Bq/l applies at consumers' taps. Available evidence indicates it is unlikely that any public supplies will exceed this level, even where radon activity exceeds 100Bq/l at the treatment works, because radon gas is readily released into the atmosphere. In the event of an exceedance of the specified value for radon at a treatment works, further investigatory samples should be collected from the works every few days, at least once per week, for a minimum period of one month, to confirm the level of activity.

6.8.6.5 If radon is detected at greater than 100Bq/l in water supplied from a treatment works, investigatory monitoring should also be undertaken at consumers' taps to assess the impact on public health. Properties in high risk areas may be at risk of elevated levels of atmospheric radon, which could be exacerbated by radon present in the tap water. Advice should be sought from UK Health Security Agency (UKHSA) or Public Health Wales (PHW) if there is any concern.

6.8.6.6 The Regulations specify an upper maximum limit for radon of 1,000Bq/l. If this level is exceeded, remedial action is required without consideration. It must be reported immediately to the Inspectorate as an event, as required by regulation 35(6). Companies should also consider, as a matter of good practice, reporting any detections of radon at levels exceeding 100Bq/l to the Inspectorate as an event. This will allow the Inspectorate to be involved with discussions about any actions required to protect public health, which will add to the overall knowledge base for radon in drinking water supplies and inform future guidance published by the Inspectorate.

Tritium

6.8.7 Regulation 6(10) [6(12)] covers the monitoring requirements for **Tritium**, which has a specified value of 100Bq/l:

- 6.8.7.1 Monitoring for tritium must be carried out where there is an anthropogenic (man-made, or artificial) source of tritium in the catchment and the data indicates that the level of radioactivity due to tritium exceeds, or is likely to exceed, the specified value. Monitoring should be carried out at the treatment works, at the monitoring frequency specified in Table 13 of Schedule 3. The treatment works must be designated as a supply point for the zones supplied.
- 6.8.7.2 Where tritium is detected above 100Bq/l and it can be demonstrated that the source is naturally-derived, then a regulation 6(12) [6(14)] notice may be applied for. This situation is unlikely to arise, however, since the presence of tritium in water would invariably be associated with an anthropogenic source.
- 6.8.7.3 In the event of an exceedance of the specified value for tritium, further investigatory samples should be collected from the treatment works every few days, at least once per week, for a minimum period of one month, to confirm the level of activity
- 6.8.7.4 If the level of tritium activity detected exceeds 100Bq/l, then companies should carry out further investigations to identify the source, and undertake monitoring for additional radionuclides – see section covering regulation 19 in paragraph 19.9. If at any time tritium is found to exceed 100Bq/l, then this should be reported to the Inspectorate as an event, as required by regulation 35(6). If action is required to protect public health, the Inspectorate may decide to issue a regulation 20(4) notice.

Exemption from Monitoring

- 6.8.8 Regulations 6(12) to (15) [6(14) to (16)] cover **allowable exemptions** from radioactivity monitoring:
 - 6.8.8.1 Under regulation 6(12) [6(14)] the Inspectorate may issue notices to water companies granting exemption from undertaking monitoring for ID, radon and/or tritium. Companies should provide evidence from their catchment risk assessments and monitoring data (whether compliance or operational monitoring) to support any application for a notice. In each case the evidence must demonstrate that water supplied from the treatment works is not likely to exceed the relevant specified value in Schedule 2 of the Regulations. The Inspectorate will determine the period of the exemption.
- 6.8.9 Regulation 6(13) [6(15)] requires the Inspectorate to publish the grounds for the notification through a method it considers appropriate: The Inspectorate does this by issuing a direct notification to water companies, as well as publishing the relevant information on the 'Improvement Programmes' section of its website. Regulations 6(14) and (15) [6(16) and (17)] cover the circumstances where the Inspectorate must revoke a regulation 6(12) [6(14)] notice, and water companies' duties to reinstate monitoring for the relevant parameter.
- 6.8.10 If, through companies' radioactivity monitoring, any isotopes of uranium are detected, the company should analyse samples for uranium concentration (as µg/l) to ensure that the concentrations of uranium found do not present a risk to wholesomeness by virtue of the element's chemical toxicity. The WHO guideline value (GV) for uranium is 30µg/l. If uranium is detected at a concentration exceeding the GV, then it should be reported to the Inspectorate as an event, as required by regulation 35(6). UKHSA/PHW should be consulted to determine whether any action is needed to protect human health.

- 6.8.11 Further guidance on radioactivity sampling and analysis is given in [Appendix 6.1: Radioactivity Sampling and Analysis](#). The Appendix includes flow charts illustrating the decision-making process for ID, a more detailed flow chart to aid investigation of ID, a table of naturally-occurring radioactive isotopes and their sources, information and reference sources for analytical methods and some guidance on the importance of understanding decay pathways.

6.9 Monitoring water supplied from tankers

- 6.9.1 Regulation 6(16), (17) and (18) [6(4) and 6(5)] specify the requirements for monitoring water supplied from tankers (i.e. any transportable or mobile vessel not hydraulically linked to the water network from which consumers may collect water) where they are used to provide a short-term alternative to the piped public supply (usually in emergencies). Water from every individual tank or bowser must be sampled for *E.coli* and conductivity at the time of deployment (i.e. when it is ready for use by consumers); and every 48 hours thereafter for those and for all other Group A and B parameters unless the source of water used for filling the tanker is exempt from sampling for that parameter by virtue of a notice served under Regulation 9(3). Only wholesome water should be used to fill bowzers. It is good practice for companies to keep records of bowzers and tanks deployed, the time filled and the time taken out of use, in order to be able to demonstrate compliance with these regulations.
- 6.9.2 Guidance on cleaning and disinfecting bowzers before use, and maintaining wholesomeness whilst in use, is given in technical guidance note [TGN12](#), published as part of *The Principles of Water Supply Hygiene*, published by Water UK (October 2015, updated March 2017). Manufacturers' instructions for use should also be followed.
- 6.9.3 These regulations do not apply to vehicle tankers when used to introduce drinking water into the distribution network either directly or to fill service reservoirs. The point of compliance remains at consumers' taps. Monitoring of reservoir outlets should remain as specified in regulation 14 [13]. The Inspectorate considers that it is good practice to carry out additional operational monitoring of water supplied from the reservoirs, and water as it is discharged from tankers, to confirm that the water supplied is wholesome.
- 6.9.4 In carrying out vehicle tankering operations companies should follow manufacturers' instructions for use and guidance in *The Principles of Water Supply Hygiene* when cleaning and preparing tankers, and for maintaining wholesomeness of the water during transport and discharge into the public supply system. Tankers used to supply drinking water should not be used for any other purpose, unless during exceptional emergency situations a lack of available water-only tankers requires the procurement of additional tankers. In such situations tankers that have been used to transport food and drink products for human consumption may be used, provided they have been thoroughly cleaned, disinfected and sampled for microbiological parameters before use.
- 6.9.5 Where vehicle tankers are used to inject water directly into the distribution network, it is considered good practice to sample water in the tanker after it has been filled or as it is discharged, as a minimum for microbiological parameters and turbidity, and also from suitable points downstream in the network to verify that flow changes and disturbance of deposits have not caused a deterioration in quality.

7. Regulation 7 – Sampling points

- 7.1 Regulation 7 requires all sampling points in water supply zones to be selected at random unless the Inspectorate issues a notice saying otherwise. Water companies are expected to maintain a sampling programme that selects sample points at random from a comprehensive list of all its consumers, including commercial premises and buildings where the water supply is made available to members of the public. The list of consumers should also include non-household customers who have switched supplier, because wholesale licensees retain responsibility for the regulatory sampling and other duties imposed by the Regulations. Sampling points must be representative of the water supply zone as a whole.
- 7.2 If a supplier is experiencing difficulty with obtaining samples from randomly selected properties within a water supply zone, for example because the population is very small, the Inspectorate should be contacted for further advice. A notice as referred to in regulation 7 may be issued in an exceptional circumstance.

8. Regulation 8 – Authorisation of supply points

- 8.1 Regulation 8 permits the use of monitoring at designated supply points, in place of monitoring in water supply zones, for certain parameters (known generically as conservative parameters). This is permitted provided it can be demonstrated that there is no material difference in the data for the parameter between the supply point and the consumers' taps in the zone. Under regulation 8(2) the Inspectorate automatically authorises the use of designated supply points for the parameters identified as supply point parameters in Schedule 3 of the Regulations.
- 8.2 A supply point can be a treatment works outlet, a service reservoir outlet or a blending point, and may supply more than one zone. Treatment works and service reservoir sampling points used as supply points must be coded as supply points in companies' monthly data returns for the applicable parameters and zones supplied.
- 8.3 The 2018 Amendment Regulations in England and the 2018 Welsh Regulations omit mercury from regulation 8 in error, although the parameter is correctly footnoted as a supply point parameter in Tables 2 and 3 of Schedule 3. The English Regulations have been corrected by the Environment, Food and Rural Affairs (Miscellaneous Amendments etc.) Regulations 2019 – SI No. 526 which came into force on 29 March 2019.
- 8.4 The following parameters are missing from footnote 1 in Table 2 of Schedule 3: *Clostridium perfringens* and trichloroethene. They are correctly referenced in regulation 8, however, and therefore are automatically authorised to be monitored at supply points.
- 8.5 It is mandatory to monitor bromate at supply points unless sodium hypochlorite dosing is practised at the treatment works or downstream in the network, in which case it must be monitored at consumers' taps. Companies should designate their treatment works final water sampling points (regulatory compliance sampling points) as supply points for the purpose of bromate monitoring.

- 8.6 As explained in previous sections, the Inspectorate considers it to be good practice that, as far as practicable, pesticides and radioactivity parameters are also monitored at treatment works outlets in place of zones. Where this is carried out the treatment works sampling point should be designated as a supply point for the zones supplied.
- 8.7 Under regulation 8(4) the Inspectorate may, upon receipt of a written application from the water company, authorise supply point monitoring for other parameters, subject to certain criteria:
- i. Antimony, arsenic, cadmium and selenium may be monitored at supply points where the water company can demonstrate for the zones supplied that these metals have not been detected at significant concentrations in samples taken from consumers' taps for at least two years.
 - ii. Trihalomethanes may be monitored at supply points where the water supply zones are supplied with water that originates solely from groundwater and the water company can demonstrate that the concentrations at consumers' taps have been an average (mean) of 30µg/l or less for at least two years and not exceeded 50 µg/l in that time.
 - iii. Where a supply point authorisation is granted for any of the above parameters, companies should adopt the same sampling frequencies specified in Table 13 of Schedule 3.
 - iv. Regulations 8(6) to 8(10) require that companies must inform the Inspectorate as soon as they become aware that use of a supply point is no longer appropriate for a parameter granted authorisation under regulation 8(4), and the Inspectorate will revoke the authorisation. Furthermore, the Inspectorate must revoke the authorisation, which it can do without prior notice.
- 8.8 **Fluoride** is one of the parameters that may be monitored at a supply point. Where supplies are artificially fluoridated at the request of the local authority, to achieve a target concentration in water supplied to consumers, fluoride should not be monitored at a supply point if the downstream fluoride concentration is likely to decrease through blending with water containing a lower concentration of fluoride. This would constitute “*adverse change*”, and therefore supply point monitoring is deemed to be inappropriate.
- 8.9 ***Clostridium perfringens*** is the only microbiological parameter which may be monitored at supply points. The primary reason for monitoring for *C.perfringens* is because of this organism's properties as an indicator of remote or historic faecal contamination, and its usefulness as an indicator of the effectiveness of treatment processes, in particular those designed to remove particles. Monitoring of *C.perfringens* at consumers' taps is not consistent with this primary role, therefore companies are encouraged to undertake monitoring at treatment works outlets, which should be designated as supply points for the zones supplied.
- 8.10 In respect of the following parameters, it is unlikely that authorisation to sample from supply points will be given because the results may differ in a material respect:
- i. *E.coli*, coliform bacteria and colony counts, because these are likely to change in concentration through the distribution system;
 - ii. Lead, copper, nickel and chromium because these metals can be present from contact of the water with plumbing materials;
 - iii. Iron, manganese and aluminium because these metals can be present in water leaving treatment works and picked up from deposits in the distribution system;

- iv. Polycyclic aromatic hydrocarbons (PAH) and benzo(a)pyrene because these substances are associated with coal tar pitch linings in distribution systems;
 - v. Colour, taste, odour and turbidity because these characteristics of the water supply can be affected by the condition of the distribution system and consumers' plumbing systems;
 - vi. Hydrogen ion (pH) because this can change as the water passes through the distribution system and by treatment equipment within consumers' premises;
 - vii. Sodium because this can increase when certain types of treatment equipment is used within consumers' premises;
 - viii. Ammonium and nitrite because these concentrations are likely to change as the water passes through the distribution system due to microbiological reactions and when chloramination is practised;
 - ix. Nitrate because it should be sampled at the same time and place as nitrite in order to calculate the nitrate / nitrite formula; and
 - x. Trihalomethanes when the water supply originates from or is influenced by surface water because the concentrations leaving the treatment works are likely to vary significantly as the water passes through the distribution system.
- 8.11 Regulation 8(3) prohibits the use of supply points where a licensee introduces water into the supply zone, unless the water quality within the supply zone remains approximately uniform.
- 8.12 The Regulations make no reference to the provision of a bulk supply of water from one water supplier to another, though this is common practice. For the parameters specified, and subject to the Inspectorate's approval, water suppliers receiving a bulk import may use data gathered by the supplying company from its supply point in place of supply zone data, provided that the zone receiving the bulk import receives water only from the supplier's supply point.

9. Regulation 9 – Numbers of samples

- 9.1 Regulation 9 requires a water supplier to take, at regular intervals, the standard number of samples from its water supply zones (consumers' taps) or, where appropriate, supply points, for analysis for the parameters listed in Groups A and B of Schedule 3. As explained previously in paragraph 6.5, parameters included in Group A monitoring do not need additional Group B samples, because the specified Group A monitoring frequencies cover both purposes.
- 9.2 Sampling frequencies for zones are based on the resident population of the zone, and for supply points the daily volume of water supplied, in cubic metres per day (written as m³/day).
- 9.3 Under regulation 9(4) the Inspectorate may issue a notice to water suppliers allowing variations in monitoring frequencies in respect of parameters monitored in zones, at supply points where a supply point is used as a surrogate for zonal monitoring, at treatment works and at service reservoirs. The Inspectorate may issue a notice either in response to an application from a water supplier, or without an application if deemed necessary because of an identified risk. The frequency of monitoring may be increased or decreased, and authorisation may be given to cease monitoring altogether, depending on demonstrable risk.

- 9.4 Monitoring reductions and exemptions for radioactivity parameters are covered by regulation 6 – see paragraph 6.8.8 above.
- 9.5 Applications for monitoring variations must be supported with a risk assessment report and other supporting evidence. This evidence must include sample results taken at regular intervals over a minimum period of three years for the parameter(s) in question. Regulation 9(8)(b) [9(8)(c)] requires that all results of samples (regulatory and operational) taken for the relevant parameter must be less than 30% of the PCV to be considered for exemption from regulatory compliance monitoring.
- 9.6 Regulation 9(8)(d) requires that all results of samples (regulatory and operational) taken for the relevant parameter must be less than 60% of the PCV to be considered for reduced monitoring. Reduced monitoring will be 50% of the standard frequency.
- 9.7 Monitoring data considered in support of an application may, therefore, be derived from regulatory compliance samples or operational samples, and companies are encouraged to consider as much sample and other data as possible as evidence to support an application. For this purpose, an operational sample is any sample that is not taken to comply with the requirements of regulation 6 or regulation 17. The Inspectorate will provide a standard pro forma template for monitoring variation applications.
- 9.8 The risk assessment supporting applications for monitoring variations must demonstrate that there are no reasonably foreseeable circumstances that could lead to a deterioration of the water quality, and increase the risk that consumers may be supplied with unwholesome water. Companies should include information about source waters and catchment risks, treatment processes in place, treatment chemicals used, and information about materials used and the condition of assets in the network.
- 9.9 A notice will be issued by the Inspectorate listing the sampling points where an application has been accepted, for specified parameters, valid for up to 5 years. A new application will be required with the necessary supporting data to confirm that the conditions supporting a monitoring variation notice have not changed, where a company wishes to continue reduced or ceased compliance monitoring beyond the expiry date of the notice.
- 9.10 Where a monitoring variation notice has been issued by the Inspectorate permitting exemption from compliance monitoring, should any sample (regulatory, operational or on-line monitoring) exceed 30% of the PCV for a specified parameter, then the company must inform the Inspectorate. If the result is between 30% and less than 60% of the PCV, monitoring for that parameter must immediately revert to reduced frequency; if the result is 60% or more of the PCV, monitoring for that parameter must immediately revert to standard frequency. The monitoring variation notice for that parameter will be replaced or revoked as appropriate.
- 9.11 Where the Inspectorate has issued a monitoring variation notice permitting reduced monitoring, should any sample (regulatory, operational or on-line monitoring) return a result of 60% or more of the PCV for a specified parameter, then the company must inform the Inspectorate and monitoring for that parameter must immediately revert to standard frequency. The monitoring variation notice for that parameter will be revoked.
- 9.12 The Inspectorate may also revoke or replace a notice if new information emerges, for example from suppliers' regulation 28 risk assessment reports, from the Inspectorate's assessment of compliance breaches, notified events, consumer complaints or from technical audits, which indicates that there is a risk that consumers may be supplied with unwholesome water.

- 9.13 Regulation 9(11)(a) requires regulation 27 risk assessments used to support applications for monitoring variation notices to be carried out in accordance with recognised principles of international standards, such as [EN15975-2 *Security of drinking water supply, guidelines for risk and crisis management*](#). Risk assessment and risk management approaches must be approved against the DWI and Lloyd's Register, Risk Management Assessment Scheme which was launched in the summer of 2019.
- 9.14 The relevant competent authority for approving accreditation bodies is the DWI. The Inspectorate has worked with the water industry, through Water UK, to draft a Water Industry Specification (WIS) document based on the principles of EN 15975-2, which also incorporates additional aspects of established good practice in England and Wales for carrying out robust risk assessments, including taking into account monitoring carried out under the Water Framework Directive¹ as required by regulation 9(11)(c)) and which should now be read in the light of regulation 9(13). The WIS document forms the guidance for companies on the implementation of accredited risk assessment methodologies. A suitably accredited body (e.g. UKAS, or another organisation approved by the Inspectorate acting on behalf of the Secretary of State) will approve the appointment of inspection bodies (under ISO 17020) to confirm water suppliers' compliance with the requirements of the WIS. A water supplier may apply to an approved accreditation body to be a certified inspection body under ISO 17020, and thereby be authorised to self-certify its own risk assessment methodologies. Existing inspection bodies can apply to have their scope extended.
- 9.15 When applying for monitoring variations for the parameters listed below, companies will be expected to demonstrate that the conditions specified in paragraphs 9.5 to 9.8 above apply. Companies will also be required to send **an additional supporting report** to demonstrate that the risk of a specified condition being breached is acceptably low and/or that suitable controls are in place which limit the likelihood of a breach of those conditions to a minimum, now and for at least 5 years. The report must include all operational sample results for the most recent three years and details of the operational monitoring that will take place for the duration of the variation. Operational samples may include samples taken from supplying treatment works' abstraction points, raw waters, through plant and final treated water, as appropriate, to demonstrate the absence of risk and/or control measures in place to minimise the risk:
- a) Aesthetic and physico-chemical parameters – colour, turbidity, pH, conductivity, taste and odour – these are important general indicators of the quality of water supplied to consumers, and indicators of risks associated with private systems.
 - b) Aluminium – common constituent of treatment chemicals which may contribute to formation of sediment in distribution.
 - c) Ammonium, nitrate and nitrite when chloramination or dosing is practised at the supplying works, and because nitrate and nitrite must be monitored at the same frequency to demonstrate compliance with the formulaic PCV.
 - d) Bromate where any of ozonation, sodium hypochlorite dosing or UV treatment is practised at a supplying works or in the network.
 - e) Chloride and sulphate – these are important indicators of corrosivity.

¹ The Water Framework Directive has been transposed into national law and remains in place as the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

- f) Coliform bacteria, colony counts at 22°C, Enterococci, *C.perfringens* and residual disinfectant – these are important indicators of microbiological quality, and the PCV-based criteria for monitoring variations do not apply.
- g) Fluoride – due to public interest in this parameter.
- h) Iron and manganese – iron is a common constituent of treatment chemicals, and because of their common association with cast iron mains.
- i) PAH and benzo(a)pyrene – because of association with coal tar lined mains, and some bitumen linings.
- j) Pesticides (individual parameters) – risk-based monitoring for pesticides is already in place, therefore the Inspectorate is not expecting to receive any applications for monitoring variations.
- k) Plumbing metals – chromium, copper, lead and nickel - because of companies' duties in respect of private domestic systems.
- l) Sodium – associated with some types of plumbed-in filters in private domestic systems
- m) Trihalomethanes – required to demonstrate compliance with regulation 26.
- n) Where a section 19 undertaking or regulation 27(4) notice or regulation 28(4) notice is in place for a sampling point, and the parameter is specified in the legal instrument.

9.16 The Inspectorate may consider applications for reduced sampling frequency or exemption from monitoring for any other parameter, and parameters where a condition specified in paragraph 9.15 does not apply, provided that all other conditions referred to in 9.5 to 9.8 are met.

9.17 Where a monitoring variation notice has been issued, companies should maintain an appropriate level of operational monitoring, depending on the parameter, to ensure that regulation 27 risk assessments are up to date. Operational monitoring should be undertaken in catchments, at abstraction points, treatment works, in distribution and at consumers' taps, as appropriate depending on the parameter, to inform risk assessments. For conservative parameters (where the concentration remains unaffected by treatment and distribution, or is not likely to be made worse), a minimal level of operational monitoring should be maintained at abstraction points or in the catchment. The Inspectorate will provide further guidance on this when notices are issued.

9.18 Where a reduced frequency or exemption notice is in place for any parameter, companies must immediately revert to either standard or reduced frequency respectively, on a pro rata basis for the remainder of that year if it is established that any of the above conditions no longer apply, and inform the Inspectorate accordingly. This includes where an operational sample result indicates that a specified condition is no longer met.

9.19 Regulation 9(3(a) requires that samples are taken at regular intervals throughout the year. Companies should ensure that they have sufficient sampling manpower resource and analytical capability to ensure that this requirement is complied with. Clustering of samples to compensate for an earlier shortfall, incurred for example during a period of high workload, or staff holidays, indicates a failure to comply with this regulation.

9.20 If a supply point has been operational for part of a year, the number of samples taken (whether at reduced or standard frequency) should be in the same proportion as the number of days in the year (midnight to midnight) that the supply point was in use.

- 9.21 If a water supplier fails to take or analyse a prescheduled compliance sample, for example because of a broken sample bottle or analytical quality control (AQC) breach, it should reschedule a further sample as soon as possible, to be taken, as far as practicable, well in advance of the next programmed sample. Since the Regulations require sampling frequencies to be met on an annual basis, rescheduling would not necessarily constitute a shortfall. Provided the resampling is prompt, occasional occurrences of this type will not be regarded as a failure to meet the regularity requirement.
- 9.22 In general it is expected that companies will meet their full regulatory sampling programme. Where shortfalls occur, due consideration will be given by the Inspectorate to the reasons for those shortfalls in deciding whether enforcement action is necessary. The Inspectorate will also acknowledge the role of external conditions.
- 9.23 In the event of a supplier facing exceptional difficulty in achieving the collection of samples (for example during periods of severe weather), it should ensure that its primary consideration is the protection and maintenance of public health. Regular bacteriological sampling in zones should not be suspended. If necessary, under such circumstances, companies may use points selected by ease of access rather than selected at random to secure compliance with the sampling program. It is important to obtain a reasonable picture of water quality throughout zones, and sampling routes should be planned and varied with this in mind. Normal sampling must be resumed as soon as possible after normal conditions return.
- 9.24 Regulation 9(3) requires that with the exception of sampling at the consumer's tap, all sampling for chemical parameters in the distribution network must be in accordance with ISO 5667-5. Samples for microbiological parameters taken in the distribution network and at consumers' taps must be taken in accordance with EN ISO 19458.
- 9.25 [Table 9](#) includes a look-up table for every parameter with guidance on individual monitoring requirements.

10. Regulation 10 – Sampling: further provisions

- 10.1 Regulation 10 requires suppliers to take appropriate samples, as soon as they have reasonable grounds for believing that any element, organism or substance is present in the water that may cause it to be unwholesome. For example, where the supplier's risk assessment has identified that a treated water is at risk of being unwholesome because of the presence of *Cryptosporidium*, which is not a parameter. In such cases, the supplier must take a sufficient number of samples, at an appropriate frequency, in order to assess and quantify the risk, and to determine any necessary remedial actions required to ensure that the water supply is wholesome at all times. This should take into account any expected seasonal variation when doing so.

Table 9: Summary Table of Parameters and Monitoring Requirements

Parameter Type: D-Directive; N – National; P – Parameter; I – Indicator parameter

C – Conditions apply; G – supply point monitoring likely to be authorised upon application from a water company

✓ - Yes; X – No; N/A – not applicable

Parameter	Parameter Type	Supply Point Monitoring Permitted	Group A	Group B	Guidance
Zonal Monitoring – Group B1 or supply point as surrogate for zonal monitoring (B2). Regulations 8 and 9.					
Acrylamide	DP	N/A	N/A	N/A	Monitoring not required because compliance is determined through product specification and instructions for use.
Aluminium	NP	X	C	✓	Group A (A4) applies when aluminium is used as a flocculant, or where water originates from or is influenced by surface water. Otherwise group B1.
Ammonium	DI	X	C	✓	Group A (A4) applies where chloramination is practised. Otherwise Group B1. Reduced or exemption from monitoring unlikely to be authorised where chloramination is practised.
Antimony	DP	G		✓	B1 (B2 if monitored at supply point).
Arsenic	DP	G		✓	B1 (B2 if monitored at supply point).
Benzene	DP	✓		✓	B1 and B2
Benzo(a)pyrene	DP	X		✓	B1
Boron	DP	✓		✓	B1 and B2
Bromate	DP	C		✓	B1 and B2. Monitoring at supply points (B2) is mandatory unless sodium hypochlorite dosing is practised downstream in the network, in which case zonal monitoring is required (B1). Reduced or exemption from monitoring unlikely to be authorised where ozonation, sodium hypochlorite dosing or UV treatment is practised at a supplying works or in the network.

Parameter	Parameter Type	Supply Point Monitoring Permitted	Group A	Group B	Guidance
Cadmium	DP	G		✓	B1 (B2 if monitored at supply point).
Chloride	DI	✓		✓	B1 and B2
Chromium	DP	X		✓	B1
<i>Clostridium perfringens</i>	DI	✓		✓	B1 and B2. Companies are encouraged to monitor at WTW outlets, and designate the works outlet as a supply point for the zones supplied, irrespective of blending downstream.
Coliform bacteria	NI	X	✓		A1. Reduced or exemption from monitoring unlikely to be authorised because integral to <i>E.coli</i> analysis.
Colony counts at 22°	DI	X	✓		A4
Colour	NP	X	✓		A4
Conductivity	DI	✓	✓		A3 (supply points) and A4 (zones). Zonal monitoring is encouraged because of potentially unrealistic sampling frequencies at large supply points. Online monitoring to be encouraged as accreditation is developed.
Copper	DP	X		✓	B1
Cyanide	DP	✓		✓	B1 and B2
1,2 Dichloroethane	NP	✓		✓	B1 and B2
Epichlorhydrin	DP	N/A	N/A	N/A	Monitoring not required because compliance is determined through product specification and instructions for use.
Enterococci	DP	X		✓	B1
<i>Escherichia coli</i> (<i>E.coli</i>)	DP	X	✓		A1 Reduced or exemption from monitoring is not permitted in the Regulations.
Fluoride	DP	C		✓	Where the supply is artificially fluoridated under agreement with UKHSA, supply point monitoring is not permitted where the dosed water blends downstream with other waters such that the concentration at consumers' taps is below the dosed concentration.

Parameter	Parameter Type	Supply Point Monitoring Permitted	Group A	Group B	Guidance
					B1 and B2 Reduced or exemption from monitoring unlikely to be authorised where the supply is artificially fluoridated.
Hydrogen ion (pH)	DI	X	✓		A4
Iron	NP	X	C	✓	Group A applies when iron is used as a flocculant, or where water originates from or is influenced by surface water. Otherwise group B1. Reduced or exemption from monitoring unlikely to be authorised because it is commonly found in distribution systems.
Lead	DP	X		✓	B1
Manganese	NP	X	C	✓	Group A applies where water originates from or is influenced by surface water. Otherwise group B1.
Mercury	DP	✓		✓	B1 (B2 if monitored at supply point).
Nickel	DP	X		✓	B1
Nitrate	DP	X	C	✓	Supply point monitoring is not permitted because the nitrate/nitrite formulaic standard applies at consumers' taps. Group A (A4) applies where chloramination is practised. Otherwise B1 applies.
Nitrite	DP	X	C	✓	Group A4 frequency applies where chloramination is practised. Otherwise B1. Reduced or exemption from monitoring unlikely to be authorised where chloramination is practised.
Odour	NP	X	✓		A4. Reduced or exemption from monitoring unlikely to be authorised because it is an important aesthetic parameter.
Pesticides: Aldrin Dieldrin Heptachlor Heptachlor epoxide	DP	✓		✓	B1 and B2 Companies are encouraged to monitor at WTW outlets, and designate the works outlet as a supply point for the zones supplied, irrespective of blending downstream.

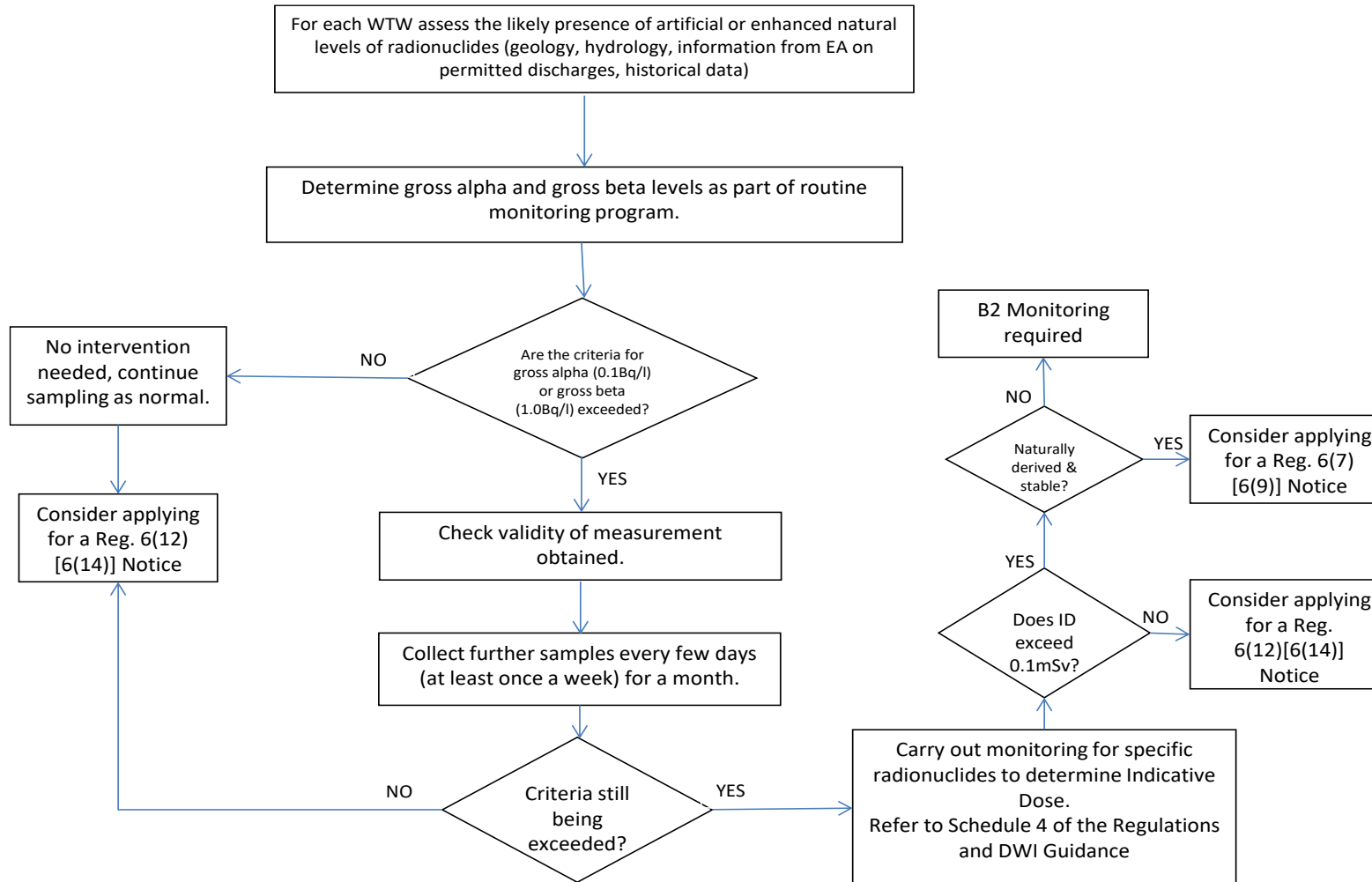
Parameter	Parameter Type	Supply Point Monitoring Permitted	Group A	Group B	Guidance
Pesticides: Other individual compounds	DP	✓		✓	Risk-based monitoring is already in place. Companies should only monitor for individual pesticides at risk of exceeding 0.1 µg/l in water supplied from WTWs. Companies are encouraged to monitor at WTW outlets, and designate the works outlet as a supply point for the zones supplied, irrespective of blending downstream. B1 and B2.
Pesticides: Total	DP	✓		✓	B1 and B2 Frequency of total pesticide monitoring should be based on the monitoring frequency of individual pesticides. Whenever a sample is taken for a single pesticide, the analysis suite should include total pesticides.
Polycyclic aromatic hydrocarbons (Total PAH)	DP	X		✓	B1
Radioactivity: Indicative Dose* Radon Tritium *Gross alpha & gross beta activity	DI	✓		✓	Monitoring (reduced and exemption) noticing process in place through regulation 6. Companies are encouraged to monitor at WTW outlets, and designate the works outlet as a supply point for the zones supplied, irrespective of blending downstream. B1 and B2
Residual disinfectant	-	N/A	✓		A1. National monitoring requirement at consumers' taps. No regulatory maximum or minimum concentration. Reduced or exemption from monitoring unlikely to be authorised.
Selenium	DP	G		✓	B1 (B2 if monitored at supply point).
Sodium	NP	X		✓	B1
Sulphate	DI	✓		✓	B1 and B2

Parameter	Parameter Type	Supply Point Monitoring Permitted	Group A	Group B	Guidance
Taste	NP	X	✓		A4 Reduced or exemption from monitoring unlikely to be authorised because it is an important aesthetic parameter.
Tetrachloroethene	DP	✓		✓	Combined PCV
Trichloroethene	DP	✓		✓	B1 and B2
Tetrachloromethane	NP	✓		✓	B1 and B2
Trihalomethanes (Total THMs)	DP	G		✓	Supply point monitoring likely to be permitted for groundwater zones (B2). Otherwise B1. Reduced or exemption from monitoring unlikely to be authorised for surface water supplies.
Total organic carbon (TOC)	DI	✓		✓	B1 and B2
Turbidity	NP	X	✓		A4
Vinyl chloride	DP	N/A	N/A	N/A	Monitoring not required because compliance is determined through product specification and instructions for use.
Mandatory monitoring ex treatment works outlets (Regulation 13 [12]) – all listed in Group A2 (Tables 5 and 11).					
Coliform bacteria	NP	N/A	✓		Reduced or exemption from monitoring unlikely to be authorised. Monitoring variation notices may be issued to increase the monitoring frequency where a risk of unwholesomeness has been identified, including where there is a risk of failing to comply with regulation 26.
Colony counts at 22°	NP	N/A	✓		
E.coli	NP	N/A	✓		
Nitrite	DP	N/A	C	✓	A2 monitoring at standard frequency is required where chloramination is practised. Otherwise group B2 frequency applies. Reduced or exemption from monitoring unlikely to be authorised where chloramination is in place.
Turbidity	NI	N/A	✓		Reduced or exemption from monitoring unlikely to be authorised because of regulation 26 requirements. Monitoring variation notices may be issued to

Parameter	Parameter Type	Supply Point Monitoring Permitted	Group A	Group B	Guidance
					increase the monitoring frequency where a risk of unwholesomeness has been identified, including where there is a risk of failing to comply with regulation 26.
Residual Disinfectant	-	N/A	✓		National monitoring requirement at treatment works' outlets. No regulatory maximum or minimum concentration. Online monitoring to be encouraged as accreditation is developed. Reduced or exemption from monitoring unlikely to be authorised. Monitoring variation notices may be issued to increase the monitoring frequency where a risk of unwholesomeness has been identified, including where there is a risk of failing to comply with regulation 26.
Mandatory monitoring at service reservoir outlets (Regulation 14 [13])					
Coliform bacteria	NP	N/A	N/A	N/A	Minimum sampling frequency of one sample each week that reservoir is in use. Monitoring variation notices may be issued to increase the monitoring frequency where a risk of unwholesomeness has been identified. Reduced or exemption from monitoring does not apply.
E.coli	NP	N/A	N/A	N/A	
Colony counts at 22°	NP	N/A	N/A	N/A	
Residual Disinfectant	-	N/A	N/A	N/A	National monitoring requirement at SR outlets. No regulatory maximum or minimum concentration. Online monitoring to be encouraged as accreditation is developed. Monitoring variation notices may be issued to increase the monitoring frequency where a risk of unwholesomeness has been identified. Reduced or exemption from monitoring does not apply.

APPENDIX 6.1: RADIOACTIVITY SAMPLING AND ANALYSIS

1. Decision Tree for Indicative Dose Monitoring (refer also to regulation 6 and regulation 19 guidance).



2. Commonly-found naturally occurring radionuclides in drinking water– an aid to risk assessment

The isotopes listed below are expected to form the basis for carrying out indicative dose calculations as they form the decay series from naturally occurring uranium.

Nuclide	Derived concentration (Bq/l) ²	Half life	□g/l	Uses/Comments	Emits	WHO guideline value (µg/l as the element)
U-238	3.0	4.468x10 ⁹ y	241.2	Start of the U-238 decay series	alpha and gamma	30 ³
U-234	2.8	2.455x10 ⁵ y	0.0121	Part of the U-238 decay series	alpha and gamma	30 ³
Ra-226	0.5	1600y	1.37x10 ⁻⁵	Part of the U-238 decay series. Formerly used in self-luminous paints for watches, nuclear panels, aircraft switches, clocks, and instrument dials. Used as a radiation source in some industrial radiography devices to check for flawed metallic parts.	alpha and gamma	
Pb-210	0.2	22.23y	7.06x10 ⁻⁸	Part of the U-238 decay series Used as a tracer for the behaviour of heavy metals in the soil-stream-estuary system.	alpha, beta and gamma	10
Po-210	0.1	138.38d	3.53x10 ⁻⁸	Part of the U-238 decay series Used in anti-static applications	alpha and gamma	
Ra-228	0.2	5.75y	1.98x10 ⁻⁸		beta	

This is not an exhaustive list, but represents the most common radionuclides likely to be found in drinking water.

²These values are calculations for a dose of 0.1mSv as an annual intake of 730 litres and taken from ICRP 119. Derived concentrations for other radionuclides can be calculated using information provided in this document - ICRP 119, Annex F – Compendium of Dose Coefficients is based on [ICRP Publication 60](#).

³ This guideline value is based on its chemical toxicity which is predominant compared to its radiological toxicity

3. Artificial Radionuclides

Artificial radionuclides do not normally occur in drinking water. If they do occur, the concentrations are normally too low to be detected. However, where it is suspected that radionuclides present are not naturally occurring, or do not account for all the radioactivity measured when calculating indicative dose, then specific advice should be sought. The advice should consider which artificial radionuclides are likely to be present in the local environment so that the radionuclide analysis can be suitably targeted. For example if the drinking water source is near a site which used or stored radium luminesced aircraft dials then the analysis should look for radium-226 and its decay products lead-210 and polonium-210. Where a radionuclide, for example radium-226 or polonium-210 has been used for its radioactive properties and is not present due to natural processes, for example as a result of decay through the uranium series, it is classified as an artificial (man-made) source.

4. Analytical requirements

These are taken directly from Schedule 4 of the Regulations and collated into a single table. In the absence of accreditation to DWTS for radioactivity parameters, the analytical method should be covered by ISO 11929.

Parameter	Limit of Detection (Bq/l)	PCV (Bq/l)	Action (Bq/l)
Tritium	10	100	
Radon	10	100	1000
alpha	0.04	0.1	0.5*
beta	0.4	1.0	
U-238	0.02		
U-234	0.02		
Ra-226	0.04		
Ra-228	0.02		
Pb-210	0.02		
Po-210	0.01		
C-14	20		
Sr-90	0.4		
Pu-239/Pu-240†	0.04		
Am-241†	0.06		
Co-60†	0.5		
Cs-134†	0.5		
Cs-137†	0.5		
I-131†	0.5		

*This is the WHO Guideline Value (GV), which may be set as the limit (screening level), if required, through the notice procedure where ID is shown to be below 0.1mSv, authorised by the Inspectorate. In order operate with this screening level, the company will be required to provide radionuclide identification as evidence to support a relaxation of the gross alpha screening level.

†These radionuclides do not occur in drinking water in normal situations, or may be found at doses that are too low to be of significance to public health. Therefore, they are of lower priority for investigation following an exceedance of the screening level unless there is local information to indicate they may be present

5. Methods of analysis

Below are the published methods of analysis for radioactive parameters. This list is not exhaustive, but these methods provide starting points for in-house methods and are under

constant review through either the Standing Committee of Analysts (SCA) or British Standards Institute (BSI). Analytical methods for radionuclides fall under the general DWTS requirements for analysis and accreditation.

Blue book methods of analysis (current 21/12/15)

1. Measurement of alpha and beta activity of water and sludge samples. The determination of Radon-222 and Radium-226. The determination of Uranium (including general X-ray fluorescent spectrometric analysis) 1985-1986 (94).
2. Determination of radioactivity in water by Multinuclide Gamma Ray Spectrometry 1989 (132).
3. The determination of tritium (tritiated water) activity concentration by alkaline distillation and liquid scintillation counting 1999 (173).
4. Guidance on the measurement of tritium in environmental samples 2005 (198).

British Standards (current 21/12/15)

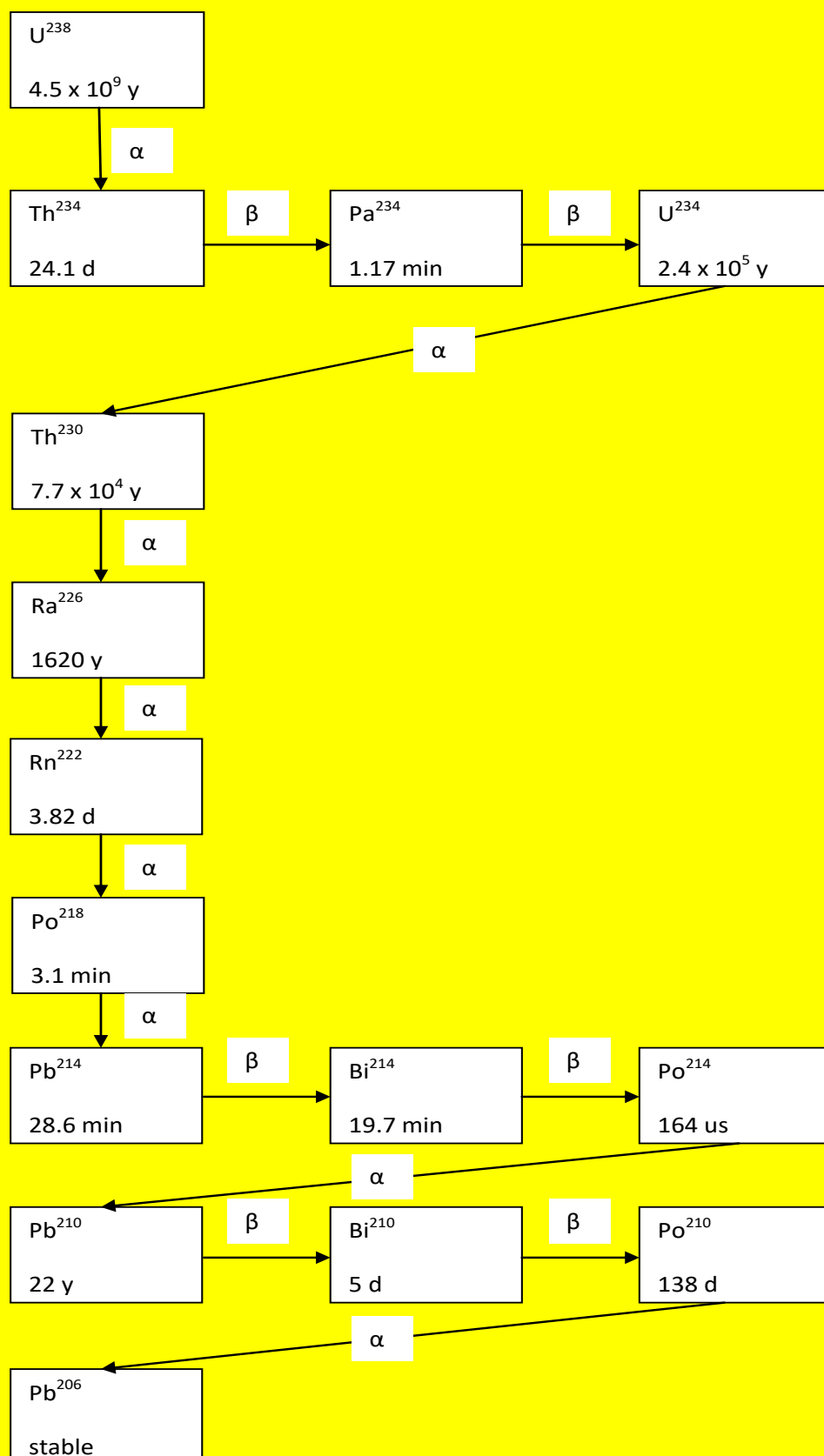
5. BS EN ISO 9698:2015 Water quality. Determination of tritium activity concentration. Liquid scintillation counting method
6. BS EN ISO 10703:2015 Water quality. Determination of the activity concentration of radionuclides. Method by high resolution gamma-ray spectrometry
7. BS EN ISO 13161:2015 Water quality. Measurement of polonium 210 activity concentration in water by alpha spectrometry
8. BS ISO 11704:2015 Water quality. Measurement of gross alpha and beta activity concentration in non-saline water. Liquid scintillation counting method
9. BS ISO 13167:2015 Water quality. Plutonium, americium, curium and neptunium. Test method using alpha spectrometry
10. BS ISO 10704:2015 Water quality. Measurement of gross alpha and gross beta activity in non-saline water. Thin source deposit method
11. BS ISO 9698:2015 Water quality. Determination of tritium activity concentration. Liquid scintillation counting method
12. BS ISO 9696:2007 Water quality. Measurement of gross alpha activity in non-saline water. Thick source method
13. BS ISO 9697:2015 Water quality. Gross beta activity in non-saline water. Test method using thick source
14. BS EN ISO 13160:2015 Water quality. Strontium 90 and strontium 89. Test methods using liquid scintillation counting or proportional counting
15. BS ISO 13163:2013 Water quality. Lead-210. Test method using liquid scintillation counting

16. BS ISO 13164-1:2013 Water quality. Radon-222. General principles
17. BS ISO 13164-4:2015 Water quality. Radon-222. Test method using two-phase liquid scintillation counting
18. BS ISO 13165-2:2014 Water quality. Radium-226. Test method using emanometry
19. BS ISO 13168:2015 Water quality. Simultaneous determination of tritium and carbon 14 activities. Test method using liquid scintillation counting
20. BS ISO 13165-3 Water quality - Radium-226 - Part 3 Test method using coprecipitation and gamma-spectrometry Shortcut
21. BS EN ISO17294-2 Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2 Determination of selected elements including uranium isotopes
22. ICRP 119 – Compendium of Dose Coefficients based on [ICRP Publication 60](#).

6. Decay Pathways

Decay pathways provide useful information to assist water companies in the process of identifying sources, or risks from radionuclides. It is advised that water companies review the radionuclide and its decay pathway to inform the risk assessment and to provide vital information regarding the stability of the radionuclide(s), to ensure that analysis is carried out without degradation to the sample and is representative of the water supplied. 30 day stability is not an absolute and some radionuclides have a considerably shorter half-life than 30 days. The following chart is an example of a decay pathway, in this case naturally occurring uranium-238 decay series, which includes radon.

Natural radioactivity decay – Uranium to Lead



Revision notes

Version	Revision	Date
1.0	First major version covering the 2016 Regulations	July 2016
1.1	Wording in paragraph 5.2 amended to improve clarity. Paragraph 5.6 is about combined licensees responsibilities. This has been footnoted with a comment that combined licenses were revoked on 1 April 2017, replaced with water supply license (wholesale and supplementary) authorisations	April 2017
1.2	Added paragraphs 9.11 and 9.12 - guidance for routine monitoring under exceptional conditions, e.g. extreme weather	August 2017
2.0	Updated following publication of the 2018 amendment regulations in England and the 2018 Welsh Regulations, with new guidance on regulation 9 covering monitoring variations, and the addition of a parameter look-up table (Table 9). Also, paragraph 6.8.5.2 is amended, changing guideline frequency for reassessing indicative dose from 5-yearly to 10-yearly. Amendments made to Appendix 6.1 - Radioactivity.	September 2018
2.1	Updated following publication of the Environment, Food and Rural Affairs (Miscellaneous Amendments etc.) Regulations 2019 – SI No. 526	April 2019
3.0	Updated following UK's exit from the European Union	April 2020
3.1	Amendment to paragraph 9.3	June 2020

