Drinking Water Inspectorate Guidance to water companies

Guidance on the Water Supply (Water Quality) Regulations 2016 (as amended) for England and Water Supply (Water Quality) Regulations 2018 for Wales specific to PFAS (per- and polyfluoroalkyl substances) in drinking water

March 2025

Contents

1 Introduction

1.1 The regulatory requirements for the quality of public drinking water supplies in England are set out in the Water Supply (Water Quality) Regulations 2016 (as amended) and in Wales by the Water Supply (Water Quality) Regulations 2018 ["the Regulations"]. The requirements of the Regulations are enforced by the Drinking Water Inspectorate ["the Inspectorate"].

1.2 This document provides consolidated guidance on aspects that water companies should consider when fulfilling their statutory obligations to ensure the safety of drinking water with respect to per- and polyfluoroalkyl substances (PFAS). It is based on a three-tiered, risk-based approach to the protection of water safety.

1.3 This document also provides further information around the reporting of notifiable PFAS events and how the Inspectorate will assess these events to ensure water companies are implementing strategies to reduce the risk associated with PFAS.

2 Background

2.1 PFAS are a large group of thousands of synthetic organic chemicals. They are substances that contain at least one fully fluorinated methyl or methylene group. Due to the strength of the carbon-fluorine bond, PFAS do not readily degrade in the environment. PFAS are highly mobile in air, water, and soil, and can bioaccumulate in humans and wildlife.

2.2 PFAS chemicals have many useful properties and have been used around the world since the 1940s. They are resistant to very high heat, protect surfaces from water, grease or friction, and have fire-retardant and stain-resistant properties. As a result, they have a large range of uses in industry (for example metal plating), everyday consumer products (for example in stain and water-resistant fabrics and carpets, cookware, and food packaging) as well as in firefighting foams.

2.3 Perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonic acid (PFHxS) are the most studied PFAS in terms of impacts on human health. Documented potential adverse health outcomes of PFAS studied include reproductive effects including reduced fertility; developmental effects in children such as low birth weight; increased risk of some cancers, including prostate, kidney and testicular; and a reduced ability of the body's immune system to fight infection (United States Environmental

Protection Agency, 2023). In 2023, a working group convened by the International Agency for Research on Cancer (IARC) Monographs programme classified PFOA as carcinogenic to humans (Group 1) and PFOS as possibly carcinogenic to humans (Group 2B) (International Agency for Research on Cancer, 2023).

2.4 PFOS and PFOA, along with their related compounds, have been classified as persistent organic pollutants (POPs) under the Stockholm Convention (listed in 2009 and 2019 respectively). These are chemicals of global concern due to their potential for long-range transport, persistence in the environment, ability to biomagnify and bio-accumulate in ecosystems, as well as their significant negative effects on human health and the environment. The manufacture, sale and use of products containing POPs is now banned. Material or products containing POPs can only be used for specific exceptions; PFOS and its derivatives can be used in mist suppressants for non-decorative hard chromium (VI) plating; PFOA and related compounds may remain present for a limited time in certain existing fire suppression installations. In 2022, PFHxS and its related compounds were also listed under the Stockholm Convention. Long-chain perfluorocarboxylic acids (LCPFCAs) are currently being reviewed by the POPs Review Committee.

2.5 The World Health Organization (WHO) is currently developing a background document for the Guidelines for drinking-water quality on PFAS in drinking-water with a focus on PFOS and PFOA (WHO, 2023), including the development of guideline values. In the interim, its advice in relation to PFOS and PFOA in drinking-water is guided by the key principles set out in the draft background document, namely:

- States should strive to achieve concentrations in drinking-water that are as low as reasonably practical.
- Contamination of water sources should be minimized, including preventing new sources of contamination.
- Non-essential uses of PFAS should be stopped.
- Risks from PFAS need to be balanced with other risks in the water supply including not having adequate supplies of drinking-water.

2.6 Currently, there are no standards in the Regulations for PFAS in drinking water in England and Wales. However, the persistent nature of PFAS chemicals, the wide variety of possible sources and the potential adverse health outcomes are such that the Inspectorate considers it appropriate to provide specific guidance to water companies in relation to these chemicals.

2.7 To establish guidance on PFAS concentrations in drinking water that do not constitute a potential danger to human health, the Inspectorate has sought advice from the UK Health Security Agency (UKHSA). It has also considered the most up to date information available from a range of other national and international organisations such as the WHO, the European Food Safety Authority (EFSA), other nations' health protection agencies, as well as the Committee on Toxicity (COT).

2.8 The guidance retains the existing three-tiered approach to the protection of water safety in relation to PFAS. The tier levels and guidance on the actions that water companies should consider when fulfilling their statutory obligations to ensure the safety of drinking water are described in section 3.

2.9 The Inspectorate considers it reasonably practicable to achieve concentrations of individual PFAS in drinking water below 0.1 µg/L. A value of 0.1 µg/L corresponds to a daily intake of 0.0033 µg/kg body weight for a 60 kg adult drinking 2 litres per day and 0.01 µg/kg body weight for a 10 kg infant drinking 1 litre per day.

2.10 Where sites fall into tier 3 (≥0.1 µg/L), the Inspectorate expects companies to put in place emergency contingency measures to reduce concentrations to below 0.1 µg/L in water supplied to consumers. Furthermore, the revised guidance requires companies with sources that fall into tier 2 (<0.1 µg/L) to design a proactive and systematic risk reduction strategy. This shall include a prioritised mitigation methodology to progressively reduce PFAS concentrations in drinking water. This requirement has been further extended to include combined PFAS on a 'sum of' basis.

2.11 There is an evolving understanding of the potential risks associated with PFAS in the environment, in products we use and in food we ingest. In line with further information from monitoring, toxicology, treatment efficacy and technological solutions, there is a need for companies to adapt, implementing forward-looking, systematic interventions. Without this precautionary approach to PFAS, the Inspectorate anticipates it may become an increasing risk to the quality of drinking water supplies in England and Wales.

2.12 The purpose of this guidance is to update and consolidate information from the following sources: 2021 guidance on the Regulations specific to PFOS and PFOA; IL 05/2021 detailing monitoring requirements for PFAS; IL 03/2022 including regulation 27 risk assessment and regulation 28 reporting requirements; and IL 02/2023 containing the Inspectorate's expectations for

company PFAS strategies during and beyond AMP8. The revised guidance supersedes these documents. It also consolidates information in the AMP8 PFAS strategy undertakings (2024) accepted from companies that clarify the Inspectorate's expectations for managing tier 2 PFAS concentrations, as well as letters clarifying the Inspectorate's expectations for managing tier 2 PFAS sent to companies with tier 2 sites in December 2023. In addition, it expands upon the guidance specific to PFOS/PFOA to apply to all identified PFAS chemicals of interest.

2.13 The Inspectorate will continue to monitor expert opinion on PFAS from organisations worldwide and update guidance to water companies accordingly.

3 PFAS tiers and actions

3.1 To ensure the continued safety of drinking water, the Inspectorate expects water companies to adopt a tiered approach to risk assessment, monitoring and management of PFAS concentrations in drinking water supplies. The tier levels are shown in Table 1, with the actions required at each level. 'Sum of' PFAS concentrations should be included within the tiers in Table 1.

Table 1: PFAS tiers and actions

Tier	PFAS concentration	Actions
Tier 1	<0.01 µg/L	• Monitoring frequency for PFAS should initially be quarterly to establish a baseline for risk assessment, accounting for temporal variation, then may be reduced to allow periodic validation of the risk assessment (minimum annual). • Conduct a regulation 27 risk assessment for every site. Submit hazard lines for PFAS in regulation 28 reports, generally with a DWI risk category of A or H, for every site in this tier. • Consider further actions required where sites are likely to breach tier 2.
Tier 2	<0.1 µg/L	• Increase PFAS monitoring frequency, generally to between monthly and quarterly, sufficient to enable predictive modelling. Higher frequency monitoring may be appropriate where concentrations could breach tier 3. • Ensure regulation 27 risk assessments are up to date and under continuous review. Regulation 28 report updates must be provided as part of the monthly submission process when a risk is reviewed and the residual risk score or DWI category has changed. Risk category will generally be C, D or E for sites in this tier. • Review existing control measures, including the effectiveness, validation, and monitoring of that measure. Identify additional control measures required to reduce PFAS concentrations. • Discuss with the Liaison Inspector (in working hours) if a final water result exceeds the company's internal alert level indicating that the tier 3 concentration may be breached, or if there is an increasing PFAS trend that could lead to a breach, to determine whether the occurrence should be a reportable event. Consult/discuss with UKHSA and local health authorities. • Prepare emergency contingency measures to prevent the supply of water to consumers with ≥0.1 µg/L PFAS should existing control measures become inadequate. • Design a proactive and systematic risk reduction strategy which shall include a prioritised mitigation methodology to progressively reduce PFAS concentrations in drinking water. Appropriate mitigation may include catchment management, direct or indirect treatment, or process-controlled blending.

Tier 3	≥0.1 µg/L	• Notify as an event any results ≥0.1 µg/L in water supplied to consumers, any raw water results that are likely to cause results ≥0.1 µg/L in water supplied to consumers, or any failure of PFAS treatment where raw water sources are in tier 3 (under the provisions of the current Water Industry (Suppliers' Information) Direction [the Information Direction]). • Notify UKHSA and local health authorities and determine what action (beyond monitoring) is appropriate to reduce exposure via drinking water supplies. Factors such as population demographics or consumer groups at particular risk should be considered. Action may, for example, include provision of alternative supplies to the affected area. • Sample investigation to include, as a minimum: resample point of contravention, individual raw water sources, blended or combined raw water points and final water from water treatment works. Consider sampling at treated water blending point (if applicable) and/or water quality zones. Samples should be fast-tracked. • Ongoing enhanced monitoring should be established at locations and frequencies to understand the impact for the specific supply situation. A minimum of one year of monthly samples at raw and final water points, timed to take account of any changes in hydrological conditions, such as precipitation, surface or groundwater flows and pumping regimes. • Review existing control measures, including the effectiveness, validation, and monitoring of that measure. Implement emergency contingency measures to prevent the supply of water with ≥0.1 µg/L PFAS to consumers. • Review the catchment risk assessment, including PFAS source information, within 3 working days of receiving the result. Provide an update to the regulation 28 report as part of the event report. Risk assessments for associated assets should also be reviewed with regulation 28 reports provided as part of the monthly submission process. Risk category will generally be C, D or E for sites in this tier. • Prioritise site within the company's PFAS risk reduction strategy for medium/long term mitigation. • This list of actions is not exhaustive; all necessary actions to investigate the source of the PFAS and reduce concentrations to below 0.1 µg/L in water supplied to consumers must be taken in the short term, with a longer term strategy designed and implemented to progressively reduce PFAS concentrations in drinking water.

3.2 The PFAS tiers are to be applied to all PFAS chemicals of interest identified in the parameter list (Annex C of the Information Direction) detected in final water.

3.3 Companies are also expected to consider the effect of combined concentrations of the PFAS chemicals of interest identified in the parameter list. Specific consideration to the approach to combine PFAS is provided in sections 3.4 to 3.7.

3.4 In our communication to companies for the Clarification of Drinking Water Inspectorate expectations for managing tier 2 PFAS in December 2023 we noted the following for company's attention:
"……..the combination of PFAS together making the site a defacto tier 3 would be expected to be prioritised as soon as reasonably possible constrained only by for instance, planning and engineering. Subsequent prioritisation may be based upon the order of the detected levels."

3.5 In extending this guidance to include an approach for combined PFAS on a 'sum of' basis, the Inspectorate is conscious of the potential for additional sites to fall into the current tier 2 or tier 3 classifications. Where this is the case, these sites should be rolled into the existing site prioritisation approach based on their relative classification. Accordingly, the approach to these sites should comply with the positive actions required to address the PFAS risk in accordance with tier classifications and actions in Table 1.

3.6 We expect companies to extend their existing risk-based strategic approaches to resolve and mitigate risk at these sites in a systematic way that deals with the highest risk sites as a priority. Such a risk reduction strategy should aim to progressively reduce PFAS concentrations in drinking water.

3.7 In requiring companies to have due regard to the combination of PFAS compounds the Inspectorate will implement a staged approach to addressing the risk posed from combined PFAS that includes the following requirements:

i. The combined PFAS summation should be based on the measured individual PFAS compounds of interest as listed in Annex C of the Information Direction for each sample. Individual results that are less than the limit of detection should be excluded from the 'sum of' calculation.

ii. Analyses for the individual PFAS compounds in Annex C should be conducted as normal and then summed to a total in each analytical sample. A combined estimate based on a total fluorine analytical technique or other similar estimation methods should not be used.

iii. The combined PFAS sum per analytical sample should be classified according to the current tier system in Table 1.

3.8 No later than from 1 January 2025 companies should provide a combined PFAS result for each site with each set of analytical results when reporting. The parameter list will include a new parameter for 'Sum of PFAS' (F366).

3.9 It is also expected that the tier levels will be applied to PFAS chemicals detected in raw water where there are no treatment processes in place to remove PFAS or reduce concentrations to an acceptable level.

3.10 It is expected that companies will have internal alert levels with appropriate actions and notifications where tier levels are likely to be breached.

3.11 Where sample results fluctuate between different tier levels, the highest tier should be assumed. If results in the higher tier do not recur in subsequent samples, the higher tier must continue to apply until robust evidence is gained to confirm that the higher tier is no longer applicable, including:

i. At least one year of sampling at the higher tier frequency.

ii. Confirmation that sampling has taken place under similar hydrological conditions as the original higher tier result (for example, same time of year, equivalent precipitation measurements and surface or groundwater flows, same pumping regimes, and any other relevant factors identified by operational and catchment teams).

iii. A review of the catchment and site PFAS risk assessments has confirmed that a change to the lower tier is applicable.

3.12 For results at tier 2 and above, design and implementation of a proactive and systematic risk reduction strategy is required. It is expected that, allowing for constraints such as planning and engineering, sites will be prioritised based on risk. Risk prioritisation factors may include, for example: analytical data indicating a variable or increasing profile from a source; dynamic risks from upstream catchments through industry changes; emergence of new contaminants; changes in risk understanding of PFAS such as toxicological classification and health risk; detection of combinations of PFAS from the same source which, when considered together, may increase risk.

3.13 Response timeframes will be site-dependent although it is expected that additional measures would be implemented at sites likely to breach tier 3 as soon as reasonably practical.

3.14 Due to the number of sources which potentially contain PFAS, it is expected that any systematic risk reduction strategy may take some years to deliver. The strategy will need to be dynamic due to the emerging understanding of PFAS chemicals and it cannot be delimited by the financial regulator's price review cycles for the industry. The Inspectorate will consider any company that does not have an ongoing process to assess emergent risks from PFAS as not being appropriately proactive.

3.15 Where results are notified as an event, it is expected that the company will provide, as a minimum, the following information in the 72 hour report:

i. Raw water and water treatment works schematics.

ii. Treatment plan for PFAS including blending information (if appropriate). Blending information for raw, partially treated and final water should include treatment protocols and confirmation that these have been followed at all times, with associated flow monitoring data evidence.

iii. Sample data for the relevant preceding period, including operational samples. Also, details of sample investigation locations and data.

iv. Evidence of regulation 27 risk assessment review to reflect any changes in risk presented in the raw water and/or through the treatment process.

3.16 Following receipt of the 72 hour report, if the site is not already subject to a regulation 28(4) notice for risks associated with PFAS the Inspectorate will issue the company with a minded to enforce letter and notice template which the water company should complete and return to the Inspectorate which should, as a minimum, include the following measures:

i. Details of short term operational measures being undertaken to reduce PFAS concentrations in water supplied to consumers

ii. Details of enhanced monitoring being undertaken in the catchment and supply system to understand any risk to consumers

iii. Details of the long term solution which is being developed to reduce PFAS concentrations, should the short term operational measures not reduce the PFAS concentrations to an acceptable level within a defined timeframe.

3.17 Water companies are not expected to notify each subsequent concentration of PFAS (or sum of PFAS) detected from the site unless the concentrations change significantly or the compounds being found change, or there is any other indication of a change of risk.

3.18 For ERI calculation purposes, the event will be given a duration of 24 hours.

3.19 As with all notifications received under the Information Direction, the Inspectorate will investigate and consider whether there are grounds for initiating a prosecution for the offence of supplying water unfit for human consumption under section 70 of the Water Industry Act 1991 (as amended) ["the Act"] and/or other offences under the Regulations.

3.20 It is important to note that although the Chief Inspector of Drinking Water can decide that it is in the public interest to initiate proceedings for the offence of supplying water unfit for human consumption, the decision as to whether any such offence has been committed is for the courts to make.

3.21 Companies are reminded of the requirements of regulation 15 covering new sources in relation to the PFAS tier levels. Companies have a duty under section 68(1)(b) of the Act to ensure no deterioration in the quality of water supplied to consumers, and should not, therefore, introduce any new source or bulk transfer that causes a deterioration in water quality. This requirement also applies where areas supplied by existing bulk transfers are extended (which covers internal company transfers and imports from another company).

4. Monitoring and reporting

4.1 Water companies are responsible for identifying risks to the quality of the water they supply. Under regulation 10, in addition to the regulatory monitoring of parameters, water companies are required to test the drinking water supply for any element, organism or substance that they have reasonable grounds to believe may constitute a potential danger to human health.

4.2 In addition to complying with regulation 10, by implementing the approach outlined in this guidance, water companies will deliver improved data on the presence of PFAS chemicals in raw and treated water, supporting a more informed understanding of where further prioritised action may be necessary.

PFAS chemicals to be monitored

4.3 The list of PFAS chemicals that should be monitored is included in the parameter list (Annex C of the Information Direction). Companies may request the addition of parameters to this list.

4.4 The parameter list will be maintained with a view to adding or removing chemicals in line with emerging information relating to the attributes of PFAS chemicals, as well as further developments in analytical detection and quantification. The Inspectorate will notify companies of any changes to the list. It is incumbent on companies to notify the Inspectorate should PFAS chemicals not listed be identified at concentrations above tier 1: these should be notified to the Inspectorate's Risk Assessment team (dwi.ra.auditteam@defra.gov.uk).

4.5 The 47 chemicals initially listed for monitoring were identified based on their known prevalence of use in England and Wales. The list was largely aligned to the Environment Agency (EA) monitoring programme list (Environment Agency, 2021). This included chemicals highlighted as having hazardous properties and restricted under regulatory regimes, those currently registered for UK use under REACH with high tonnage, potential contaminants of concern through hazard and risk assessment, chemicals with potential for significant environmental exposure associated with UK manufacturing sites, and chemicals commonly reported as a significant contaminant in environmental studies and literature. The Inspectorate will continue to review information published by the EA and consider the need for updates to the parameter list.

4.6 Monitoring by water companies has highlighted a further PFAS compound of potential concern; 6:2 fluorotelomer sulfonamide alkylbetaine (6:2 FTAB). This compound has been added to the parameter list and companies are expected to initiate monitoring and reporting for this parameter as soon as practical, with monitoring initiated at latest by 1 January 2025.

Sampling

4.7 An ongoing risk-based PFAS monitoring programme should be developed by companies relating sampling frequencies to the tier level of the raw water source(s) identified by the risk assessment. It should also account for the representativeness of the sampling point(s) in relation to the water entering the downstream water treatment works.

4.8 Companies must sample and analyse for all required PFAS chemicals using a fully accredited method where available. Where a method is not fully accredited, and no accredited method is available, results must be flagged as non-accredited.

4.9 Individual raw water abstraction points should be sampled, as well as final water. Where there is no treatment process that may impact PFAS concentrations, and only a single raw water source or where treated water sampling demonstrates consistently low concentrations, the company may choose to sample the final water only. In addition to individual raw water points, companies may wish to sample combined raw water points to provide information about raw water blending.

4.10 Resampling protocols should be established to cover raw water sources, raw and treated water blending points, final water and consumer properties (where applicable). Where there is treatment in place for PFAS, sampling should include pre and post treatment sample points.

4.11 Automated triggers should be set to highlight anomalous results, with processes in place to take action. Sample results should be reviewed on a regular basis with changes made to the monitoring programme frequencies and updates to risk assessments as necessary.

Reporting

4.12 Sample results for PFAS should be submitted alongside the monthly compliance upload in accordance with the current Information Direction. All PFAS results associated with raw water should be uploaded via the raw water results table, all other PFAS results can be uploaded via the operational results table.

4.13 Companies should refer to Information Letter 01/2025 Reporting of PFAS results which details the processes for reporting PFAS results to the Inspectorate.

4.14 PFAS results must be submitted with the units of micrograms per litre (µg/L), as specified in the parameter list.

5. Regulation 27 risk assessment for PFAS chemicals, and regulation 28 reporting

5.1 Regulation 27 requires companies to carry out a risk assessment of each treatment works and connected supply system. Regulation 28 sets out the procedure for reporting the risk assessments or reviews of such assessments.

5.2 Companies must conduct an assessment of PFAS chemicals to establish whether there is a significant risk of supplying water from treatment works or supply systems that could constitute a potential danger to human health.

5.3 Risk assessments should include data/knowledge obtained from both external and internal stakeholders, as well as utilising the company's own raw and treated water monitoring data, data from the Environment Agency and/or Natural Resources Wales and, in respect of surface water, data gathered under the industry's collaborative Chemical Investigation Programme (CIP).

5.4 As use of some PFAS, for example PFOS and PFOA are now largely prohibited, companies will need to assess historic uses in the catchments they abstract from as well as current uses.

5.5 It is important for companies to review the risk factors and their risk assessments as further data become available.

5.6 Companies must have a risk assessment methodology for PFAS chemicals. This may be incorporated into the company's general water safety planning (WSP) methodology, however, specific details relating to the assessment of PFAS risks must be included.

5.7 The methodology document should be regularly reviewed as more information regarding PFAS becomes available, for example, analytical capability and availability, toxicology and additional potential PFAS sources. The PFAS methodology should be subject to the same company internal audit arrangements as the WSP methodology.

5.8 Risk scores must clearly align to the PFAS tiers specified within Table 1 of this guidance, and the details of this alignment must be clearly documented within the WSP methodology.

Catchment risk assessments

5.9 Catchment risk assessments should use a source-pathway approach to determine PFAS risk for individual sources (for example, individual boreholes). They should consider, as a minimum, the potential sources of PFAS shown in Table 2. Companies must ensure a system is in place to identify all present and historic sources of PFAS, and how these could enter drinking water abstractions. It is good practice to engage with catchment stakeholders and conduct physical investigations to verify the catchment risk and to ensure that data-driven risk assessments are reliable.

5.10 The source element of the risk assessment should consider the number/size and type of PFAS sources within a catchment. Companies should ensure a system is in place to

identify emerging sources of PFAS not included in Table 2 but potentially relevant in their catchments. The Inspectorate has funded research projects that may assist in understanding potential PFAS sources (see Section 8.2).

5.11 The pathway element of the risk assessment should consider the proximity of PFAS sources to abstraction points, geological features, catchment flows and dilution. It should consider extremes of hydrological conditions and the impact of changes in pumping regimes. Other potential considerations should be identified based on information from operational and catchment staff as well as relevant site or desktop information.

Table 2: Minimum PFAS source considerations for catchment risk assessments

PFAS source	**Information**
Airports, airfields, airstrips (including military)	Location; use of PFAS foams, in particular aqueous film forming foam (AFFF) (current and historic); use of PFAS hydraulic fluid; drainage
Fire training centres, fire stations (including military)	Location; use of PFAS foams, in particular AFFF (current and historic); drainage
Major fire locations	Location of AFFF use historically; notification by stakeholders of current use in the catchment
Wastewater discharges	Location; quality; combined sewer overflows; private discharges
Trade effluent	Risk industries; volume and dilution; sampling
Industry (including historic), especially chromium plating and manufacture of paper/cardboard, carpets, textiles, cosmetics, food packaging	Number of each industry type; discharge consent; private or public sewer; dilution volume
Landfill (including historic)	Number; location; leachate quality
Biosolids	Spreading location; active or historic
Sludge to land	Spreading location; active or historic
Mining	Location; use of PFAS foams (current and historic); use of PFAS as surfactants

Treated water risk assessments

5.12 Risk assessments of the treatment works should take account of the PFAS risks identified for individual sources in the catchment risk assessments. They should consider the effects of blending raw water sources, taking a worst-case approach.

5.13 Where water, including treated water and washwater, is returned to the treatment process, this must be considered in the PFAS risk assessment and appropriate testing undertaken.

5.14 Controlled risk scores should not be determined solely by sample results; results should be used to verify risk. Where sample results identify a different risk tier, particularly a higher one, the catchment risk assessment should be reviewed as soon as possible.

5.15 Risk assessments of the storage, distribution, consumer and bulk supply stages should consider controlled blending within distribution systems.

Control measures

5.16 Any control measures used to manage PFAS concentrations must be scientifically proven to reduce concentrations of these chemicals. They should be appropriately validated and verified through sampling. Options may include treatment, for example granular activated carbon (GAC) or ion exchange, and/or blending of water, as well as implementation of policies or procedures and Supervisory Control and Data Acquisition (SCADA) controls such as interlocks, alarms and shutdowns. Any treatment process employed should have an associated policy and procedure as well as appropriate proactive maintenance activity.

5.17 If GAC is used as a control measure, the company should have a policy ensuring that the type of carbon used is suitable for removal of the PFAS present in the raw water. Also, that the empty bed contact time required for PFAS removal has been calculated at the works' maximum flow rate (taking account of contactor outages). Any policy should also ensure that GAC cannot be bypassed, to ensure continuous control for PFAS.

5.18 The company should also have a policy for GAC regeneration/replacement, including details of carbon exhaustion rates, bed volume considerations and adsorption capacity for the PFAS present in the raw water. The company should regularly test adsorbers to ensure that the carbon remains effective for PFAS removal. A similar approach should be taken for ion exchange and other similar treatment processes, with all the relevant details of media exhaustion and regeneration/replacement identified.

5.19 Where treatment for PFAS removal is used, the company should have a policy for decommissioning and disposal of PFAS-contaminated products.

5.20 Where blending is employed as a control measure, a policy should be in place documenting the management of the process to maintain an acceptable final PFAS concentration. This policy should include calculations accounting for all potential raw water sources (used alone and/or in combination), flow rates, weather and demand conditions, and any other relevant variables. Where there is uncertainty in the calculations, a safety margin should be included to ensure an acceptable concentration is achieved. Alarms and interlocks should be installed and maintained as required to ensure continuous control for PFAS is maintained.

Stakeholder communication

5.21 Engagement with stakeholders is an important aspect of conducting risk assessments for PFAS. Examples of key external stakeholders, as well as examples of information they should provide, is detailed in Table 3. The equivalent information for internal stakeholders is shown in Table 4.

Table 3: External stakeholders for PFAS risk assessments

External stakeholder	**Examples of risk assessment information**
Environment Agency and Natural Resources Wales	Spill locations; environmental pollution incidents; river flow and dilution; discharge consents; waste management permits; historic landfill sites
Fire Brigade (including military)	Major uses of foam; location of training centres; incidents in which AFFF foam used
Airports, airfields, airstrips (including military) operators	Location; run-off locations; waste disposal
Landfill operators	Location, including historic landfill; discharge conditions; discharge quality; type of landfill
Local authorities	Confirmation of information held; discussion regarding possible effects on private supply boreholes; exchange of risk assessments and data; landfill site location and type
UKHSA	Consideration of any health-based restrictions

Table 4: Internal stakeholders for PFAS risk assessments

Internal stakeholder	Examples of risk assessment information
Water Resources and Catchment teams	Location of PFAS risk sources; understanding the effect of different hydrological conditions on PFAS concentrations; liaison with airports, airfields and other catchment stakeholders; risk to catchment from sludge to land and biosolids applications
Water Quality/treatment/ process scientists and site operators/technicians/ managers	Processing sample results and making any associated notifications in a timely manner; control measures for PFAS operated according to company policies and procedures; escalation of any changes that could affect final water PFAS concentrations to enable prompt action and risk assessment review
Sampling teams	Reporting any changes within the catchment when travelling to and accessing sites; using appropriate sampling techniques/bottles and minimising risk of cross contamination from non-associated sources, for example clothing or equipment
Laboratories	Samples processed according to service level agreements using accredited analysis methods when available
Wastewater teams	Location and volume of discharges; combined sewer overflow locations and spill frequency
Trade Effluent teams	Companies and industry types operating within the catchment and discharge consents
Maintenance teams and raw water rangers	Reporting any changes within the catchment when travelling to and accessing sites
Water Regulations teams	Recording uses of PTFE tape or other sources of PFAS that could have contaminated the drinking water supply when completing Water Regulations inspections in consumer properties

5.22 Communications are expected to occur on a regular basis at an appropriate risk-based frequency. Appropriate provision should be made for external stakeholders to notify PFAS pollution incidents both in and out of hours.

5.23 Dialogue between water companies and local authorities regarding PFAS risk assessments is encouraged. Risk assessments and data held by water companies pertaining to catchments in which there are private water supplies should be made available to local authorities on request.

DWI categories

5.24 Information on the use of DWI categories within PFAS risk assessments is provided in Table 5.

5.25 It is expected that all tier 3 sites will have a DWI category of C, D or E. It is likely that these categories will also apply to tier 2 sites.

Table 5: Application of DWI risk categories to PFAS

Risk category	**Description**
A	Control measures are in place to maintain PFAS below 0.01 µg/L in final water at all times. Control measures are fully validated and verified by sampling.
B	Additional control measures to reduce and control PFAS concentrations have been delivered and are undergoing validation. Robust evidence, as described in section 3.11, is required for validation and the risk should be verified by sampling.
C	Additional control measures are being delivered to reduce and control PFAS concentrations.
D	Additional control measures are required to reduce and control PFAS concentrations. These are being designed, determined or are awaiting funding. It is acknowledged that sites will be prioritised based on severity and a site may be at category D for an extended period.
E	The risk is under investigation to understand the severity and extent of the PFAS issue and what control measures may be required. This may include new sites where little data is available, or sites where elevated concentrations of PFAS have been identified.

Risk category	Description
F	Partial mitigation is in place at the asset, for example, where there is blending at the raw water point, but further treatment is required downstream.
G	PFAS is present as a hazard. There are no control measures at the stage being assessed but PFAS control measures are present at a downstream asset.
H	No PFAS control measures are in place and none required. This category may be used where there are no PFAS sources in the catchment and/or where raw water concentrations are consistently below 0.01 µg/L.
I	An increasing PFAS trend has been identified, but the company does not consider any immediate actions to be required. Details of when the risk will become critical are required. This will generally only apply to sites in tier 1.

Regulation 28 reports

5.26 The parameter list in the Information Direction includes hazard codes for the currently identified individual PFAS chemicals of interest, as well as H067 which represents the group of PFAS chemicals. The parameter list will include a new hazard code for 'Sum of PFAS' (F366).

5.27 The regulation 28 report must list hazard code H067 as a minimum for all company assets at every stage of the supply system from catchment to consumer (either following a risk assessment or as a carried forward risk).

5.28 Where sites are classified as tier 2 or tier 3 for PFAS, and/or where any form of additional mitigation or investigation is required (DWI risk categories B, C, D or E), each individual PFAS parameter that these criteria apply to must be reported as separate hazard lines, in addition to H067. Similarly, where sites are classified as tier 2 or tier 3 due to combined concentrations of PFAS, the Sum of PFAS (F366) must be reported as a separate hazard line, in addition to H067.

5.29 Raw water PFAS risk assessments must be reported in the regulation 28 report, either as individual lines for each source (for example a borehole) or, where sources are grouped, the score should reflect the worst-case individual source with details of individual sources provided within the comments field.

6. PFAS strategy

6.1 The Inspectorate expects companies to develop robust strategies to investigate the extent of sources of PFAS in their catchments, concentrations in raw and final waters, and to detail trigger levels and actions required to reduce the risk of PFAS in drinking water. PFAS strategies must be considered as 'live' documents that should be adaptable and able to respond to potential future changes in regulatory expectations.

6.2 The Inspectorate considers that PFAS strategies should detail as a minimum:

i. Operational monitoring: complementary to the monitoring requirements defined in section 4 of this document, sampling extended upstream of abstraction points into catchments and sub-catchments, and downstream through different stages of water treatment to the final water sampling location. Comprehensive sampling programmes are required to identify the source and concentration of PFAS chemicals.

ii. Enhanced investigatory monitoring: enhanced sampling should be risk-based and representative of different hydrological conditions. Companies should consider appropriate sampling frequencies to inform risk assessments. A clear strategy should be employed to improve understanding of the risks and inform the identification and implementation of appropriate control measures.

iii. Catchment characteristics/identification of PFAS sources: identification of PFAS sources in the catchment (minimum requirements defined in Table 2), product usage (existing data and data gathering), catchment modelling with analysis of weather, surface and groundwater flows, catchment walkovers and identification of high-risk locations.

iv. Engagement with stakeholders: initiating and maintaining regular engagement with stakeholders to ensure that catchment risk assessments are current. Examples of external and internal stakeholders are included in Table 3 and Table 4 respectively.

v. Operational measures: as more data relating to PFAS in raw water is collected, companies may be able to employ abstraction management in response to weather forecasts, changes in hydrological conditions or other intelligence. As more research is published in the field, optimisation of existing treatment processes within the normal operating envelope of a works could be implemented, for example, GAC regeneration frequencies. Companies should establish appropriate operational measures to mitigate PFAS risk in the short, medium and long term.

vi. Participation in research and development: examples include research projects into removal of PFAS through optimising existing, or utilising emerging, treatment technologies; appropriate disposal of PFAS waste; best practice for identification of risk hotspots; increased understanding of sources of PFAS chemicals; increased understanding of transmission through the environment; identification of catchment mitigations; and innovation for the use of online monitors for PFAS.

vii. Engaging with regulatory mechanisms: examples include liaison with appropriate regulators responsible for environmental legislation to introduce compulsory measures; restrictions on product use; product formulation and labelling; and promotion of product substitution.

6.3 Following a precautionary approach, where the presence of PFAS poses a likely current or future risk to the quality of water supplied, appropriately defined section 19 Undertakings to meet the requirements of section 68(1)(b) of the Act will be considered for acceptance from companies. The Inspectorate will consider alternative enforcement to direct mitigatory actions by companies who have identified PFAS risks and do not offer section 19 undertakings to address those risks.

7. Guidance for bulk supplies, including new appointments and variations (NAVs)

7.1 Companies receiving bulk supplies for onward distribution retain the statutory responsibility for compliance with section 68 of the Act, and are responsible for completing regulation 27 risk assessments.

7.2 Companies receiving bulk supplies should have a monitoring programme with sampling frequencies that align with those set out in Table 1. The source of water, including whether it is supplied by a single or multiple treatment works and their individual tier classifications, should be taken into account when considering sampling frequencies. In scenarios where there is a single source works assessed as tier 1, data are provided by the supplying company to enable a risk assessment, and there are no PFAS sources identified within the bulk supply zone, sampling by the receiving company may not be required. Where these criteria are not met, sampling is required.

7.3 Bulk supply arrangement documents should detail the information to be provided by the company providing the bulk supply. This should include details of PFAS risk assessments and regulation 28 reports for relevant assets, as well as the proportion of supply from each asset where more than one water treatment works forms part of the bulk supply. It should also include details of control measures, either in place or

proposed, to mitigate the PFAS risk. Sample data may also be provided. These arrangements, and the information provided, should be reviewed at regular bulk supply liaison meetings.

7.4 Where PFAS is detected at a consumer tap receiving a bulk supply, the company providing the bulk supply should provide an opportunity to the bulk supply recipient company to discuss the catchment and treatment risk assessments, including any control measures in place for PFAS. This opportunity should be provided as soon as practical to enable the PFAS risk to be fully understood from source to tap.

7.5 Companies receiving bulk supplies should not rely on event notifications to obtain PFAS information. The purpose of risk assessment is to proactively understand and act on risk information to prevent water quality events from impacting consumers. As such, it is expected that companies receiving bulk supplies will actively seek adequate information to risk assess their supplies and put in place any necessary measures to reduce or eliminate the risk. Companies receiving bulk supplies must identify material control measures to mitigate PFAS. It is expected that companies in receipt of bulk supplies will make active representations to companies providing the bulk supply on the efficacy of the control measures they have in place for PFAS, or proposed additional control measures, for example monitoring and challenging delivery timescales.

7.6 The Inspectorate expects recipients of bulk supplies, including NAVs, to develop forward-looking PFAS strategies that include all aspects detailed in section 6.2.

8. PFAS research

Environmental sources of PFAS

8.1 The Environment Agency's PFAS Risk Screening Project was initiated in 2019 to assess the environmental impacts of PFAS. In Phase 1, a GIS model was developed using water quality data to assess PFAS sources and the risks they posed to the environment. This GIS model was refined in Phase 2 with ground truthing, additional data sets and sampling to enhance outputs. In-depth studies of key sites were carried out in Phase 3 to evaluate the nature and scale of the PFAS issue, and validate the model. The current phase, Phase 4, aims to develop best practice guidance, carry out detailed assessment of potential problem sites, conduct an economic appraisal, assess active and historic landfill sites as a source of contamination and look at background concentrations of PFAS in soil.

Drinking water research on PFAS

8.2 The Inspectorate has commissioned a number of research projects in relation to PFAS that can be found in the Research pages of the Inspectorate's website (Completed Research).

9. References

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