Position statement

Per- and Polyfluoroalkyl Substances (PFAS) in UK Drinking Water

June 2023

PFAS are a class of substances with many useful properties for manufacturers and consumers, but these chemicals (and their degradation products) also have high persistence, are highly mobile, and can bioaccumulate in humans and wildlife. The RSC has previously advocated for risk-based regulation of PFAS.[i] Increasing concern about environmental persistence and toxicity of PFAS has spurred international regulators to impose stricter regulatory limits on the acceptable levels of PFAS in drinking water to limit human exposure and consequently prevent harm. In the UK, we must urgently address PFAS water pollution to minimise the potential for negative health effects today and in future generations. By implementing stronger regulatory controls on PFAS in drinking water, the UK has an opportunity to show international leadership in managing chemicals in the environment and furthering the UN Sustainable Development Goals (SDGs), especially SDG6 on clean water.

We recommend using a *Source-Pathway-Receptor* model for considering PFAS risks, with action required across government, industry, and the water sector:

Key Asks of Government

Ensure the many hundreds of *sources* of PFAS are reported and captured in a national inventory.

Identify, test, and regulatethe *pathways* of PFAS from factory emissions and product related waste to surface and ground waters through tighter environmental standards

To reduce the potential for harmful levels of PFAS to accumulate in the *receptor* of the human body, establish new statutory action standards for PFAS in drinking water of a maximum concentration of 10 ng/L per single PFAS and 100 ng/L for the overall summed concentration of all PFAS.

To manage PFAS pollution and risks effectively, given the widescale use of PFAS across sectors, the government needs a national chemicals regulator that brings greater cohesiveness and connectivity across government departments.

Key Asks of the UK Water Sector

Greater collaboration is needed across the water sector to harmonise and standardise measurement approaches, generate and publish PFAS in drinking water monitoring data across UK, and develop improved remediation solutions to meet stricter action standards for PFAS in drinking water. Sector bodies could help coordinate this effort.

Ensure that, as far as possible, the pollutor pays for the delivery of wholesome water. Based on evidence relating to sources of PFAS use in the UK, the use of PFAS is widespread across virtually all production sectors. The chemicals and related industries, water sector, and government should work together to provide a fair funding system so that polluters, rather than water consumers, pay for the monitoring and remediation activities required to meet new standards.

Background

Per-and Poly-fluoroalkyl Substances (PFAS) are a group of fluorinated chemicals that have water-, oil-, heat-, and stain-resistant properties. Due to the strength of the carbon-fluorine bond, PFAS resist degradation and have high stability, mobility, and persistence in nature. Used around the world since the 1940's, these chemicals have found their way into the environment and are now omnipresent in soil, ground water, surface water, and the polar ice caps. Evidence suggests that PFAS can bioaccumulate in wildlife and humans and some are known to pose a potential risk of toxicity, especially following local pollution incidents.[2,3,4,5,6,7,8] PFAS are used in a variety of sectors, as their unique properties provide value in manufacturing processes and consumer products. Estimates of the number of PFAS vary but may include anywhere from 4,700 to >10,000 substances.[9,10] The RSC uses the 2021 Organisation for Economic Co-operation and Development (OECD) definition for PFAS[1] which standardised the characterisation of such substances:

The OECD 2021 definition[11]

"Any fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e.with a few noted exceptions, any chemical with at least a perfluorinated methyl group (–CF_3) or a perfluorinated methylene group (–CF_2–) is a PFAS"

The widespread, growing use and persistence of PFAS has made it difficult to manage these chemicals in the environment and for regulations to keep pace. Scarcity of data on PFAS uses and discharges, legacy contamination, and uncertain human health and environmental effects related to consistent low level exposure have all influenced the lack of action on this issue. However, given cases of observed effects from localised pollution by PFAS, regulators have increasingly recognised that PFAS require immediate attention because of their persistent, mobile, bioaccumulative, and potentially toxic nature.[12,13,14] Understanding and managing all aspects of PFAS use is a complex undertaking and is expected to take many years. The RSC laid out a potential future risk management framework for PFAS regulation, using the best scientific evidence, in a 2021 policy position.[15]

[1] The Health and Safety Executive, in its April 2023 PFAS Regulatory Management Options Analysis (RMOA), used a more refined subset of PFAS than in the OECD definition, reducing the scope of the analysis to hundreds of substances.

It is likely that the greatest risks of harm from PFAS exposure to wildlife and humans would be if toxic PFAS were ingested orally in harmful concentrations in food and drinking water. Therefore, to prioritise the minimisation of human exposure in the short term, regulators should first focus on investigating the evidence for the most common sources of and pathways to direct oral exposure to PFAS. This policy position focuses on contaminated drinking water as the most risky route of exposure to PFAS in the general population and the corresponding regulatory options that could improve management of PFAS in the environment.

Evidence for PFAS in UK waters and in UK Drinking Water

Following presentations at an RSC expert-led event on PFAS in water in November 2022, and the RSC's independent research, there is clear evidence to show that PFAS are present in UK surface and groundwaters.[16] However, environmental monitoring for PFAS has been patchy and inconsistent, using varied criteria for which PFAS are measured, and different analytical methods and limits of detection. Data from the Environment Agency (England & Wales), and more recently from research by Stéphane Horel presented in Le Monde (and other media outlets), indicate that there is widespread PFAS presence in water in the UK and elsewhere in Europe.

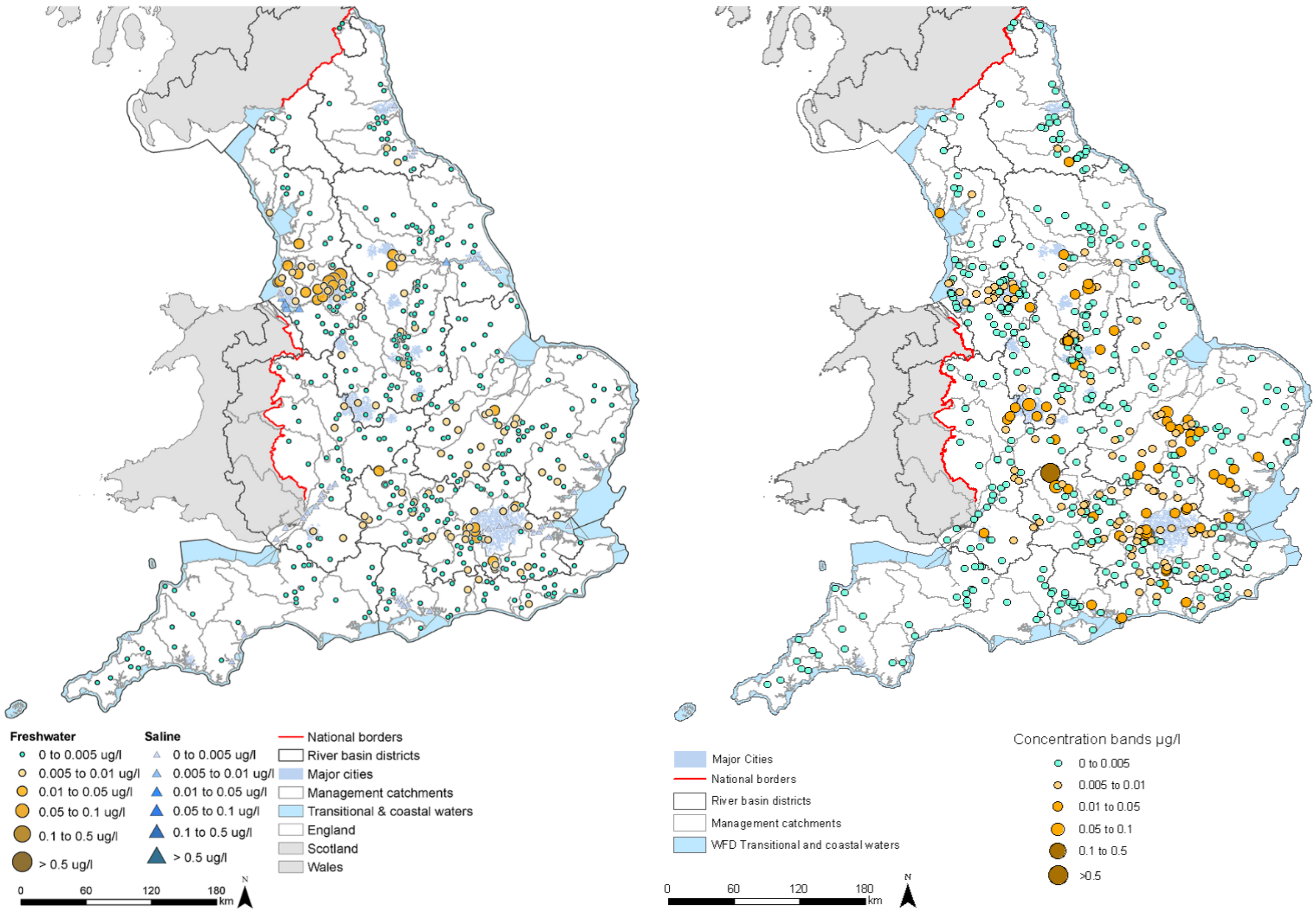

Figure 1 Sampling locations and mean measured PFOS (left) and PFOA (right) concentrations from Environment Agency surveillance monitoring programme (borrowed from EA 2021)

The EA has been conducting fully quantitative assessments of the levels of the two PFAS most known to be toxic and persistent, perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), from

~500 sites across England (Figure 1).[2] They conclude that the PFAS problem appears widespread, with examples of hotspots.[17]

Data from the Le Monde analysis of ~1,700 samples also shows widespread presence of PFAS in the UK (Table 1). For approximately two thirds of sites, measurements of PFOS and PFOA are less than 10 ng/L in surface and ground waters. However, a third of sites measured between 10-100 ng/L of PFOS and PFOA, which is considered a medium risk by the Drinking Water Inspectorate (DWI) in the UK, and 3-4% are at levels designated by the DWI as requiring immediate remediation.[18]

	Total number of samples included in analysis	Percentage of samples less than 10 ng/L	Percentage of samples 10 ng/L to 100 ng/L	Percentage of samples greater than 100 ng/L (wholesomeness concentration exceeded)
PFOS	1644	63	33	4
PFOA	1768	65	32	3

Table 1 Le Monde data on PFAS in UK water

Based on the RSC expert-led event in November 2022 and ongoing consultation with our members, there is broad agreement that PFAS contamination of water is a growing and unchecked problem in the UK, but there is also much uncertainty around the true scale of the problem because of variance in analytical methods and lack of clear human health data on the majority of PFAS. Evidence from human biomonitoring has indicated that PFAS are present in and do accumulate in the human body.[19] Some evidence has also shown negative health outcomes from PFAS exposure, such as increased cholesterol, immune suppression, and possible mutagenic and carcinogenic effects. However, it would take many decades to generate new toxicology data for all PFAS using standard approaches.[20] The US EPA have begun a programme to test PFAS using new approach methods (NAMs), but this work is still ongoing.[21] In the interest of public safety, with today's knowledge about PFAS persistence, bioaccumulation, and toxicity, it is unfeasible to follow a classical toxicological paradigm to test all PFAS. Instead, the precautionary principle states that despite the uncertainty that still exists, robust and timely action – including good regulation – ought to be taken in order to protect consumers.

Current UK Regulatory Context

Current UK chemical regulations post EU-exit are not fit for the purpose of managing PFAS in the environment. Regulatory accountability for PFAS use in products, processes, and waste management is fragmented across government departments. To provide a holistic and consistent approach for wide-reaching topics such as PFAS pollution, the government would benefit from a national overarching regulator for chemicals management, such as a Chemicals Agency, that brings greater cohesiveness and connectivity across government departments.

This RSC policy position is timely, as the Department for Environment Food and Rural Affairs (Defra) and the Health and Safety Executive (HSE) have prioritised PFAS in the Great Britain REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) work programme for 2022-25. As part of this work, the HSE released a report (conducted by the Environment Agency (EA) for England & Wales) of the most appropriate regulatory management options (RMOA) in April 2023, which surveyed the current

[2] More detailed information on the full scope of EA monitoring can be found in the HSE's RMOA.

status of PFAS monitoring in the UK and existing regulation related to PFAS. Defra are also looking at the whole landscape of PFAS policy for England; some matters will be within devolved environment policy in Scotland, Wales, and Northern Ireland.

GB REACH is the primary method of regulating industrial chemicals in the GB market, but many PFAS fall outside the scope of the REACH registration process. The HSE notes in its RMOA that 'In UK REACH, there are 36 individual PFAS registered with the potential that 40 others could be registered by the final registration deadline. This does not provide the whole picture with respect to the PFAS market in GB as it is likely that some PFAS are manufactured or imported below the UK REACH registration threshold of 1 tonne / per year per manufacturer / importer, or that PFAS are present in finished or semi-finished goods.'[22]

These findings highlight the need for a more comprehensive approach to managing PFAS across the range of uses and potential routes of exposure. As a main pathway for human exposure to PFAS, and out of scope of current regulations such as REACH, drinking water is an ideal area to focus new methods of PFAS management. The RMOA came to the same conclusion, listing as a priority the 'Development of statutory standards for PFAS in drinking water in England and Wales.'[23]

UK Drinking Water Guidelines

The current approach regulates for individual PFAS in water. In October 2021 the Drinking Water Inspectorate (DWI), which covers England and Wales, released a list of 47 PFAS, including PFOA and PFOS, to be monitored in drinking water. Water companies must test their water sources for PFAS using fully accredited methods or, 'Where an analytical method is not fully accredited and an accredited method is not available, results must be flagged as being non-accredited.'[24] Results are mapped against the DWI's 3-tier system for managing risks from PFAS (table below). PFAS concentrations in Tier 1 constitute a low risk and no additional action needs to be taken. Tier 2 requires increased monitoring and preventative measures to avoid moving into Tier 3. Tier 3 is high risk, where PFAS are present in concentrations high enough to exceed wholesomeness standards (where presence of a substance constitutes a potential danger to human health). Tier 3 requires water companies to notify consumers and health authorities and take immediate action to remediate the water supply.[25]

Tier	Concentration of any single PFAS in final drinking water	Summary of actions (for a more detailed list, see DWI guidance)
Tier 1 – Low Risk	Less than 0.01 µg/L (10 ng/L)	Continue to monitor for PFAS and include in risk assessments
Tier 2 – Medium Risk	Less than 0.1 µg/L (100 ng/L)	Continue to monitor for PFAS, update risk assessments, review control measures, consult with health authorities
Tier 3 – High Risk (action standard)	Greater than or equal to 0.1 µg/L (100 ng/L)	Wholesomeness concentration exceeded: notify health authorities, fast-track resamples of water sources, review control measures and prepare emergency contingency measures to prevent the supply of water to consumers, increase frequency of future monitoring for at least 12 months

Table 2 DWI PFAS in water risk tiers and summary of actions

The tiered approach does allow for resources to be prioritised to the most at risk areas. Additionally, compared to efforts in other regions, the DWI's list of 47 PFAS is a much wider range of substances than is usually tested. However, while positive steps have been taken, the current testing regime ignores total PFAS concentration. Also, compared to new regulatory action being taken in other jurisdictions and the most up to date research on the risks to human health from PFAS, the current guideline value for a single PFAS concentration of >0.1 µg/L as a Tier 3 action standard is high.

International Regulatory Context

There has been a recent upsurge in efforts around the world to better define, monitor, regulate, and remediate the problems with PFAS. For example, these chemicals are considered an issue of concern in international chemicals policy forums such as the UN Strategic Approach to International Chemicals Management (SAICM).[26] Ideally, given the persistence and mobility of PFAS around the globe, a harmonised approach to PFAS standards in water should be developed. However, to date, the approach to managing PFAS differs across jurisdictions. While a comprehensive analysis of global PFAS action is outside the scope of this paper, the following section briefly explains the approaches in USA and EU.

USA

The United States Environmental Protection Agency (EPA) released a PFAS Strategic Roadmap in 2021 and has embarked on a work program including:

- restricting the future use of currently unused PFAS, through its 'significant new use rule'
- increased data collection on PFAS manufacture, use, disposal, and exposure
- updating pollution limits for and increasing monitoring of industrial discharges

The EPA has also introduced national drinking water limits for six PFAS: PFOS and PFOA will be regulated as individual contaminants at 4 ng/L each, and PFNA, PFHxS, PFBS, and GenX Chemicals will be regulated as a mixture not to exceed a designated hazard index.[27]

EU

The European Union has taken a variety of actions in recent years to control PFAS use and exposure to the environment, including:

- regulation of longer chain PFAS, PFHxS, and PFHxA, through EU REACH restriction
- an ECHA-endorsed plan to restrict all PFAS in firefighting foams
- a proposal to ban all (>10,000) PFAS (according to the OECD definition of PFAS) through the restriction process

In the 2021 update to the EU's Drinking Water Directive, two measures of PFAS are used to determine water quality. First, 'sum of PFAS' specifies 20 PFAS, of which the sum of concentrations must not exceed 100 ng/L. Second, 'total PFAS' sets a limit of 500 ng/L for the overall concentration of all PFAS present in water.[28]

European Food Standards Authority (EFSA) review of PFAS human heath data

The EFSA CONTAM panel reviewed the human health data for PFAS contamination of food in September 2020, and established a tolerable weekly intake (TWI) of 4.4. ng/kg bw/week, based on the sum of four PFASs: PFOS, PFOA, PFHxS and PFNA.[29] In this analysis in Europe, it was found that the mean lower bound exposure estimate in adolescent and adult age groups ranged from 3-22 ng/kg bw/week with the 95th percentile estimate from 9-70 ng/kg bw/week. This evaluation included a great deal of uncertainty, but it did indicate that based on the current evidence, exposures are thought to be higher than might be considered safe or acceptable.

Applying the TWI of 4.4. ng/kg bw/week in the context of drinking water intake, one would assume that a 70kg adult drinks 2 litres of water per day, equivalent to 14 litres of water a week. For a 70 kg adult, the TWI represents a weekly intake of 4.4 ng/kg bw/week x 70 kg = 308 ng/week. For an assumed weekly intake of 14 litres of water, this would equate to a safe level of 22 ng/L per day for a sum of the four PFASs: PFOS, PFOA, PFHxS and PFNA. However, there are other pathways of exposure, e.g. food intake, to take into account as well, justifying a slightly more conservative approach to water standards.

Current UK Committee on Toxicity position on the EFSA Opinion on PFAS

The Committee on Toxicity (COT) in the UK issued a statement on the EFSA opinion in October 2022 but have not yet recommended any health based guideline values for use in a UK context.[30] It is expected that the UK will perform its own evaluation of the data and, given the scale of the data package for PFAS and emerging new data from the US EPA, this may take some years to finalise.

Policy options

Proper regulatory and environmental management of PFAS will require action across the spectrum of government, industry, and the water sector. We use a source-pathway-receptor model from Sunderland et al (2019) to conceptualise the issue and identify priority areas for action.[31]

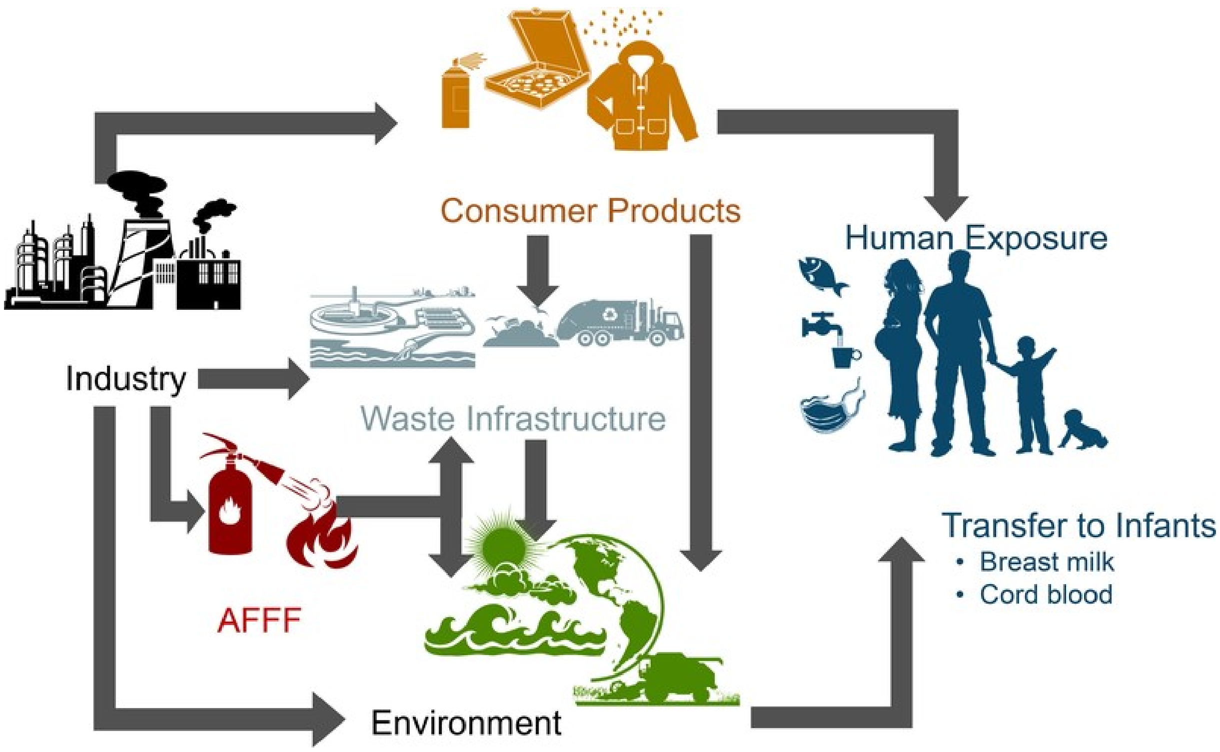

Figure 2 PFAS exposure pathways (borrowed from Sunderland et al 2019)

Ultimately, stopping or reducing pollution at the source is the most effective way to prevent humans and the environment from being exposed to harmful chemicals. In the meantime, current and legacy pollution must also be addressed by identifying and removing it from the environment, especially in drinking water. The following policy options address actions that can be taken in both areas to reduce the risk of human PFAS exposure.

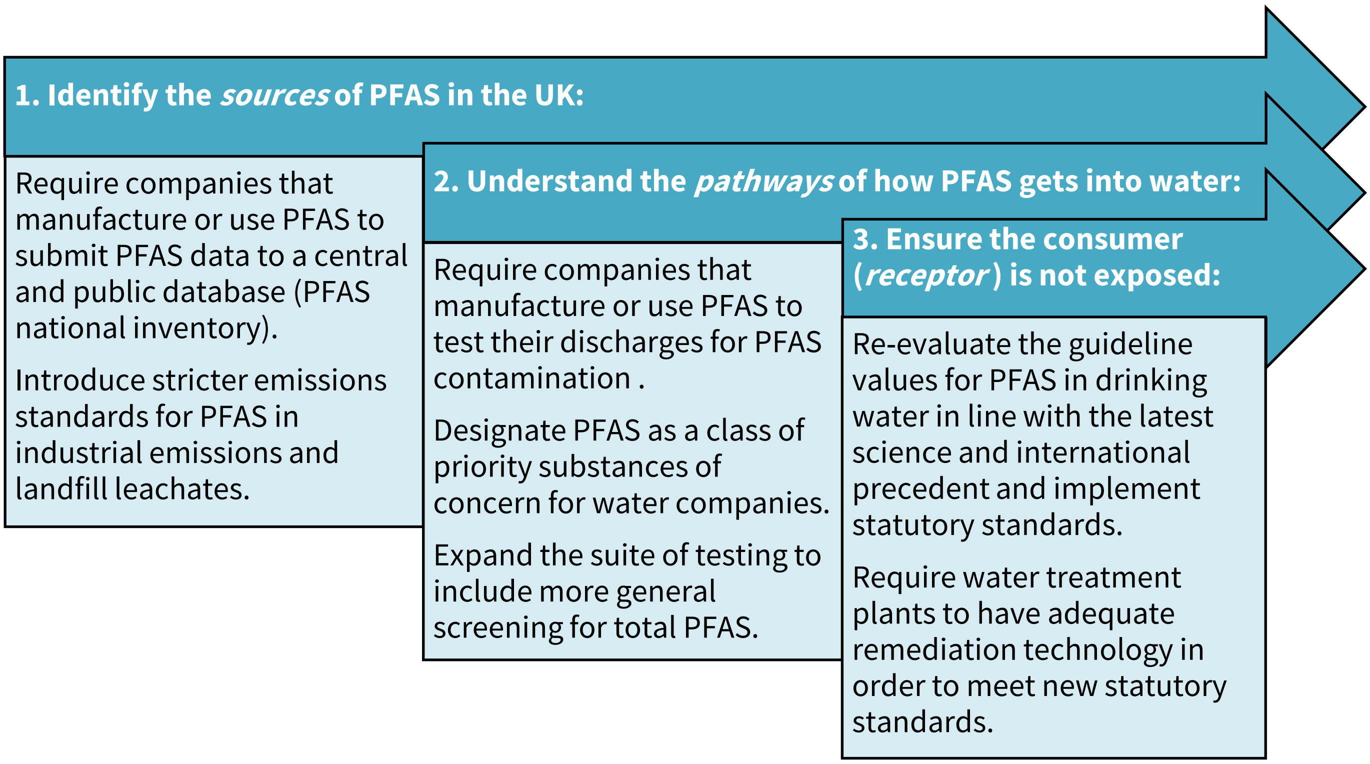

Figure 3 Policy options for the management of PFAS in UK drinking water

1. Identify the sources of PFAS in the UK:

Require companies that manufacture or use PFAS to submit data to a central and public database (PFAS national inventory).

Currently, information on the UK sources of PFAS from manufacture and use is difficult to access. The government and indeed wider industry do not have a record of where PFAS are present or being used across the supply chain. Standards for PFAS in products are difficult to get from manufacturers due to confidentiality concerns, and users do not always know or share the full picture of PFAS in their products. The HSE's PFAS RMOA (2023) concurs that 'the information available in GB is not able to provide a comprehensive picture of volumes, uses and PFAS used.'[32] Therefore, the first step towards better risk management of PFAS would be to require an audit of all PFAS manufacture and use across all industrial sectors and consumer products. This may also require testing and reporting of imported products. It is especially important to include substances that do not fall under the scope of UK REACH but within the OECD definition. The audit should also include null reporting.

Compiling such data in a central and accessible database will allow regulators to make decisions based on complete information about the sources of PFAS in the UK. Researchers and regulators can also better identify, prevent, and remediate potential water contamination sites if there is complete data on where PFAS is made and used. It is also important for companies to have better knowledge of their own PFAS use to fully control emissions. Requiring annual reporting will increase awareness in company management of the potential benefits and harms of PFAS use, transparency with regulators and the public, and opportunities to phase out PFAS and/or substitute to other substances. Fines could be imposed if companies do not perform adequate reporting on environmental emissions into UK waters.

2. Understand the pathways of how PFAS gets into water:

Require companies that manufacture or use PFAS to test their discharges for PFAS contamination.

With data from a national PFAS audit, as well as pre-existing data about existing PFAS hotspots, regulators should have a reference list of sites that are at a high risk of producing PFAS contamination. Regular testing for total PFAS and individual PFAS at sites with waste water discharges would help to identify any sources of pollution early on. Then, regulators and companies can take immediate action to limit the spread of the problem, including notifying downstream water treatment plants, so they can do extra monitoring and testing to ensure that drinking water remains to a high standard.

Monitoring of industrial emissions would also enable regulators to determine liability for localised PFAS pollution. Identifying the source of pollution is an important aspect of the polluter pays principle, which requires the responsible party to pay for the damage and clean-up of pollution incidents.[33] Exclusion of known point sources could also help pinpoint more disperse sources of contamination that may not be regulated or may indeed be non-compliant.

Introduce and enforce stricter emissions standards for PFAS in industrial emissions to water and landfill leachates.

The Environment Agency should implement stricter standards for PFAS in industrial emissions via its power to grant and amend environmental permits. In particular, these rules should require companies to use the best available techniques to minimise any emissions to the environment.[34] Landfill emissions permits should also be updated to include standards for PFAS in leachate.

New monitoring requirements for individual and total PFAS would generate the data needed to refine and enforce these new standards. Incidences of rule breaking could be fined via a similar approach to the current EA prosecutions of water and sewage companies, where fines are reinvested into environmental schemes. The fines need to be higher than the cost of implementing any new technology in order to be effective. Monies could also be directed toward PFAS-specific remediation projects.

This aligns with the goal published in the UK government's 25 year Environmental Improvement Plan (EIP), which aims to 'tackle chemical pollution at source through regulatory action.'[35] Rectifying pollution at its source is an important principle for managing chemicals in the environment.[36]

Designate PFAS as a class of priority substances of concern for water companies.

Water companies are tasked with monitoring and remediating many other existing contaminants, often resulting in limited resources to address PFAS. Formally designating PFAS as a class of priority substances will provide justification for the further expansion of monitoring capacity, method accreditation, and remediation efforts.

Designating PFAS (defined by the OECD definition) as priority substances of concern in water also aligns with UK commitments to the Stockholm convention on POPs, of which PFOA, PFOS, and PFHxS are listed substances (and long chain PFCAs are currently under consideration).[37,38]

Clarify testing methods for individual PFAS and expand the suite of testing to include more general screening for total PFAS.

Since 2021 when the DWI introduced the list of 47 PFAS for testing, water companies and laboratories have invested in improved analytical testing capabilities and standardised methods. However, methods for testing for PFAS in water are constantly evolving, and there are accredited analytical methods for only a limited number of substances. Currently, methods often vary from lab to lab, and data is not always comparable. The government could support the development of standardised and accredited methods for testing PFAS in the environment.

There are two main approaches to testing water for PFAS, by targeting PFAS as a group or as individual substances. The grouped approach evaluates the total amount of PFAS (or a reliable indicator for total PFAS, such as organic fluorine). The individual approach evaluates the concentration of specific well-defined substances. Both have pros and cons (see Table 3).

	Pros	Cons
Grouped approach	• Limits total amount of PFAS in water, capping total risk • More manageable amount of testing required	• May allow a more than desirable amount of any given substance, risking increased exposure and harms from the more toxic types of PFAS
Individual approach	• Ensures that PFAS deemed to be high risk are specifically monitored and remediated	• Too many substances to regulate everything on an individual basis – testing for each individual substance would be a burden • May miss out on substances that are toxic but because of lack of data have not yet been identified as high risk

Table 3 Grouped versus individual approach to testing for PFAS in water

A combination of both approaches is ideal, balancing the cost and resource burden of testing with the need to manage highest risk substances.

Testing for total PFAS can reveal hot spots that might be missed when testing for the current DWI list of 47 PFAS, which will allow researchers to better identify locations that require further investigation. This type of testing is important because the total number of potential PFAS is so vast; current testing regimes may ignore places where cumulative PFAS may be beyond healthy exposure levels, even if levels of individual PFAS do not trigger a contamination warning. Expanding the testing suite is also important because PFAS can transform once they are in the environment, resulting in the release of other substances of concern.[39] Testing only for a specific list of PFAS may allow these precursors/end-state substances to persist under the radar.

Regular water tests should include total PFAS methods, such as total organic fluorine (TOF) or total oxidisable precursor (TOP) assays,[40] in addition to targeted methods that identify the presence of specific PFAS. If total PFAS is much higher than the sum of the targets, the source should be flagged for further testing. Then, non-targeted methods can be used to identify the unknowns and update the list of targets for future monitoring.

3. Ensure the consumer (receptor) is not exposed to PFAS via drinking water:

Re-evaluate the current guideline values for PFAS in drinking water in line with the latest science and international precedent, and implement statutory action standards for water companies.

Approaches to setting limits for PFAS in drinking water vary between jurisdictions, with some countries or regions setting total PFAS limits and others setting maximum concentrations for each individual PFAS, or some combination of these methods.

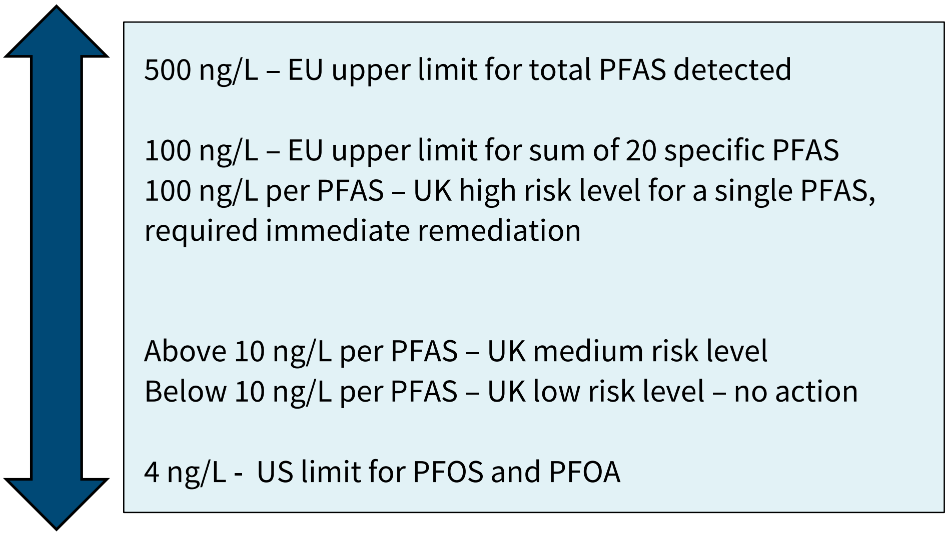

Figure 4 Current limits on PFAS concentration in drinking water in the UK, US, and EU

Currently in the UK, 47 different PFAS are measured and regulated individually, with a maximum level of 100 ng/L per PFAS. A new statutory action standard should lower the limit to 10 ng/L or lower per PFAS, and accredited analytical methods should be developed within the next few years to ensure this standard can be met for all of the DWI-listed individual PFAS. Compared to the current DWI Tier system, any measurement above 10 ng/L would be considered a Higher Risk, while Lower Risk would be 10 ng/L or less. Therefore, the new system would focus on bringing the whole of the UK population into a lower risk scenario. This approach aligns with the precautionary principle and lowers the likelihood of sustained exposure to PFAS. Water companies would be required to remediate down to 10ng/L or less in order to meet wholesomeness requirements, according to the current Tier 3 guidelines.

Tier	Current DWI guidance*	Proposed statutory standards*
Tier 1 – Low Risk	Less than 0.01 µg/L (10 ng/L)	Less than or equal to 0.01 µg/L (10 ng/L)
Tier 2 – Medium Risk	Less than 0.1 µg/L (100 ng/L)	Tier eliminated
Tier 3 – High Risk (action standard)	Greater than or equal to 0.1 µg/L (100 ng/L)	Greater than 0.01 µg/L (10 ng/L) – triggers remediation action

*for measurement of a single PFAS

Table 4 Existing DWI guidelines versus proposed statutory standards

Additionally, a new PFAS action standard should be established which sets a maximum acceptable concentration of 100 ng/L of either a sum of PFAS or total PFAS, using methods as described earlier in this report. There are two options for this standard: sum of PFAS, which looks for the sum of concentrations of a defined list of PFAS, or total PFAS, which looks for the total amount of PFAS present without identifying individual substances.

If using the sum of PFAS method, there are two further options for determining the list of substances. First, the regulator could use the current DWI list of 47 PFAS, which would align this standard with the current testing regime. Alternatively, the list of 20 PFAS from the EU sum of PFAS standard could be used. It could be useful, given the persistence and mobility of PFAS in rivers and seas and the EU being our closest geographical neighbour, to harmonise these standards as much as possible.

Water companies that measure levels in drinking water above 100 ng/L using sum or total PFAS methods would be required to remediate immediately to 100 ng/L or less, according to the actions currently prescribed in DWI rules for Tier 3.

Final drinking water should meet all requirements for individual and total PFAS in order to meet a definition of 'wholesome' for the consumer. Such an approach to regulation would assure the best protection for human health now and for future generations, and it would contribute to meeting the sustainable development goals for water quality.

Figure 5 Requirements for final drinking water to be considered wholesome

Require water treatment plants to have adequate remediation technology in order to meet new statutory standards.

Conventional water treatment systems are not always equipped to remove PFAS effectively, nor is it proven that existing strategies are effective. Also, PFAS-containing sewage sludge from wastewater treatment plants is often spread on land or transferred to landfill, where PFAS are rereleased into the environment. Commonly used methods for filtering PFAS out of drinking water supplies include activated carbon, ion exchange, and membrane filtration, which result in PFAS-laden waste that must be treated or disposed of without rereleasing PFAS into the environment. Also, there is currently limited available information to judge their effectiveness and cost in water treatment facilities, and further information is urgently needed.

Within a reasonable timeframe, water treatment plants should be required to have technology in place that can adequately remediate water to the lowest levels defined by new statutory standards. It is understood from our research that new technologies are available for this purpose; however, concern remains about the cost of implementation, especially as water companies are being made to address a problem that stems from outside sources. Companies should also prepare plans for the management and appropriate disposal of filter or other wastes that may contain concentrated PFAS, in order to lessen the risk of PFAS re-entering the environment.

Although it is out of scope for this policy position to have a full discussion of the available remediation technologies, it is important to support the continued research, development, and commercialisation of new methods for remediating and destroying PFAS such that they do not pollute the environment. Currently, UK investment in new technologies is difficult to obtain for entrepreneurial SMEs. There are opportunities for collaboration between industry, academia, and the water sector to innovate in this space. Regulatory tools and new standards can also be used to incentivise change – for example, producers and users of PFAS could be made to pay a levy per unit of PFAS used, which could encourage them to look for alternatives to PFAS and fund effective end of life management of PFAS in the waste and water systems.

Final thoughts on policy implementation

The actions laid out in this policy position are not linear. Some, such as a national PFAS inventory, will take time to develop. Others can and should be implemented at the earliest opportunity. Importantly, a precautionary approach requires that we do not wait to take action where possible, based on the scientific evidence we have today. Our approach is focused on human consumers and drinking water. Stricter controls of factory emissions at source will also enhance the quality of water for wildlife and make the downstream remediation of water by the water sector to meet drinking water standards an easier challenge.

Additionally, PFAS are mobile in water, so pollution in the UK could originate internationally in addition to known domestic sources. These policy options are described in the context of the UK, but we would advocate that these policy options can be applied in any jurisdiction. If all of the world adheres to stricter action standards, the global burden of PFAS pollution in water and as measured in human beings and wildlife will reduce over the years ahead.

The UK has an opportunity to be a leader in this area by taking decisive regulatory action now. We would like to see the formation of a collaborative PFAS action group involving government, academia, PFAS manufacturing, product manufacturing industry, and the water sector – to develop joint funding solutions, reduce factory emissions using the best available technology, improve monitoring of PFAS in water, and increase the use of water remediation technologies to assure new standards for drinking water can be met.

Contact

The Royal Society of Chemistry would be happy to discuss any of the issues raised in our statement in more detail. Any questions should be directed to the RSC Policy & Evidence Team at policy@rsc.org. This document was prepared by Stephanie Metzger with support from Camilla Alexander-White and Geena Goodwin of the RSC Policy & Evidence Team. Our position was developed following an RSC engagement event in November 2022 with members of the RSC and the wider international scientific community. Special thanks to Sue Bullock, Daniel Brown, Rebecca Miller, and Mike Padgham of TSG Consulting for providing scientific evidence and to expert reviewers Dr. David Megson, Dr. Stephen Mudge, and Prof. Tom Welton.

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With about 50,000 members in over 100 countries and a knowledge business that spans the globe, the Royal Society of Chemistry is the UK's professional body for chemical scientists, supporting and representing our members and bringing together chemical scientists from all over the world. Our members include those working in large multinational companies and small to medium enterprises, researchers and students in universities, teachers and regulators. There are numerous ways in which chemical scientists are working towards a sustainable, clean and healthy planet, and this position statement is part of The Royal Society of Chemistry’s contribution to do so.

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