INTERIM JOINT POSITION PAPER

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN DRINKING WATER

This position paper has been developed by the Health Service Executive and the Environmental Protection Agency. It provides a summary of legislation, potential health impacts and interventions in relation to PFAS (per- and polyfluoroalkyl substances) in drinking water.

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KEY MESSAGES

Monitoring for per- and polyfluoroalkyl substances (PFAS) in drinking water is required in Ireland from 12 January 2026.

The recast Drinking Water Directive (EU 2020/2184) includes a limit of 0.1 µg/l for the 'Sum of PFAS' in drinking water. This will come into effect on 12 January 2026.

If a water supply exceeds the parametric value for 'Sum of PFAS', efforts must be made to reduce levels below the parametric limit within a reasonable timeframe.

WHO health-based guideline values for PFAS in drinking water are being developed. In the interim, if an exceedance occurs, there should be careful consideration around potential risk to human health and a precautionary approach should apply.

1. INTRODUCTION

The Drinking Water Directive (DWD)[1] is the European Union's main law on drinking water. The DWD concerns access to, and the quality of, water intended for human consumption to protect human health.

The recast DWD (EU 2020/2184)[1] entered into force on 12 January 2021. Among the key features of the recast DWD is the tackling of emerging pollutants, including PFAS (per- and polyfluoroalkyl substances). PFAS comprise a large group of thousands of synthetic chemicals that are widely used in industrial and consumer products.

The recast DWD was transposed into Irish law on 7 March 2023 through the European Union (Drinking Water) Regulations 2023 (S.I. No. 99 of 2023)[2] https://www.irishstatutebook.ie/eli/2023/si/99/made/en/pdf.

The Drinking Water Regulations 2023 introduced PFAS parameters and parametric values for drinking water. These PFAS parameters will need to be monitored at the point of compliance, and the parametric values are required to be complied with from 12 January 2026.

This Interim Joint Position Paper outlines what PFAS are, associated legislative requirements for drinking water, potential human exposure and potential health effects, together with caveats around understanding the scientific evidence, drinking water monitoring requirements, action on exceedances and intervention considerations. The Joint Position Paper will remain interim

in the short term given the rapidly evolving nature of evidence regarding this emerging pollutant.

It should be noted that health-based guideline values for PFAS in drinking water are awaited from the World Health Organisation (WHO).

2. PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

PFAS are man-made substances that have been used in industrial and consumer products since the 1950s due to their physical and chemical properties. PFAS are created by replacing hydrogen atoms (the natural bonding partner for carbon) with fluorine atoms. This gives PFAS water- and oil-repellent properties.

These properties are sought after in many industrial production processes. However, the fluorinated parts of the emitted PFAS are not degradable. This means that once released into the environment, these PFAS cannot be broken down into carbon dioxide or methane by bacteria, enzymes or sunlight, earning them the name of 'forever chemicals'.[3]

PFAS can be found in many everyday products – outdoor clothing and equipment, textiles, paints, food packaging, photographic coatings, non-stick coatings on cookware as well as fire-fighting foam.[4]

Drinking water is one of several environmental sources of human exposure to PFAS, along with exposure via food, use in consumer products and occupational exposures.[5]

There are concerns with the persistence and impacts of PFAS on the environment and human health, as a result of exposure through the widespread uses of these chemicals.[5]

3. LEGISLATIVE REQUIREMENTS

The Drinking Water Regulations 2023 set out requirements for drinking water quality, safety and management, which apply to all regulated drinking water supplies. The Environmental Protection Agency (EPA) is the supervisory authority in relation to public water supplies, and local authorities are supervisory authorities in relation to private water supplies. Both the EPA and local authorities have enforcement powers under the regulations.

The Drinking Water Regulations 2023 set drinking water quality limits, known as parametric values, which apply to all regulated drinking water supplies. Each water supplier must investigate failures to meet a parametric value, to identify the cause of the failure and take action to restore drinking water quality. Where a failure is considered a risk to human health, the water supplier must consult with the Health Service Executive (HSE) on appropriate actions to protect human health. The regulations also require the water supplier to notify its supervisory authority of failures.

The recast DWD entered into force on 12 January 2021. It was transposed into Irish law on 7 March 2023 through the Drinking Water Regulations 2023.

The recast DWD introduced PFAS parameters and parametric values to be monitored - PFAS Total' and 'Sum of PFAS' - with limit values of 0.50 µg/l and 0.10 µg/l respectively (Table 1).

Table 1. 'PFAS Total' and 'Sum of PFAS'

PFAS Total	0.50	µg/l	'PFAS Total' means the totality of per- and polyfluoroalkyl substances.
Sum of PFAS	0.10	µg/l	'Sum of PFAS' means the sum of per- and polyfluoroalkyl substances considered a concern as regards water intended for human consumption listed in point 3 of Part B of Annex III.

Source: Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (recast) – DWD Annex 1 Part B. https://eur-lex.europa.eu/eli/dir/2020/2184/oj

Article 13(7) and Part B of Annex 1 of the Drinking Water Directive state that *Member States may decide to use either one or both parameters 'PFAS Total' or 'Sum of PFAS'*.

Following consultation and agreement between the EPA and the HSE in 2024, the EPA will use the parameter 'Sum of PFAS', and thus, at time of writing, Uisce Éireann (UÉ) shall monitor the parameter 'Sum of PFAS' only.

The 'Sum of PFAS' comprises 20 individual PFAS substances of concern (see Appendix).

The PFAS parameters will need to be monitored at the point of compliance (in most cases the tap), and the parametric values are required to be complied with, by 12 January 2026 at the latest (Article 25 of DWD).

4. HUMAN EXPOSURE

The extensive use of PFAS over the past decade implies that most people are now exposed to these chemicals to some extent – in food, drinking water, house dust, indoor and outdoor air and certain consumer products.

Routes of potential human exposure to PFAS include ingestion, placental transfer and inhalation. Dermal absorption of PFAS is limited and does not appear to be a significant route of exposure for the general population.[6,7]

Ingestion of PFAS is the primary exposure pathway for the general population. Major ingestion sources include consuming food produced in areas contaminated by PFAS, eating food packaged in materials containing PFAS, and drinking contaminated water.

With regard to water, ingestion of PFAS may occur if a drinking water source becomes contaminated with PFAS. The main point sources for such contamination could include industrial pollution from PFAS-production sites, from PFAS-use sites, and from sites where PFAS-containing fire-fighting foams were used.

Showering, bathing or washing dishes in water containing traces of PFAS is not likely to increase exposure.[8]

5. POTENTIAL HEALTH EFFECTS

PFAS exposure is associated with an increased risk of some adverse effects for human health. Risks differ among different PFAS based on their potential toxicity, mobility and bioaccumulation.[8]

Scientific research involving humans suggests that high levels of certain PFAS may lead to particular health effects. However, for most of these potential health effects, current scientific evidence is not clear-cut or conclusive. Ongoing studies continue to explore how varying levels and types of PFAS exposure may impact health, particularly the effects of long-term, low-level exposure.

The US Centres for Disease Control and Prevention (US-CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR)[6] have pointed out that:

- Research is ongoing to understand the mechanisms of PFAS toxicity.

- The risk of health effects associated with PFAS depends on
  - Exposure factors (e.g. dose, frequency, route and duration)
  - Individual factors (e.g. sensitivity and chronic disease burden)
  - Other determinants of health (e.g. access to safer water and quality healthcare)

- Epidemiological evidence suggests associations between increases in exposure to (specific) PFAS and certain health effects
  - Increases in cholesterol levels (PFOA, PFOS, PFNA, PFDA)
  - Small decreases in birth weight (PFOA, PFOS)
  - Lower antibody response to some vaccines (PFOA, PFOS, PFHxS, PFDA)
  - Kidney and testicular cancer (PFOA)
  - Pregnancy-induced hypertension or preeclampsia (PFOA, PFOS)
  - Changes in liver enzymes (PFOA, PFOS, PFHxS)

The HSE had previously outlined the above potential health effects in both its interim position paper[8] and FAQ document[9] relating to PFAS in drinking water.

HEALTH-BASED GUIDANCE VALUES FOR PFAS

The WHO is currently identifying and prioritising key ingested PFAS and key health effects of PFAS. In addition to the most widely studied PFAS – perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) – this initiative includes additional PFAS and the development of risk assessment methodology for prioritised PFAS, including individual PFAS and as mixtures. These WHO initiatives facilitate the Joint WHO/FAO Expert Committee on Food Additives (JECFA) and the WHO Guidelines for Drinking-water quality expert meetings in developing formal, normative health-based guidance values for key ingested PFAS.[10]

International health-based guidance values for PFAS in drinking water are awaited.

6. CAVEATS AROUND UNDERSTANDING THE SCIENTIFIC EVIDENCE

There are several challenges in interpreting scientific evidence on the potential health effects of PFAS exposure.

Many studies have examined possible relationships between PFAS levels in blood and harmful health effects in humans. However, these studies involved different PFAS, study populations and exposure types. Therefore, the outcomes may not be directly comparable.

The US Environmental Protection Agency (US-EPA)[11] cautions that, while scientists continue to conduct and review the growing body of research about PFAS, health effects associated with exposure to PFAS are difficult to specify for many reasons, such as:

- There are thousands of PFAS, yet most studies focus on a limited number of better known PFAS compounds.
- People can be exposed to PFAS in different ways and at different stages of their life.
- The types and uses of PFAS change over time, making it challenging to track and assess how exposure to these chemicals occurs and how they will affect human health.

Different PFAS have distinct physical, chemical and toxicological properties; people are exposed to more than a single PFAS. As a result, exposures are often to mixtures of PFAS such that specific effects are difficult to disentangle.[12]

Because of the nature of studying drinking water and health, robust conclusions can be difficult to reach. Even in well-designed studies, it is difficult to assess a person's individual exposure to levels of a particular chemical in drinking water over a long period of time. Other factors may explain the results and it can be difficult to control these. Positive adverse associations are often just very small increased risks. These can occur randomly, and it is difficult for a scientist to say with absolute certainty that the increase is due entirely to the chemical being studied. All of the above factors are even more pronounced when the health outcome is a chronic disease that may take decades to develop. In order for findings to be valid, they must be reproduced, as policy generally cannot rely on one study.

These methodological limitations are not unique to PFAS and drinking water. They are common to many environmental and health issues. In public health matters such as these, the precautionary principle applies. Where evidence with regard to the environment and health is uncertain, human exposure to the hazard should be minimised (i.e. where exceedances are persistent and remedial actions are required to minimise human health impacts, the level and duration of exposure should be as low and short as possible). Any precautionary action should be proportionate to likely benefits and potential harms.

7. PFAS MONITORING

In line with Article 13(7) of the recast DWD and based on consultation with Member States, the Commission has established technical guidelines regarding methods of analysis for monitoring 'PFAS Total' and 'Sum of PFAS' in drinking water.[13] These technical guidelines include analytical methods and approaches considered most appropriate for monitoring the recast DWD PFAS parameters in drinking water.

UÉ shall ensure that monitoring of the 'Sum of PFAS' is in accordance with the requirements of Schedule 1, Table B, Note 17.

Monitoring of the 'Sum of PFAS' comes into effect after 11 January 2026.

8. RISK ASSESSMENT

Where a 'Sum of PFAS' exceedance is determined, a water supplier should assess whether there is a possible risk to the consumer (see Section 9 below also).

If following this assessment, 'a water supplier or a local authority considers that a supply of water intended for human consumption constitutes a potential danger to human health, the water supplier or the local authority, as the case may be, shall consult with the HSE'. Regulation 15, Drinking Water Regulations 2023.

9. PFAS EXCEEDANCES

CHEMICAL EXCEEDANCES (General)

A typical risk assessment in respect of a chemical exceedance in drinking water considers the following.

Representative Sampling

- Checks to determine whether the sample is representative of the overall supply or if it reflects a localised issue

Remedial and Operational Actions

- Remedial actions already taken by the water supplier(s)
- Details of the source, treatment operations, storage and distribution of the water

Potential for Health Effects

- Concentration of the particular chemical
- Potential for acute toxicity at the concentrations detected
- Potential for chronic toxicity at the range of concentrations detected, considering the expected remediation timeframe

Historical Context

1. Previous history of the water supply
2. Recent changes to the water supply system
3. Impact of extreme weather incidents

Consumer and Community Impact

- Complaints or reported illnesses from consumers
- If any vulnerable groups (e.g. infants, elderly, immunocompromised)
- Availability of alternative water supplies

Consequently, each assessment is specific in time, location and population. In considering the action to be taken by the water supplier(s), the HSE also has regard to the risk to human health that would be caused by the interruption of the water supply or restriction of water use.

EXCEEDANCES OF 'SUM OF PFAS'

In addition to the above, there may be further risk assessment considerations for a 'Sum of PFAS' exceedance. An exceedance may be sporadic or PFAS levels may be persistently elevated. More frequent testing may be required to assess if a specific result is representative of the mean PFAS concentration in the supply. A breakdown of individual PFAS in the 'Sum of PFAS', if available, may be requested.

10. INTERVENTIONS

The whole area of interventions in relation to PFAS exceedances in drinking water is an evolving one. There is no legal obligation to monitor for PFAS until January 2026. To date there is no guidance to advise specific interventions relating to PFAS exceedances.

Possible intervention approaches may need to consider such aspects as protection of the source of the water supply, drinking water treatment options or consumer restriction considerations (restrictions on use of the water supply, or prohibition of the supply of such water). Any consideration relating to consumer restriction should bear in mind the potential risk to human health that might result from an interruption of the supply or a restriction in use.

Water treatment technologies that have been shown to be capable of removing PFAS from drinking water include activated carbon filtration, reverse osmosis and anion exchange treatment. Carbon filtration has been demonstrated to be more effective for treatment of longer chain (more hydrophobic) PFAAs, such as PFOS and PFOA, as opposed to the shorter chain compounds such as PFHxA. However, practical implementation may be difficult. Ion exchange

resins are generally more successful in removing shorter chain anionic PFAS, as electrostatic interactions can be used to remove them from water.[14]

WATER SAFETY PLANS

The EPA continues to endorse a risk management approach to ensuring drinking water is both safe and secure. A supply is deemed safe if it meets the required quality at the consumer's tap, and secure if a management system is in place that identifies potential risks, with measures in place to manage these risks, for example by implementing the WHO Water Safety Plan approach. Risk assessment and risk management are at the core of these safety plans. Water suppliers should implement water safety plan methodologies for the management of water supplies to reduce PFAS in drinking water. The Drinking Water Regulations 2023 introduced a legal requirement for water suppliers to use a Water Safety Plan method of risk assessment and management, which will come into effect from 12 January 2029.

11. CONCLUSIONS

PFAS is an emerging pollutant. The PFAS group of substances is under ongoing review internationally as the state of the science evolves. A considerable amount of related research is ongoing. A current Irish research project, being undertaken by the EPA, is investigating PFAS from source to sink and assessing risk to inform a PFAS strategy in Ireland.[15]

Monitoring for PFAS in drinking water has not been previously required in Ireland. That requirement will come into effect on 12 January 2026. The Drinking Water Regulations 2023 include a limit of 0.1 µg/l for 'Sum of PFAS' in drinking water.

WHO health-based guidance values for PFAS in drinking water are awaited.

The recommended interim approach to PFAS in drinking water is outlined below, and includes WHO's advice to its Member States:[16]

- Member States should strive to achieve concentrations in drinking water that are as low as reasonably practical.[16]
- Contamination of water sources should be minimised, including preventing new sources of contamination.[16]
- Non-essential uses of PFAS should be stopped.[16]
- Risks from PFAS need to be balanced with other risks in the water supply including not having adequate supplies of drinking water.[16]
- Comprehensive risk assessment of all breaches of the 'sum of PFAS' parametric value must take place, with efforts made to reduce levels below the parametric limit within a reasonable timeframe.
- Where public drinking water supplies with persistent PFAS exceedances have been assessed as posing a potential risk to public health, the water supplier will be required to have an agreed plan of works in place with a timescale for restoring compliance.
- The Water Safety Plan approach, which identifies hazards to drinking water quality from catchment to consumer, must be adopted to ensure that drinking water supplies are safe

and secure. Implementation of this approach may assist in tackling PFAS in drinking water and will be a legal requirement for drinking water supplies from 12 January 2029.

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APPENDIX: Sum of PFAS (20)

3. Sum of PFAS

The following substances shall be analysed based on the technical guidelines developed by the European Commission in accordance with Article 13(7) of the Directive:

(a) Perfluorobutanoic acid (PFBA);
(b) Perfluoropentanoic acid (PFPA);
(c) Perfluorohexanoic acid (PFHxA);
(d) Perfluoroheptanoic acid (PFHpA);
(e) Perfluorooctanoic acid (PFOA);
(f) Perfluorononanoic acid (PFNA);
(g) Perfluorodecanoic acid (PFDA);
(h) Perfluoroundecanoic acid (PFUnDA);
(i) Perfluorododecanoic acid (PFDoDA);
(j) Perfluorotridecanoic acid (PFTrDA);
(k) Perfluorobutane sulfonic acid (PFBS);
(l) Perfluoropentane sulfonic acid (PFPS);
(m) Perfluorohexane sulfonic acid (PFHxS);
(n) Perfluoroheptane sulfonic acid (PFHpS);
(o) Perfluorooctane sulfonic acid (PFOS);
(p) Perfluoronoane sulfonic acid (PFNS);
(q) Perfluorodecane sulfonic acid (PFDS);
(r) Perfluoroundecane sulfonic acid;
(s) Perfluorododecane sulfonic acid;
(t) Perfluorotridecane sulfonic acid.

Those substances shall be monitored when the risk assessment and risk management of the catchment areas for abstraction points carried out in accordance with Regulation 10 conclude that those substances are likely to be present in a given water supply.

Source: European Union (Drinking Water) Regulations 2023 (S.I. No. 99 of 2023). Schedule III Part 2. https://www.irishstatutebook.ie/eli/2023/si/99/made/en/pdf

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