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POLICY BRIEFING:

Toxic tide rising: time to tackle PFAS

National approaches to address PFAS in drinking water across Europe

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Summary

PFAS chemicals are of growing concern for human and environmental health due to their links to several negative health effects together with their persistent and mobile properties that make them difficult and costly to remove. The recast 2020 Drinking Water Directive sets thresholds for PFAS that EU Member States must comply with by 2026. Meanwhile, guidance values by authorities and expert groups worldwide on 'safe' exposure levels to PFAS are continuously lowered as new knowledge emerges and several Member States have already based their national drinking water thresholds on these stricter health guidance.

We argue that PFAS drinking water thresholds in the EU should be updated and based on the latest science, i.e. become stricter. However, to only regulate concentrations at the end-of-pipe while not addressing the source is a waste of public money and resources, as PFAS removal is costly and requires energy and resources. It is therefore crucial that the Commission moves forward with the proposed ban of PFAS and that environmental monitoring and regulation of PFAS in natural water is improved across the EU to guide measures. At the same time, solutions must be found to hold PFAS producers liable for the societal, health, treatment, monitoring and remediation costs linked to PFAS pollution, which are likely to be in the order of tens of billions of euros per year.

1 Introduction

1.1 Background

Per-and polyfluoroalkyl substances (PFAS) are a family of chemicals with over 10,000 members known so far. PFAS are human-made chemicals that have very 'special' chemical properties that make them resistant to high temperatures and are powerful water, dirt and grease repellents. This is why they are widely used in industrial applications and consumer products, from non-stick coating in pans, to cosmetics, textiles, fire extinguishing foam, detergents and lubricants. But these special properties come at a cost: PFAS are not degradable. This means that once released into the environment, PFAS don't break down by bacteria, enzymes, or sunlight within common timescales of test for persistency, earning them the name "forever chemicals".

PFAS are today omnipresent in the environment and in our bodies and by further emitting these substances as a society, we keep adding to the stock of pollution. The Nordic Council of Ministers estimate that around 100,000 sites across Europe are potentially emitting PFAS chemicals[1] and a cross-European journalistic investigation identified more than 2 100 sites in Europe as PFAS hotspots – places where contamination reaches levels considered to be hazardous to the health of exposed people[2].

Areas close to industrial sites for PFAS production, manufacturing (such as in Veneto, Antwerp and Dordrecht) and facilities where fire-fighting foams have been used, such as military airports and fire-fighting training sites (Ronneby and Korsør) have been found to particularly contaminate the air, soil, water and blood of people living nearby.[3] Due to their properties, PFAS however migrate and spread

[1] Nordic Council of Ministers (2019) The cost of inaction https://www.norden.org/en/publication/cost-inaction-0

[2] Le Monde, (2023): The Forever Pollution Project. Journalists tracking PFAS across Europe. https://foreverpollution.eu/ (18/08/2023)

[3] HEAL, website, How PFAS pollution affects people's health across Europe https://www.env-health.org/banpfas/

globally and several of them can get via different pathways into water sources and food chains. Humans are exposed to PFAS via various sources, including air and dust, but food and drinking water are the major exposure routes[4].

PFAS are related to different concerning effects for human health, including cancer, liver damage, and reproductive effects as well as for the environment (aquatic toxicity, etc.). Many of the substances in the large PFAS group are not well studied yet. Several PFAS have the capacity to disrupt the endocrine system of humans and wildlife. Endocrine disrupters are considered non-threshold chemicals, meaning that any level of exposure may cause harm.

A PFAS exposure assessment by the European Food Safety Authority (EFSA), based on food sample analyses from 16 Member States, including drinking water, revealed that actual exposure of EU citizens to four PFAS that accumulate in the body (PFOA, PFNA, PFHxS and PFOS), even when looking at conservative values, is up to five times the recommended maximum weekly intake for adults.[5] For children, the exposure is two times higher than for adults, and for infants even higher. This results however, does not take into account the health effects of those PFAS that might be present but on which occurrence data were not available.

The mean total intake of PFAS-4 from different types of foods and beverage categories, based on EFSA's exposure assessment, is shown in **Figure 1** for adults and **Figure 2** for toddlers in different EU countries. Differentiated figures with the contributions of each category can be found in Annex 2.

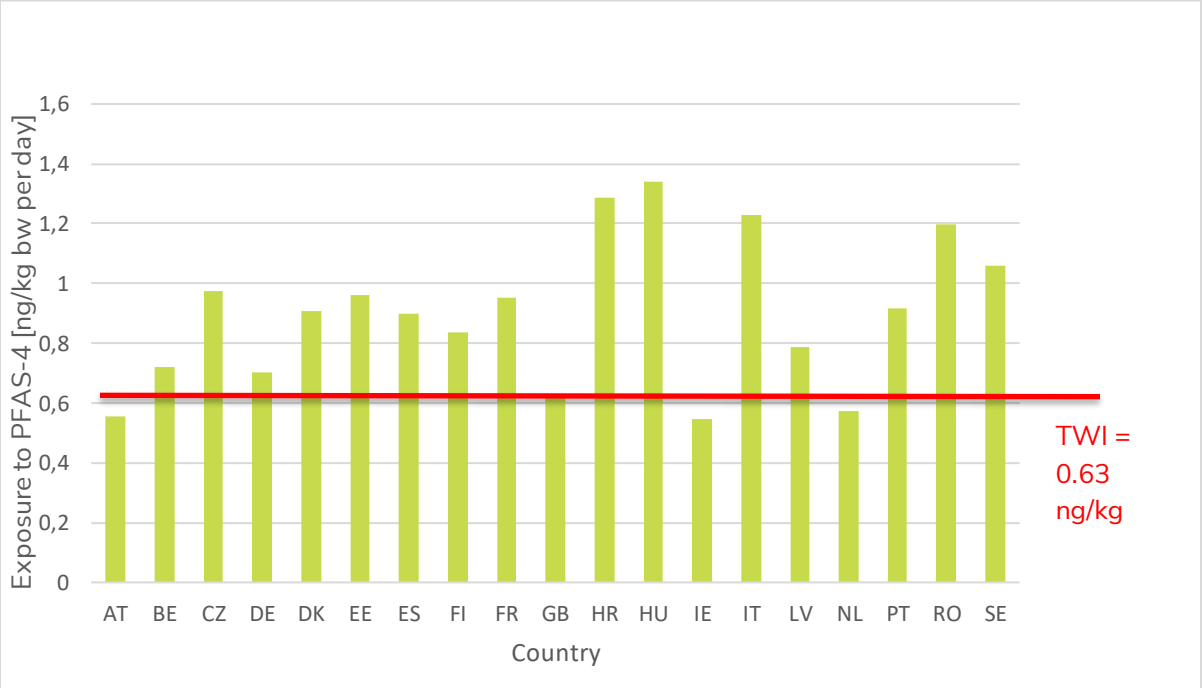

Figure 1 *Mean total exposure of adults to PFAS-4 from different food and beverage categories in EU countries compared to the TWI recommended by EFSA*

[4] **HBM4EU 2022, EFSA 2020** https://www.hbm4eu.eu/hbm4eu-substances/per-polyfluorinated-compounds/

[5] EFSA, (2020), Risk to human health related to the presence of perfluoroalkyl substances in food https://doi.org/10.2903/j.efsa.2020.6223

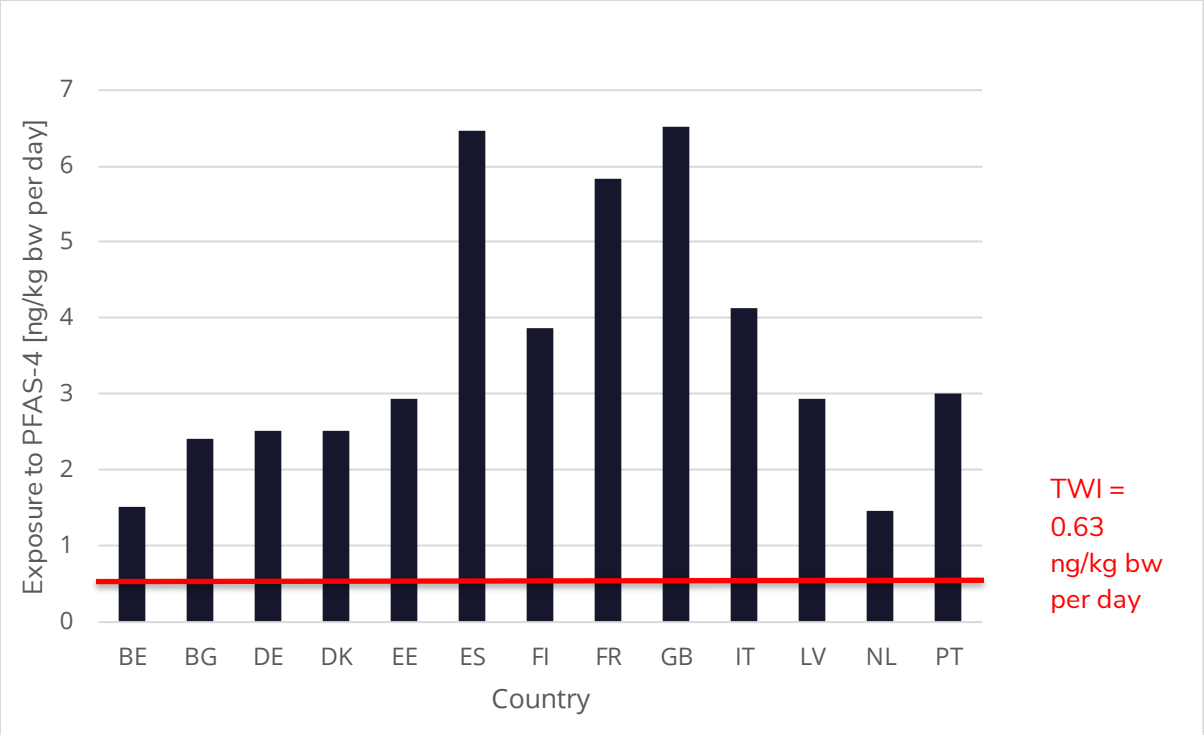

Figure 2 *Mean total exposure of toddlers to PFAS-4 from different food and beverage categories in EU countries compared to the TWI recommended by EFSA*

1.2 What does the EU law say?

The **Drinking Water Directive** (2020/2184/EU) is the main EU law regulating the quality of, and access to, drinking water. The Directive was revised recently, and the recast version was adopted in December 2020.

Among the new provisions in the recast Drinking Water Directive are thresholds for PFAS[6]. The Directive sets two group thresholds for PFAS:

- '**sum of PFAS'**: 0.1 µg/L for a group of 20 PFAS[7]
- '**PFAS total':** 0.5 µg/L meaning the totality of per- and polyfluoroalkyl substances.

Member States have to transpose the rules of the Drinking Water Directive into national law and comply with the provisions by 12 January 2023. **However, Member States only need to take measures to ensure compliance with the PFAS thresholds ('sum of PFAS' or 'PFAS total') by 12 January 2026. The 'PFAS total' parameter only comes into force once technical guidelines for monitoring of this parameter has been developed. Member States can then choose if they apply the 'sum of PFAS' or the 'PFAS total' parameter.**

The EU thresholds for pollutants in natural waters, the source for drinking water, are regulated under the **Water Framework Directive** (WFD, 2000/60/EC), the **Environmental Quality Standards Directive** (EQSD, 2008/105/EC) and the **Groundwater Directive** (GWD, 2006/118/EC). Since 2013, **PFOS** is

[6] Set in Annex 1, Part B of the Directive

[7] PFBA, PFPA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFBS, PFPS, PFHxS, PFHpS, PFOS, PFNS, PFDS, Perfluoroundecane sulfonic acid, Perfluorododecane sulfonic acid, Perfluorotridecane sulfonic acid

designated a **priority substance** under the WFD, with associated environmental quality standards (EQS) set in the EQSD[8]. This means that Member States need to monitor its presence in water and take measures to ensure the EQS is not surpassed.

The European Commission proposed, in October 2022, new priority substances (for surface water) and groundwater pollutants. The proposal included a threshold of 4.4 ng/L for a group of 24 PFAS in surface and groundwater as well as a threshold for PFAS in biota (0.077 µg/kg wet weight, also for the group of 24 PFAS). The thresholds are expressed as PFOA equivalents and makes use of a *Relative Potency Factor* approach to account for the potencies of the different substances when setting the group threshold.

Currently, the EU legislation that regulates chemicals (both source legislation like REACH and in-media legislation like the WFD) and their effects is mostly focussed on individual substances. This means that a single substance that is regulated substance easily can be substituted by another with similar harmful properties. There is also rising concern about the **effects of chemical mixtures**, that can occur even when single substances are present at 'safe' levels. Regulating substances as a group, e.g. by setting a threshold for a group of substances with similar properties, is a way to counter that, and is in line with the Chemicals Strategy for Sustainability (CSS) aim to regulate substances as a group[9].

France: Lack of coherent monitoring

An analysis of surface water monitoring data showed that PFAS pollution in France is widespread and concerns almost the entire territory, but that monitoring is not coherent between the departments.

In only 5 out of 101 department, no PFAS was quantified. The number of PFAS analysed ranged from 1 to 16 depending on department and the frequency of monitoring varied between 6 to 440 samples analysed in 2020. This difference risks some PFAS to go undetected. The limits of quantification (the precision of the analytical technique) also varied greatly and could be 500 times higher from one department to another. In departments with less precise analytics PFAS might be present but not quantified.

Source: Générations Futures, (2023). *État des lieux de la présence de Composés perfluorés dans les Eaux de surface en France*

PFAS restriction

The EU Commission acknowledges the need to act on PFAS and announced in the CSS under the Green Deal several actions to address PFAS[10]. One is to ban all PFAS as a group, allowing their use only where they are essential for society. A ban in the form of a universal restriction of the production,

[8] PFOS EQS set in EQSD Annex 1: **annual average** $6.5 \cdot 10^{-4}$ µg/L (inland surface water), $1.3\ 10^{-4}$ µg/L (other surface water), **maximum allowable concentration**: 36 µg/L (inland surface water), 7.2 µg/L (other surface water), **biota** 9.1 µg/kg wet weight

[9] CCS, section 2.2.1. Protect consumers, vulnerable groups and workers from the most harmful chemicals (p. 10). https://eur-lex.europa.eu/resource.html?uri=cellar:f815479a-0f01-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF

[10] CCS, section 2.2.3. Towards zero chemical pollution in the environment (p. 14) https://eur-lex.europa.eu/resource.html?uri=cellar:f815479a-0f01-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF

use and placing on the market of all PFAS was proposed by five EU member states. The dossier[11] outlining the details of their proposal was published in spring 2023. The Risk Assessment Committee (RAC) and the Socio-Economic Analysis Committee (SEAC) started to assess this proposal in June 2023. Their opinions are expected to be published in 2025. The Commission will then take the opinions into account and decide if it sees a necessity for a restriction and if so, it will propose a restriction that will be voted on by the EU Member States in the REACH Committee and scrutinised by the European Parliament and Council before adoption into law. Once agreed, the list of restrictions (Annex XVII to the REACH Regulation) will be amended to include PFAS. In the best case, altogether the restriction process will take at least another two years. However, this is quite improbable as the Commission usually delays during years the publication of its draft decision and the discussions with Member States.[12]

2 PFAS thresholds and guidelines

2.1 Guidelines on PFAS exposure

Knowledge on the health impacts of PFAS exposure is evolving and guideline values have been continuously become more stringent in the past decades. The guidelines by the EFSA on PFAS exposure have been revised down several orders of magnitude over the past 15 years, as more scientific evidence on the dangers of PFAS exposure has been known (see Figure 3).

In 2018, EFSA updated the daily exposure limit (from 2008) of 150 ng/kg bodyweight per day for PFOS and 1.500 ng/kg bw per day for PFOA respectively, with a Tolerably Weekly Intake (TWI) of 13 ng/kg bw per week for PFOS and 6 ng/kg bw per week for PFOA in 2018.13 In its opinion, EFSA also noted that "a considerable part of the population exceeds the proposed TWIs" for the two compounds. The TWI is the maximum amount a person may be exposed to without health effects are expected.

In July 2020, EFSA again adopted a new safety threshold for PFAS, this time for a group of four PFAS that accumulate in the body (PFOA, PFOS, PFNA and PFHxS).[14] The threshold of the TWI set to **4.4 ng per kilogram of body weight** and follows EFSA's guidance for assessing combined exposure to multiple chemicals.

[11] ECHA (2023) Submitted restrictions under consideration - Per- and polyfluoroalkyl substances (PFAS) https://echa.europa.eu/restrictions-under-consideration/-/substance-rev/72301/term

[12] EEB, (2022), Need for Speed – Why it takes the EU a decade to control harmful chemicals and how to secure more rapid protections, https://eeb.org/need-for-speed-on-chemical-protections-in-europe/

[13] EFSA, (2018), Risk to human health related to the presence of perfluorooctane sulfonic acid and perfluorooctanoic acid in food

[14] EFSA, (2020), Risk to human health related to the presence of perfluoroalkyl substances in food

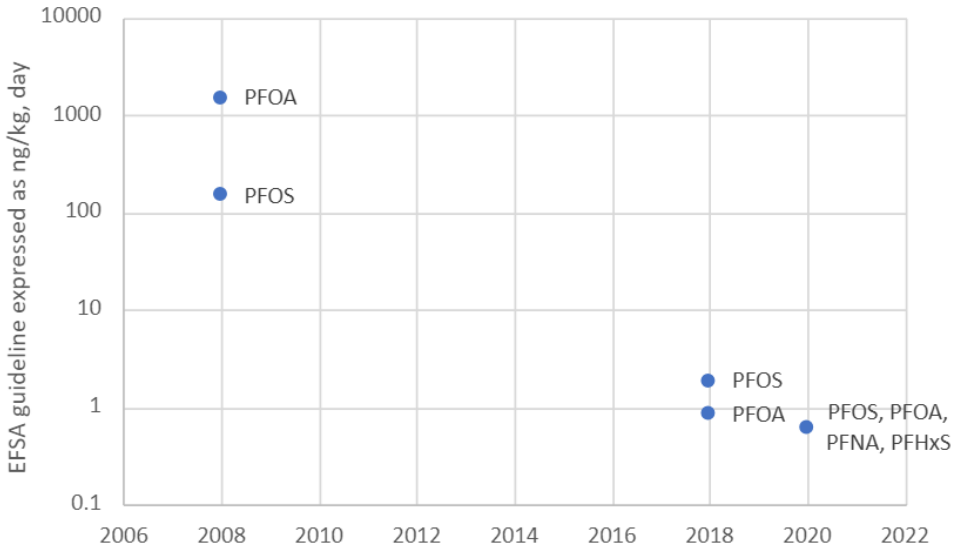

Figure 3 *EFSA guidelines on PFAS exposure have been revised down several orders of magnitude over the past 15 years*

Limiting PFAS pollution in natural waters have multiple benefits

Humans are exposed to PFAS via different pathways, but food and drinks represent the main one.

While limiting PFAS in natural waters (surface and groundwater) decreases the need for treatment to provide drinking water, it also limits the exposure of wildlife to PFAS. Not only does this benefit biodiversity, it also safeguards fish as a food product.

PFAS contamination is already considerable in many rivers. Consuming just 16 g of fish meat from the downstream section of the Elbe is sufficient to meet the tolerable weekly intake of PFAS-4.

Source: Semerád et al., (2022), The driving factors of per- and polyfluorinated alkyl substance (PFAS) accumulation in selected fish species: The influence of position in river continuum, fish feed composition, and pollutant properties DOI: 10.1016/j.scitotenv.2021.151662

In the US, drinking water guidelines for PFOA and PFOS have also decreased by several orders of magnitude since the early 2000s[15]. In 2016, the US Environmental Protection Agency (US EPA) issued non-regulatory lifetime drinking water **'Health Advisories'** of 70 ng/L for the individual and total concentrations of PFOA and PFOS. These updated the previous provisional short-term Health Advisories of 400 ng/L (PFOA) and 200 ng/L (PFOS) from 2009. In May 2020, nine US states concluded that the federal guidelines were not sufficiently protective and developed more stringent drinking water guidelines. In addition, 10 states have developed guidelines for other PFAS.

In March 2023, the US EPA proposed a National Primary Drinking Water Regulation that would establish **legally enforceable thresholds** for six PFAS: PFOA and PFOS as individual substances and

[15] Post, Environmental Toxicology and Chemistry, Vol 40, Issue 3, pp. 1–14, 2020, DOI: 10.1002/etc.4863

PFHxS, PFNA, PFBS, and HFPO-DA (commonly referred to as GenX Chemicals) as a group.[16] The proposed Maximum Contaminant Levels are **4 ng/L** for PFOA and PFOS individually. The GenX chemicals would have to be monitored individually and their weighed concentrations (based on toxicity) should not exceed a Hazard Index of 1.[17] The US EPA also proposes a non-enforceable advisory level of zero for both PFAS and PFOA.

While both the EU and the US are tightening advisories on PFAS based on concerns for human health, the **World Health Organisation** instead chose to focus on minimizing treatment costs when proposing new revised guidelines for PFAS in drinking water. The draft WHO 2022 document on revised Guidelines for Drinking-water Quality[18], proposes to limit PFOS and PFOA to **100 ng/L** individually, which disregards findings of health risk studies and has sparked concern among scientists[19].

2.2 National European PFAS thresholds for drinking water

The EFSA opinion was not considered for the setting of PFAS thresholds in the recast Drinking Water Directive. However, some EU countries, when transposing the new EU drinking water rules, have based their national drinking water thresholds on the EFSA opinion and set stricter thresholds than those mandated by EU law.

[16] US EPA, website (last updated June 6, 2023) Proposed PFAS National Primary Drinking Water Regulation
[17] See EPA explainer of the Hazard Index https://www.epa.gov/system/files/documents/2023-03/How%20do%20I%20calculate%20the%20Hazard%20Index._3.14.23.pdf
[18] WHO, (2022), PFOS and PFOA in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality
[19] Letter from 116 scientists (November 2022) The World Health Organization Should Significantly Revise or Withdraw Its Draft PFAS Drinking Water Guidelines https://greensciencepolicy.org/docs/General/pfas-scientists-letter-to-who-20221110.pdf

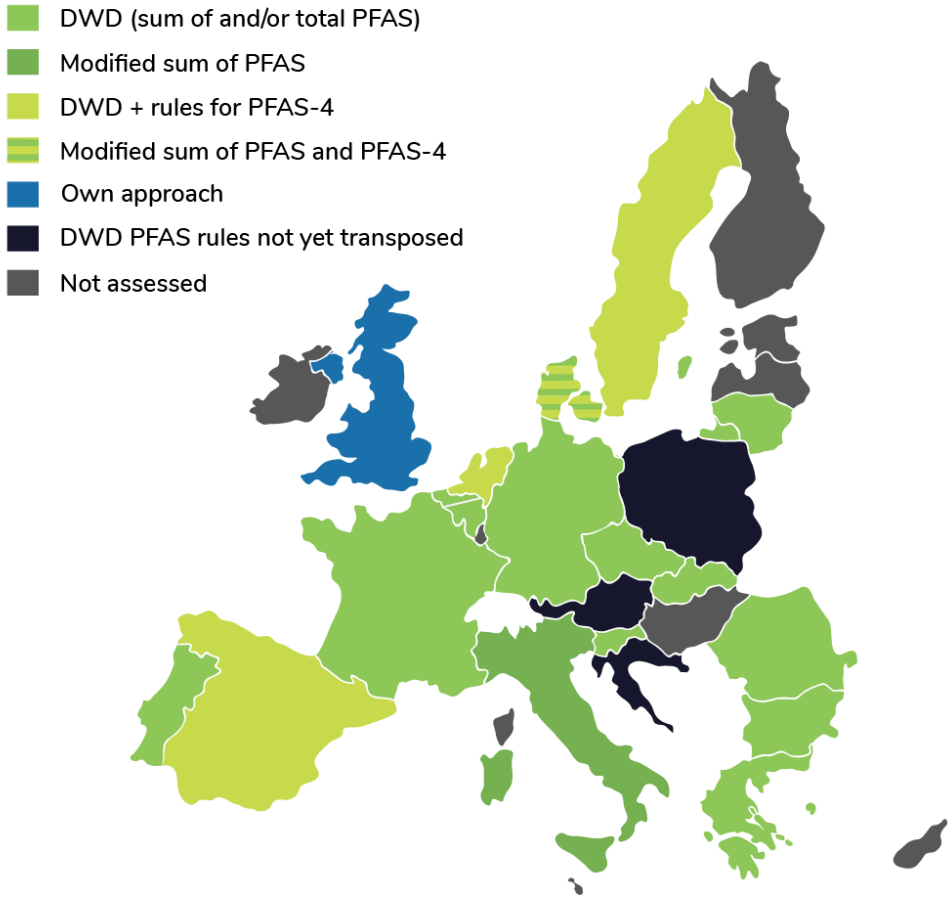

Figure 4 *Different approaches to setting PFAS thresholds in national drinking water law across Europe*

Out of the 19 Member States assessed, most have followed the Drinking Water Directive guidelines, and set in law provision that restrict 'PFAS total' and 'sum of PFAS' from 2026. Some of these countries, however, have chosen to include more PFAS substances in the 'sum of PFAS' parameter than the 20 mandated by EU law. This includes **Denmark** that have included 22 substances and **Italy** that have included 24, both with a sum threshold of 100 ng/L.[20]

Some countries or administrative regions have additionally issued specific thresholds or guideline values for the four PFAS covered by the EFSA opinion (PFAS-4). This includes **Flanders** (Belgium),

National thresholds and guideline values for the PFAS-4 following the EFSA opinion

1. Denmark: 2 ng/L
2. Flanders and Sweden: 4 ng/L
3. The Netherlands: 4.4 ng/L (PFOA equivalents)
4. Germany: 20 ng/L[2]
5. Spain: 70 ng/L[3]

2) Only comes into force in 2028

3) Per individual PFAS-4, until 2026

See also EWG (2022) Flawed WHO report on 'forever chemicals' fails human health, EWG scientists find

[20] In addition to the 20 PFAS mandated by the DWD, **Denmark** has added 6:2 FTS and PFOSA, while **Italy** has included 6:2 FTS, HFPO-DA (Gen X), DONA / ADONA and C6O4.

Denmark, Germany, Spain and **Sweden**. However, the approaches differ both regarding concentration limit, timeline and whether the PFAS-4 are regulated as individual substances or as a group. The national limits for the group of PFAS-4 vary from 2 ng/L (Denmark) to 20 ng/L (Germany), while Spain has set an interim threshold of 70 ng/L for the individual substances of PFAS-4 until 2026. The German group threshold for PFAS-4 will only enter into force in 2028.

The Dutch the National Institute for Public Health and the Environment (RIVM) has issued a guidance recommendation of 4.4 ng/L for PFAS in drinking water.[21] This is expressed as PFOA equivalents, meaning that the toxicity of each type of PFAS is compared to that of PFOA (similar to how concentration of different greenhouse gasses is expressed as CO_2 equivalents). For example, PFOS is assigned a Relative Potency Factor of 2, meaning it is twice as potent as PFOA. This is to account for the fact that PFAS contamination rarely occur as result of one single substance, but typically involve several PFAS substances.

Finally, some countries still seem not to have transposed the EU PFAS thresholds for drinking water into national law. This includes **Austria, Croatia,** and **Poland**.

The **UK** requires monitoring of 47 PFAS in raw water sources that are used for the abstraction of drinking water. There is no statutory standard, but a guidance from the Drinking Water Inspectorate, updated in July 2022 includes a tiered approach to action based on the concentration detected with aim to reduce concentrations below **100 ng/L** per individual substance in the water supplied to consumers.[22]

2.3 What is a safe drinking water threshold?

The EFSA guidance value sets a limit to the total weekly intake of four PFAS via food and drink. It is therefore not straightforward to translate the EFSA guideline to a drinking water concentration as it depends on how large the exposure is via other food and drink sources. The exposure also depends on body weight and drinking water intake.

As an example, the Dutch RIVM derived the threshold value of **4.4 ng/L** for PFAS-4 by assuming a standard adult body weight of 70 kg and a daily water intake of 2 litres, while limiting PFAS exposure via drinking water to 20% of total intake.[23] This could be considered a conservative estimate.

Denmark instead based their threshold (**2 ng/L**) for PFAS-4 to be sufficiently protective for a more vulnerable group, 1-year olds, in order to avoid negative effects on their immune systems. The Danish National Food Institute remark that the EFSA exposure assessment showed that the Danish population – across all age groups – exceed the tolerable weekly limit of PFAS via food consumption, which leaves little room for exposure via drinking water.[24] Therefore, the intake of PFAS via drinking water was limited to 10% of total PFAS intake in the derivation of the Danish threshold.

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[21] RIWA, (2021), Analyse bijdrage drinkwater en voedsel aan blootstelling EFSA-4 PFAS in Nederland en advies drinkwaterrichtwaarde

[22] UK Drinking Water Inspectorate, (2022), Risk assessments under regulation 27 and associated reports under regulation 28 of the Water Supply (Water Quality) Regulations 2016 (2018 in Wales) for Poly and Perfluorinated Alkyl Substances (PFAS)

[23] RIVM, (2021), Analyse bijdrage drinkwater en voedsel aan blootstelling EFSA-4 PFAS in Nederland en advies drinkwaterrichtwaarde https://www.rivm.nl/sites/default/files/2021-06/Advies%20drw%204-PFAS%20DEF%20beveiligd.pdf

[24] Vinggaard, A. M., & Olesen, P. T., (2021). Sundhedsmæssige konsekvenser af at indtage PFOS kontamineret drikkevand, No. DTU DOC nr.: 21/1035548

Similarly, an intervention value can be derived defined as the maximum concentration that would be equivalent of consuming the tolerable weekly intake of PFAS-4 via drinking water only. Based on the assumption of adult body weight and drinking water intake, this would be **22 ng/L**.

As the EFSA TWI guidance sets a threshold for intake via food and drink, an integrated approach is needed in order to understand and limit the combined total exposure via food and drink.

With background in the fact that people in the Netherlands are exposed to above the EFSA threshold for PFAS via food and drink,[25] the Dutch RIVM has issued revised guidelines for PFAS in surface water, as a complement to the new guidelines for PFAS in drinking water in order to limit PFAS intake via fish consumption. The risk limits in surface water are considerably lower than current water quality standards for these PFAS and are set to: 0.3 ng/L for PFOA, 0.007 ng/L for PFOS, and 10 ng/L for HFPO-DA (GenX).[26] This is around 100 times lower than the existing annual average threshold for PFOS mandated by the WFD and 5 million times lower than the maximum allowable concentration.[27]

It should be kept in mind that the EFSA guidance, and the resulting national thresholds and guidelines, only refers to a small sub-set of the full group of PFAS substances and do not account for the effects for other PFAS. Additionally, people are exposed to PFAS not only via intake of food and drinks, but also via other exposure routes, such as dust. PFAS in food-contact materials can also further increase the exposure via food and drinks.

However, it is clear that the existing thresholds in the Drinking Water Directive, as well as in the proposed WHO standards can falsely lead authorities to conclude that monitored PFAS concentrations do not need to trigger action. In **Czechia** for example, a survey of 28 PFAS[28] was conducted in 2021 across 180 drinking water supply systems across the country.[29] The results were within the limits of the DWD, which led the authorities to conclude that no additional treatment of drinking water was needed. However, in some regions, including Prague, the Moravian-Silesian and the Zlín regions, the median concentration was close to or above 4.4 ng/L which would represent a conservative translation of the EFSA guideline, and some of the maximum concentrations were above 22 ng/L meaning that adults would exceed the TWI just via drinking water consumption only.

3 Remediation, treatment and liabilities

3.1 Scale of the problem

PFAS is already basically everywhere, in furthest corners away from anthropogenic activities to our own blood.

Coherent monitoring of PFAS in EU drinking water will only start in 2024 when the provisions of the Drinking Water Directive kick in. EFSA food exposure assessment, including drinking water, however, showed that exposure from food and drink is 'concerning' for the adolescent, adult and elderly

[25] RIVM (2021)

[26] RIVM (2022) Risk limits for PFAS in surface water. Derivation of surface water concentration limits based on EFSAs healthbased limit value (in Dutch with English synopsis) https://www.rivm.nl/publicaties/risicogrenzen-voor-pfas-in-oppervlaktewater-doorvertaling-van-gezondheidskundige

[27] See footnote 8

[28] The 20 PFAS from DWD, **except** PFDoDA and PFDoDS and **additionally** HFPO-DA (Gen X), PFDoA, PFHxDA, PFODA, PFTeDA, PFTeA, PFDoS, 6:2 Cl-PFESA; 9ClPF3ONS, NaDONA, 8:2 Cl-PFESA; 11ClPF3OUdS, PFPrS

[29] The Water Supply and Sewerage Association of the Czech Republic (SOVAK ČR), website Per- a polyfluorované alkylové sloučeniny (PFAS) v pitné vodě (data retrieved 2023-08-11)

population – and even more severe for children and infants across the EU – even when looking only at the exposure to four of the thousands of PFAS substances on the market.

A recent study from **the Netherlands** revealed that the PFAS concentration exceeded the thresholds for drinking water advised by RIVM in over half of cases where the water is sourced from surface water as well as in 1 of 10 measurements in drinking water from groundwater.[30]

Due to its mobile properties, PFAS is not sufficiently removed by regular **water treatment,** as common removal techniques, such as activated carbon and/or ozonation, do not work well on highly polar compounds.[31] Treatment methods such as reverse osmosis or nanofiltration are needed to capture such polar substances, but this is both costly and requires large amounts of energy and not only remove contamination but also minerals from the water, which means the water must be re-mineralised before it can serve as drinking water. The European association for the water sector, EurEau, estimates that reverse osmosis treatment would raise the price of water treatment by more than 0.5-1 €/m^3, resulting in circa 200 €/year additional cost for the average household.[32] Additionally, reverse osmosis, active carbon and nanofiltration do not destroy the removed chemicals, but the waste created has to be treated separately.

Sweden: Drinking water of 2 million people exceed EFSA recommendation for PFAS intake

In Sweden, at least 2 million people have been supplied water that surpass 10 ng/L and 200,000 people have such high PFAS levels in the drinking water that they exceed the EFSA guidance only by their daily need for water.

Removing this would cost around 1 billion SEK per year (roughly 100 million euros yearly). This is however much lower than the societal cost of PFAS exposure, calculated to be around 10-17 billion SEK per year.

Source: Svenska Naturskyddsföreningen (2022) *Minst 2 miljoner svenskar har för mycket PFAS i dricksvattnet*

In the Veneto region, after it was revealed in 2013 that close to 130,000 people were exposed to PFAS via their drinking water, the local water supplier spent close to €3,000,000 to remediate the most contaminated sites primarily linked to the industrial emissions of a PFAS-producing chemical plant in the area and planned to spend another €21,200,000 to remediate remaining contaminated water sources.[33]

Even if the treatment cost to reduce PFAS contamination of drinking water are large, they must be compared to the societal costs of PFAS exposure. The Nordic Council of Ministers estimates the annual **health-related costs** related to PFAS to be €52 – 84 billion for all EEA countries.[34]

On top of this comes the cost for **remediation of contaminated sites**. An example from the ECHA committees' opinion on PFOA includes information on costs related to pollution in groundwater caused

[30] RIVM, (2022), PFAS levels in drinking water from river water need to be brought down
[31] EurEau, (2019), Briefing Note: Moving Forward on PMT and vPvM Substances
[32] EurEau, (2019)
[33] EurEau, (2020). PFAS and drinking water: With case studies reported by EurEau members
[34] Nordic Council of Ministers, (2019), The cost of inaction: A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS

by a plant in the EU that formerly produced PFOA.[35] Discharges from the plant led to a "continuous and severe pollution" of the groundwater in an area wider than 150 km^2 resulting in an average concentration of 360 ng/L, and the maximum concentrations in many sites being above 1000 ng/L. The cost of removal of PFOA was estimated to be more than €10 million with remediation time estimated to be in the order of decades.

The total cost for drinking and wastewater treatment to remove PFAS has been estimated to be as high as €238 billion per year in the EU.[36]

3.2 Who is responsible for the pollution and who will pay?

The treatment, remediation and health costs related to PFAS pollution will likely reach the tens, or even hundreds, of billions of euros annually and the question inevitably arises about who will foot the bill. Despite the Polluter Pays Principle being one of the key principles underlying the EU's environmental policy and enshrined in the EU treaties, the cost of pollution is still largely falling on the taxpayers.[37] In the case of water pollution, this can come via an increase of the water bill or through public money when the cost is covered by the State.

At the same time, the water sector is heavily underinvested. The OECD estimates that all Member States except Germany will need to increase annual expenditure for water supply and sanitation by more than 25% to comply with the provision of current EU drinking water and urban wastewater rules.[38] New requirements, related to the recast Drinking Water Directive and the upcoming revised Urban Wastewater Treatment Directive will increase the investment need even further. While drinking water largely is affordable[39] in Europe today, there is a limit to how much the water bill can increase to keep this situation.

Liabilities

A recent investigation by the Swedish NGO ChemSec showed that only 12 companies are responsible for the production of most PFAS chemicals worldwide and globally. The societal costs of PFAS are astronomical (estimated to €16 trillion annually) and widely exceeds the industry's annual profit margin (revenues from production estimated to €26 billion annually and the industry's profits only $4 billion[40] Currently, the liability risks are rarely reflected by the companies if the polluter pays principle would be enforced at source, the production of PFAS would no longer be economically viable. However, for such cases to be successful, stronger environmental liability laws and stricter permitting rules that address the manufacturer directly are needed.

[35] ECHA RAC and SEAC, (2014), Opinion on an Annex XV dossier proposing restrictions on Perfluorooctanoic acid (PFOA), its salts and PFOA-related substances
[36] Arp, Hans Peter H. (2022, May 18). Towards reducing pollution of PMT/vPvM substances to protect water resources. SETAC Europe 32'nd Annual Meeting (SETACCopenhagen), Copenhagen, Denmark. Zenodo. https://doi.org/10.5281/zenodo.6566861
[37] European Court of Auditors, (2021), Special Report 12/2021: The Polluter Pays Principle: Inconsistent application across EU environmental policies and actions https://www.eca.europa.eu/en/publications?did=58811
[38] OECD, (2020), Financing Water Supply, Sanitation and Flood Protection: Challenges in EU Member States and Policy Options
[39] defined (by the OECD) as households not spending more than 3-5% of their disposable income on water and sanitation
[40] ChemSec, (2023). The top 12 PFAS producers in the world and the staggering societal costs of PFAS pollution

There are 20 PFAS manufacturing facilities in Europe[41] and additionally, emissions resulting from the use of PFAS-containing products (such as fire-fighting foams) and end-of-life handling of PFAS-containing goods. Some of these emissions are 'permitted emissions', i.e. allowed under an operating permit. Currently the Environmental Liability Directive (ELD) exempts most of the damages caused to the environment through such permits (Article 8(4)). As the 'permitted pollution' in many cases is far larger than accidental pollution, most of the environmental damage is in effect exempted. This in the end transfers the cost of damage onto the bearer, taxpayers and wider society.

Some major chemicals **companies** start acknowledging partially their contribution by settling deals. The chemicals company 3M faces a large number of lawsuits over PFAS contamination, yet it did not admit liability when reaching the settlement of $10.3bn with a host of US public water systems. The money is supposed to be used to test public water systems for PFAS and to filter PFAS from drinking water.[42]

In light of the enormous costs associated to the production and use of PFAS, it is unreasonable to continue to produce and emit the substances that are behind these costs. Yet, in 2020, the estimated production volumes of PFAS manufacture in the EU was between 120,000 and 400,000 tonnes per year. The estimates for total use and placing on the market of PFAS as substance on their own, in mixtures or articles (excl. manufacture) even lie between 690,000 and 990,000 tonnes per year, thus almost 1 million tonnes, with a growing trend.[43]

Upcoming opportunities

The recast Drinking Water Directive does not provide any **tools for recovering costs** for PFAS treatment from producers. While the WFD provides economic instruments to implement the polluter pays principle, including cost recovery, these have been insufficiently used.[44]

Some legal avenues to increase the contribution from the private sector to the cost for water treatment are opening up.

The European Commission has proposed, as part of the revision of the Urban Wastewater Treatment Directive, the setting up of an **Extended Producer Responsibility** scheme that would require producers and importers to cover the cost to remove harmful substances from wastewater. This would as a start cover the human pharmaceuticals and the cosmetics sectors but could be extended to cover the producers (and users) of PFAS.

A similar approach has been proposed by the Environmental Committee in the European Parliament – and adopted by the full Parliament - to cover the cost of monitoring of substances of emerging concern in surface and groundwater, as part of the update of priority substances and groundwater pollutants.[45]

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[41] https://foreverpollution.eu/, 2023

[42] The Guardian (2023): 3M pays $10.3bn to settle water pollution suit over 'forever chemicals'. https://www.theguardian.com/environment/2023/jun/22/3m-settlement-municipal-water-systems-pfas-contamination (10/08/2023)

[43] ECHA (2023): ANNEX XV RESTRICTION REPORT – Per- and polyfluoroalkyl substances (PFASs)

[44] European Commission, (2019), Staff work document: Report on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) - Second River Basin Management Plans

[45] European Parliament, (12 Sept 2023) Protection of groundwater against pollution and environmental quality standards in the field of water policy https://oeil.secure.europarl.europa.eu/oeil/popups/summary.do?id=1757244&t=e&l=en

Restriction decisions include derogations for uses where the Commission considers that a ban is not proportionate. If the **universal PFAS restriction** that is now being assessed by ECHA Committees includes any derogations, they should include mandatory measures for the companies benefiting from the continued production and use of PFAS. Measures should include strict operational conditions and risk management measures that minimize emissions, as well as strict monitoring and reporting of emissions. A fee on the emissions should also be established to cover at least part of the health and environmental costs related to the derogated uses.]

4 Conclusions

Following the publication of the EFSA's guidelines for TWI of PFAS-4, several Member States have issued national regulations or guideline values for PFAS-4. However, the different considerations regarding which population group (e.g. adults or infants) and how large a share of total PFAS-4 intake can be accepted to come via drinking water consumption has rendered national thresholds of PFAS-4 between 2 and 70 ng/L for the countries assessed in this briefing. This has resulted in a legal patchwork that leaves the EU population inconsistently protected towards PFAS consumption via drinking water.

Despite the awareness of the dangers of PFAS, with guidelines continuously revised down and the already staggering societal cost for PFAS pollution is staggering. The cost is building up as more PFAS is continuously put on the market. Today, EU rules and regulations do not sufficiently reflect the polluter pays principle, which leaves the bill to taxpayers. It is therefore urgent that PFAS production and use is banned as soon as possible and by 2030 the latest.

Recommendations

Urgent and ambitious actions are needed to protect people and the environment considering the multiple planetary crisis humanity is currently facing, including the exceedance of the chemical pollution planetary boundary:

1. **European Commission: A**ll PFAS should be phased out in consumer products by 2025 and PFAS production and all other uses should be phased out by 2030. To achieve this a wide scope restriction under REACH, that includes not only all PFAS (also polymeric PFAS) but also all uses (including active substances in pesticide, biocide, medicinal or veterinary products) should be adopted;
2. **European Commission:** Revise the PFAS threshold in the Drinking Water Directive based on the latest scientific findings;
3. **Council and European Parliament:** Adopt strict PFAS environmental quality standards for surface and groundwater to improve monitoring across the EU and help direct mitigations efforts;
4. **European Commission and Member States:** Ensure that the polluter pays principle is implemented by requiring polluters to cover remediation, treatment and monitoring costs related to PFAS pollution.

5 Annex

Annex 1 – National PFAS thresholds and guidelines for drinking water

Standards and guidance values for PFAS in drinking water (the substances in the 'sum of' parameters are listed in Annex 2)

		PFAS Concentration (µg/L)						
				DWD requirements		National sum parameters		
Location	Last year updated	PFOA	PFOS	Total PFAS[1]	Sum of 20 PFAS[2]	Sum of xxx	Sum of PFAS-4	Reference
European Union	2021			0,5	0,1			a
Austria	2023			/	/	/	/	b
BE-Flanders	2023			0,5	0,1		0,004	c
BE- Wallonia	2023			0,5	0,1			d
Bulgaria	2023			0,5	0,1			e
Croatia				/	/	/	/	-
Czechia[3]	2023				0,1			f
Denmark	2023					0,1[4]	0,002	g
France	2022			0,5	0,1			h
Germany	2023				0,1		0,02	i
Greece	2023			0,5	0,1			j
Italy	2023			0,5		0,1[5]		k
IT - Veneto	2017	≤ 0,009 (of which PFOS ≤ 0,003)				0,3[6]		l
Lithuania	2023			0,5	0,1			m
Netherlands	2021				0,1		0,0044	n
Poland	2017			/	/	/	/	o
Portugal	2023			0,5	0,1			p
Romania	2023			0,5	0,1			q
Slovakia	2023			0,5	0,1			r
Slovenia	2023			0,5	0,1			s
Spain	2023				0,1		0,07	t
Sweden	2023			0,5	0,1		0,004	u
UK	2022[7]	0,01	0,01					v
	2022[7]	<0,1	<0,1					v
	2022[7]	>0,1	>0,1					v

Footnotes

1) **'PFAS Total' means the totality of per- and polyfluoroalkyl substances. This parametric value will only apply once technical guidelines for monitoring this parameter are developed in accordance with DWD Article 13(7). Member States may then decide to use either one or both of the parameters 'PFAS Total' or 'Sum of PFAS'.**
2) **'Sum of PFAS' refers to the sum of 20 PFAS considered a concern as regards water intended for human consumption This is a subset of 'PFAS Total' substances that contain a perfluoroalkyl moiety with three or more carbons (i.e. –CnF2n–, n ≥ 3) or a perfluoro alkylether moiety with two or more carbons (i.e. –CnF2nOCmF2m–, n and m ≥ 1).**
3) **The sum value refers to 20 substances but a previous monitoring has been done for 28 PFAS: PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUdA, PFDoA, PFTrDA, PFTeDA, PFHxDA, PFODA, PFPrS , PFBS, PFPeS, PFHxS, PFHpS, Sum of PFOS , PFNS, PFDS, PFUnDS, PFDoS, PFTrDS, HFPO-DA, NaDONA , 9Cl-PF3ONS, 11Cl-PF3OUdS**
4) **Applies to the individual results as well as the sum concentration for 22 PFAS**
5) **The sum value refers to 24 PFAS**
6) **The sum value refers to the sum of 10 PFAS**
7) **The individual tiered values applies to 47 substances, including PFOS and PFOA**

Legal references

a) **EU: 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)**
b) **Austria: *Verordnung des Bundesministers für soziale Sicherheit und Generationen über die Qualität von Wasser für den menschlichen Gebrauch* (Ordinance of the Federal Minister for Social Security and Generations on the Quality of Water for Human Consumption)** https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20001483
c) **BE-Flanders: VR 2023 2001 DOC.0045/3 Bijlage I Parameters en parameterwaarden (a), aandacht voor stoffen en richtwaarde (b)** https://beslissingenvlaamseregering.vlaanderen.be/document-view/63C65DA517E4B551F4BD066E
d) **BE-Wallonia: *Arrêté du Gouvernement wallon modifiant diverses dispositions en ce qui concerne la qualité de l'eau destinée à la consommation humaine* (Order of the Walloon Government amending various provisions concerning the quality of water intended for human consumption)** https://wallex.wallonie.be/files/pdfs/20/90563_Arr%C3%AAt%C3%A9_du_Gouvernement_wallon_modifiant_diverses_dispositions_en_ce_qui_concerne_la_qualit%C3%A9_de_l'eau_destin%C3%A9e_%C3%A0_la_consommation_humaine_12-01-2023-.pdf
e) **Bulgaria: *НАРЕДБА № 9 ОТ 16 МАРТ 2001 Г. ЗА КАЧЕСТВОТО НА ВОДАТА, ПРЕДНАЗНАЧЕНА ЗА ПИТЕЙНО-БИТОВИ ЦЕЛИ* (Ordinance No 9 of 16 March 2001 on the quality of water intended for drinking and domestic purposes) amended 2023** https://lex.bg/laws/ldoc/-549175806
f) **Czechia, Vyhláška č. 256/2023 Sb., kterou se mění vyhláška č. 428/2001 Sb., kterou se provádí zákon č. 274/2001 Sb., o vodovodech a kanalizacích pro veřejnou potřebu a o změně některých zákonů (zákon o vodovodech a kanalizacích), ve znění pozdějších předpisů** https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=NIM:202305059
g) **Denmark: *Bekendtgørelse om vandkvalitet og tilsyn med vandforsyningsanlæg, BEK nr 1023 af 29/06/2023* (Decree on water quality and supervision of water supply facilities)** https://www.retsinformation.dk/eli/lta/2023/1023
h) **France: *Arrêté du 30 décembre 2022 modifiant l'arrêté du 11 janvier 2007 relatif aux limites et références de qualité des eaux brutes et des eaux destinées à la consommation humaine***

mentionnées aux articles R. 1321-2, R. 1321-3, R. 1321-7 et R. 1321-38 du code de la santé publique. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000046849403

i) **Germany: *Zweite Verordnung zur Novellierung der Trinkwasserverordnung BGBl. 2023 I Nr. 159.* (Second Act amending the Water Management Act). Publication date: 11/01/2023.** https://www.recht.bund.de/bgbl/1/2023/159/VO.html

j) **Greece: Δ1(Δ)/ΓΠ/ΟΙΚ.27829/23 ΚΥΑ (ΦΕΚ3525Β/23) Ποιότητα νερού ανθρώπινης κατανάλωσης σε συμμόρφωση προς τις διατάξεις της Οδηγίας (ΕΕ) 2020/2184 του Ευρωπαϊκού Κοινοβουλίου και του Συμβουλίου της 16ης Δεκεμβρίου 2020 (L435/1, 23.12.2020)** https://eur-lex.europa.eu/legal-content/EL/TXT/PDF/?uri=CELEX:72020L2184GRC_202302993

k) **Italy: Decreto legislativo 23 febbraio 2023, n. 18. Attuazione della direttiva (UE) 2020/2184 del Parlamento europeo e del Consiglio, del 16 dicembre 2020, concernente la qualità delle acque destinate al consumo umano. Publication date: 06/03/2023.** https://www.gazzettaufficiale.it/eli/gu/2023/03/06/55/sg/pdf

l) **Italy – Veneto: Gazzetta ufficiale della repubblica Italiana, Regional decision, DRG 1590/2017**

m) **Lithuania: įsakymas dėl lietuvos higienos normos hn 24:2023 „geriamojo vandens saugos ir kokybės reikalavimai“ patvirtinimo (Hygiene norm HN 24:2023 "Requirements for the safety and quality of drinking water")** https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.216309/asr

n) **The Netherlands: Besluit van 8 november 2022 tot wijziging van het Drinkwaterbesluit, het Besluit kwaliteit leefomgeving en enkele andere algemene maatregelen van bestuur in verband met de omzetting van EU-Drinkwaterrichtlijn 2020/2184 (herschikking)** https://zoek.officielebekendmakingen.nl/stb-2022-450.html **and RIVM (2021)** https://www.rivm.nl/sites/default/files/2021-06/Advies%20drw%204-PFAS%20DEF%20beveiligd.pdf

o) **Poland: Rozporządzenie Ministra Zdrowia z dnia 7 grudnia 2017 r. w sprawie jakości wody przeznaczonej do spożycia przez ludzi (Regulation of the Minister of Health of December 7, 2017 on the quality of water intended for human consumption)** https://eli.gov.pl/eli/DU/2017/2294/ogl

p) **Portugal: Decreto-Lei n.º 69/2023, de 21 de Agosto Estabelece o regime jurídico da qualidade da água destinada ao consumo humano, transpondo diversas diretivas (DECREE LAW No. 69/2023)** https://data.dre.pt/eli/dec-lei/69/2023/08/21/p/dre/pt/html

q) **Romania: Ordonanta 7/2023 privind calitatea apei destinate consumului uman (Government Ordinance No 7/2023 on the quality of water intended for human consumption). Publication date: 25/01/2023.** https://legislatie.just.ro/Public/DetaliiDocument/264337

r) **Slovakia: Vyhláška Ministerstva zdravotníctva Slovenskej republiky č. 91/2023 Z. z., ktorou sa ustanovujú ukazovatele a limitné hodnoty kvality pitnej vody a kvality teplej vody, postup pri monitorovaní pitnej vody, manažment rizík systému zásobovania pitnou vodou a manažment rizík domových rozvodných systémov (Decree of the Ministry of Health of the Slovak Republic No 91/2023 laying down indicators and limit values for the quality of drinking water and hot water quality, the procedure for monitoring drinking water, the risk management of the drinking water supply system and the risk management of domestic distribution systems - Annex no. 1 to decree no. 91/2023)** https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2023/91/20230401, https://www.slov-lex.sk/pravne-predpisy/prilohy/SK/ZZ/2023/91/20230401_5519623-2.pdf

s) **Slovenia: Uredba o pitni void (Drinking water regulation)** http://www.pisrs.si/Pis.web/pregledPredpisa?sop=2023-01-1848**, monitoring of PFOA and PFOS mandated since 2019 via the Program monitoringa pitne vode 2019** http://mpv.si/assets/docs/mpv/program/mpv-program-2019.pdf

t) **Spain: Real Decreto 3/2023, de 10 de enero, por el que se establecen los criterios técnico-sanitarios de la calidad del agua de consumo, su control y suministro, BOE-A-2023-628 (Royal Decree 3/2023, of January 10, which establishes the technical-sanitary criteria for the quality of drinking water, its control and supply)** https://www.boe.es/buscar/doc.php?id=BOE-A-2023-628

u) **Sweden: Livsmedelsverkets författningssamling LIVSFS 2022:12 Livsmedelsverkets föreskrifter om**

dricksvatten (The National Food Agency's regulations on drinking water) https://www.livsmedelsverket.se/globalassets/om-oss/lagstiftning/dricksvatten---naturl-mineralv---kallv/livsfs-2022-12_web_t.pdf

v) **United Kingdom: Risk assessments under regulation 27 and associated reports under regulation 28 of the Water Supply (Water Quality) Regulations 2016 (2018 in Wales) for Poly and Perfluorinated Alkyl Substances (PFAS)** https://dwi-content.s3.eu-west-2.amazonaws.com/wp-content/uploads/2023/01/13123351/IL_03-2022_PFAS_Guidance-4-1.pdf

Annex 2 – Overview of the PFAS listed for EU and national 'sum of PFAS' parameters

	Proposed EU-EQSD and GWD	EU - DWD	DK	IT	IT Ven	UK
Number of substances	24	20	22	24	12	47
Substances in 'sum of PFAS' parameter						
PFBA	x	x	x	x	x	x
PFPeA	x	x	x	x	x	x
PFHxA	x	x	x	x	x	x
PFHpA	x	x	x	x	x	x
PFNA	x	x	x	x	x	x
PFBS	x	x	x	x	x	x
PFHxS	x	x	x	x	x	x
PFOA	x	x	x	x	x	x
PFOS	x	x	x	x	x	x
PFDA	x	x	x	x	x	x
PFTrDA; PFTriA	x	x	x	x		x
PFPeS	x	x	x	x		x
PFHpS	x	x	x	x		x
PFNS		x	x	x		x
PFDS	x	x	x	x		x
PFUnDS		x	x	x		x
PFUnDA	x	x	x	x	x	
PFTrDS		x	x	x		
PFDoDA	x	x	x	x	x	
PFDoDS		x	x	x		
6:2 FTS			x	x		x
PFOSA			x			
HFPO-DA (Gen X)	x			x		x
DONA; ADONA	x			x		x
C6O4	x			x		
PFDoA						x
PFUnA; PFUdA						x
PFHxDA	x					x
PFODA	x					x

PFTeDA, PFTeA	x					x
6:2 FTOH	x					
8:2 FTOH	x					
PFDoS						x
6:2 Cl-PFESA; 9ClPF3ONS						x
8:2 Cl-PFESA; 11ClPF3OUdS						x
HFPO-TA						x
3:3 FTCA						x
5:3 FTCA						x
7:3 FTCA						x
PFEESA						x
4:2 FTSA; 4:2 FTS						x
8:2 FTSA; 8:2 FTS						x
FBSA						x
FHxSA						x
FOSA						x
MeFOSA; N-MeFOSA						x
EtFOSA; N-EtFOSA						x
MeFOSE						x
EtFOSE						x
NMeFOSAA; MeFOSAA						x
NEtFOSAA; EtFOSAA						x
PFecHS						x
PFMOPrA						x
NFDHA						x
PFMOBA						x

Annex 3 – EFSA exposure data for PFAS-4 from different food and beverage categories in EU countries

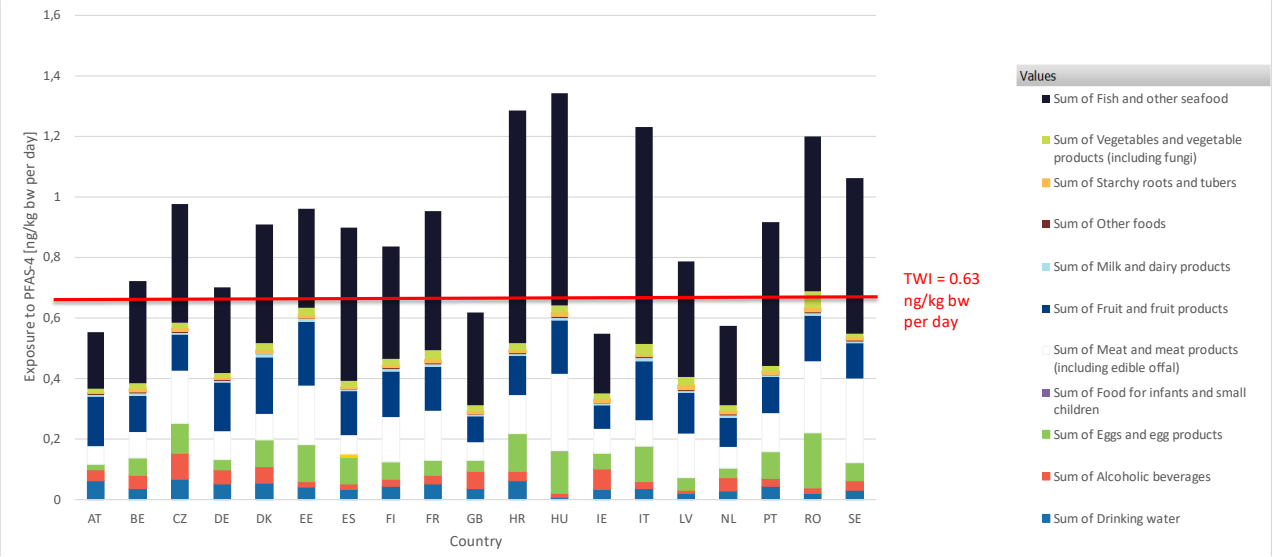

Figure 3 *Mean exposure of* ***adults*** *to PFAS-4 from different food and beverage categories in EU countries compared to the TWI recommended by EFSA*

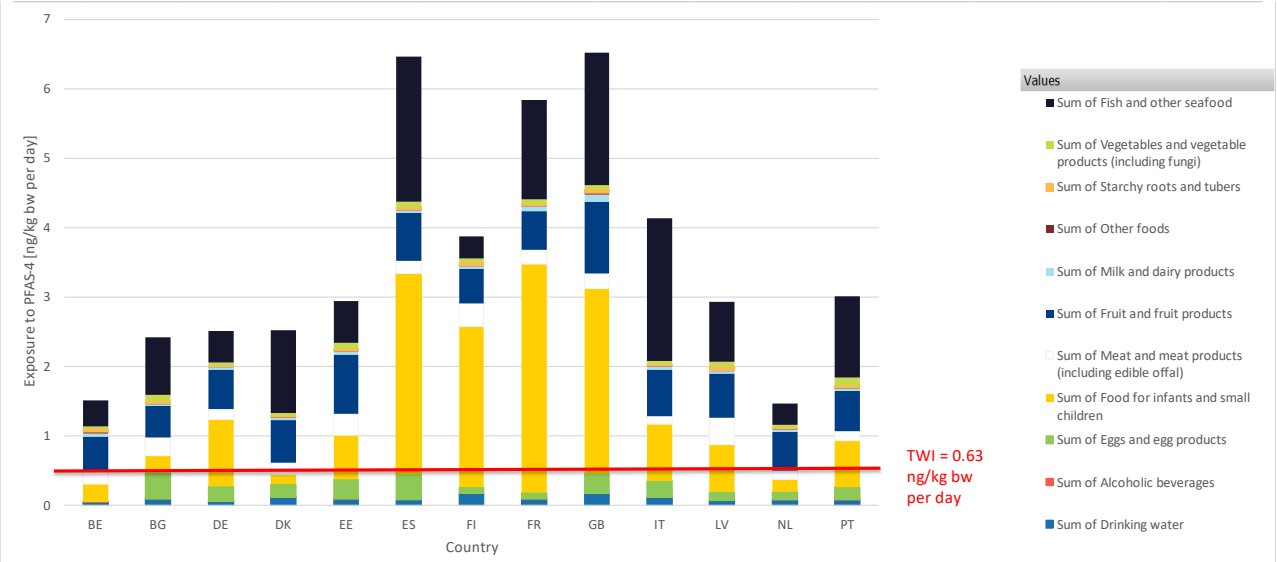

Figure 4 *Mean exposure of* ***toddlers*** *to PFAS-4 from different food and beverage categories in EU countries compared to the TWI recommended by EFSA*