18 September 2023

EurEau

Universal PFAS restriction - Consultation on Annex XV report

Additional EurEau comments

1 Water sector - main victim of ubiquitous PFAS presence

Numerous point sources (production sites, landfill sites, fire drill sites etc.) and diffuse pollution (households, air deposition) have led to a quasi-ubiquitous presence of PFASs in surface water and groundwater bodies. We may also find them in drinking water above European or national regulatory thresholds applicable now or in the near future.

Due to the persistence of PFAS, this contamination will continue to build up in the environment, including in the water cycle. Groundwater and surface water bodies and their sediments will remain contaminated for many decades.

While the PFAS industry claims there would be no Green Deal without these substances, the contrary holds true for the water sector: There is no Green Deal for the drinking water and wastewater sector as long as the use of these substances is not ended. Removing (and possibly destroying) PFAS is resource intensive (fast saturation of activated carbon, a fossil material often imported from China), energy intensive (about 0.05 kWh per m3 of wastewater treated). It generates extra waste streams (disposal of brine from reverse osmosis), requires additional (scarce) water resources (reverse osmosis) and jeopardises the closing of nutrient and material cycles (use of sewage sludge as fertiliser and source of soil carbon) as well as the reuse of treated wastewater.

Depending on the level of contamination, the chain-length of PFASs and the target values, extra drinking water and wastewater treatment costs (including staff costs and analytical costs) can be very substantial.

2 Setting the right priorities

EurEau supports the full and prompt ban of all PFAS uses. We call on ECHA to set the maximum allowable PFAS content in mixtures and articles on the basis of regulatory thresholds to protect public health and the environment.

The key question to be answered is therefore the following:

Given the intrinsic properties of PFASs, are the proposed thresholds of 25 ppb (25 µg/kg) for any PFASs and 250 ppb (250 µg/kg) for sum of PFASs low enough to guarantee compliance with the following regulatory thresholds in the long-term? Are the impacts from intermediates and waste flows taken into account?

- **4.4 ng/L (PFOA eq) for the sum of 24 PFAS for surface water and groundwater bodies**[1]
- **500 ng/L for PFAS total and 100 ng/L for the sum of 20 PFAS for drinking water**[2]
- **2 ng/L for the 4 EFSA PFAS for drinking water (additional Danish parametric value for drinking water quality)**

In this context, it would not be enough to look solely at future emissions but we must take into account what has already been emitted to our surface and groundwater bodies and soils. This historic pollution will not go away. On the contrary, each drop of rain water increases contamination levels. Each ocean wave[3] and even sea wind[4] lead to the deposit of PFAS on our lands.

3 Polluter pays principle must be respected

We call on ECHA to implement the polluter-pays principle as stipulated in the TFEU (article 191.2), the Water Framework Directive 2000/60/EC (article 9), the Zero Pollution Action Plan and the Chemicals Strategy for Sustainability. The Court of Auditors Special Report 12/2021 "The Polluter Pays Principle: Inconsistent application across EU environmental policies and actions" further highlights the need to hold the polluters liable for the damage they cause. The Council conclusions regarding this European Court of Auditors' report ('European Court of Auditors' Special Report No 12/2021 entitled "The Polluter Pays Principle: Inconsistent application across EU environmental policies and actions" - Council conclusions (2021)') call for the application of this principle in all Union policies and "underlines the necessity to assess the scope for strengthening the integration of the Polluter Pays Principle with respect to diffuse water pollution from all sources…"

Internalising the environmental and health-related costs of PFAS use will increase the competitiveness of alternative solutions and, thus, trigger innovation. The water consumer should not pay for the PFAS pollution.

[1] Proposal for a directive amending Directive 2000/60/EC establishing a framework for Community action in the field of water policy, Directive 2006/118/EC on the protection of groundwater against pollution and deterioration and Directive 2008/105/EC on environmental quality standards in the field of water policy (COM(2022) 540 final)
[2] Directive 2020/2184 on the quality of water intended for human consumption (DWD)
[3] 2021 - Sha_Sea Spray Aerosol as a Source of Perfluoroalkyl Acids to the Atmosphere_Field Evidence from Long Term Air Monitoring EST
[4] 2023_- VITO_PFAS in sea water and seafoam

As a matter of example, Chemours, DuPont, 3M and Corteva must pay US$11.5 billion to resolve claims that the chemical manufacturers contaminated drinking water across the United States[5].

4 Benefits of a PFAS ban

There are wide societal benefits of the prompt PFAS phase-out, in particular related to avoided environmental and health risks. For the water sector that EurEau represents, the benefits of a PFAS ban can be determined based on avoided drinking water and wastewater treatment costs, and avoided costs for introducing alternative sewage sludge management routes.

To this point however, we do not have Europe-wide data sets on the occurrence of PFAS in drinking water resources, in wastewater or in sludge. Some regional data are available but cannot be extrapolated to all countries.

Furthermore, many data sets cover only a limited number of PFASs. The full extent of PFAS pollution is therefore not known today. Research shows that samples contain up to 85% of "dark matter", unidentified organic fluorine (UOF), possibly comprising overlooked PFASs.

The available data confirm that the financial impacts of PFAS contamination on water services, and hence the benefits of a PFAS ban, are very substantial for the sector and, hence, for the water consumers.

As stated in the Restriction Dossier, the total societal costs of PFAS use (human health risks and environmental risks), outnumber the benefits of their use by far. According to a recent Chemsec publication, the costs of PFAS use are 1000 times higher than the related benefits[6].

The following chapters outline the costs and environmental impacts that could be (largely) avoided if the universal PFAS ban was implemented quickly.

Note 1: Apart from some isolated cases, the costs of PFAS removal from drinking water and wastewater can only be estimated/calculated today. The real extent of PFAS pollution still needs to be determined and existing technologies may not be able to remove short-chain PFASs. No viable technologies exist today to remove PFAS from wastewater. Furthermore, PFAS destruction costs are not considered.

Note 2: Most of the cost data do not take into account the latest price hikes for raw materials (such as activated carbon), energy and staff costs. The costs in today's euros are likely to be higher.

[5] https://www.nytimes.com/2023/06/22/business/3m-settlement-forever-chemicals-lawsuit.html

[6] https://chemsec.org/chemsec-identifies-the-top-12-pfas-producers-in-the-world-and-reveals-shocking-societal-costs/#:~:text=Key%20findings%20from%20ChemSec's%20investigation%3A&text=The%20global%20societal%20costs%20%E2%80%93%20remediation,%E2%82%AC18%20734%20per%20kilogram

Contamination of drinking water resources:

PFAS are ubiquitous in surface water bodies. In the absence of point sources, groundwater is usually less polluted, but PFAS (and in particular short-chain molecules) can be found, too. This is particularly worrying, as aquifers will take far more time to eliminate this contamination and drinking water suppliers using groundwater usually do not have the treatment technologies in place to remove PFAS.

Point sources can cause extremely high pollution levels. As a matter of example, a large-scale PFAS pollution was discovered in the Veneto Region of Italy in 2013. The highest combined concentration levels of PFAS[7] found in groundwater samples amounted to 60,000 ng/L and those found in the drinking water distribution system reached 1,214 ng/L.

None of the technologies used for PFAS removal (activated carbon, reverse osmosis, ion exchange (lab scale only)) is sustainable today.

According to our information, the **DWD parametric values** (500 ng/L for PFAS total and 100 ng/L for the sum of 20 PFAS) will be achieved by the overwhelming majority of drinking water operators without additional treatment steps.

For example, according to data from the Czech State Institute of Public Health covering 180 water distribution networks (2021 data), the concentration of the sum of 28 PFAS is mostly below 4 ng/L with a maximum of less than 12 ng/L. The average content of PFAS total in drinking water was 2.4 ng/l, the median 0.8 ng/l. A total of 14 samples (8%) contained PFAS amounts in the order of tens of ng/l. The maximum value of PFAS total determined in this representative amount of samples was 24 ng/l, i.e. about a quarter of the limit value for PFAS-20. Among the substances identified with the highest frequency were PFBA, PFPeA, PFHxA, PFOA and PFOS.

Data from Flanders confirm that in none of the supply areas, PFAS-20 concentrations exceed 100 ng/L today. However, 39 out of 75 supply areas measured an average concentration for PFAS-20 greater than 5.0 ng/l [8].

The share increases significantly, when the EFSA recommendations for **PFAS-4** are translated into water quality requirements as shown by measurements in the Netherlands[9] and Germany[10]. As a result of PFAS pollution, about 40% of all drinking water in the Netherlands (supplied to about 7,000,000 citizens) exceeds the RIVM drinking water advisory level of 4.4 ng PFOA equivalents/l.

As the DWD parametric values will only have to be complied with from 2026 onwards, and Member States are setting different additional thresholds for the 'EFSA PFAS-4', no EU-wide datasets are available today.

Additional reading: [Briefing note on drinking water and PFAS]

[7] PFBA, PFBS, PFDA, PFDoDA, PFHpA, PFHxA, PFHxS, PFNA, PFPeA and PFUnDA

[8] Perfluorverbindingen in drinkwater 2021 — Vlaamse Milieumaatschappij (vmm.be)

[9] PFAS in Nederlands drinkwater vergeleken met de nieuwe Europese Drinkwaterrichtlijn en relatie met gezondheidskundige grenswaarde van EFSA, RIVM-briefrapport 2022-0149

[10] Impact Assessment of the Proposed PFAS Limit Value on the German Drinking Water Supply, DVGW Forschung (2021)

a) PFAS limit values as defined in the DWD (PFAS total: 500 ng/l, Sum of 20 PFAS: 100 ng/l)

(e) = estimated

	WTW capacity (m^3/h) or WTW/people affected	PFAS concentration in raw water (Sum of 20 PFAS) (ng/L)	Extra treatment cost (€ or €/m^3)	Other costs (€)	Extra energy use (kWh/m^3)
Germany					
Country (BDEW, DVGW: Treatment of PFAS - theoretical cost estimate for possible PFAS limits in the new Drinking Water Ordinance (2021 data))	83,000,000 inhabitants	0.3% of the raw water volume above Sum of 20 PFAS >100 ng/l (16 million m^3)	Annual costs for activated carbon: € 1.74 million Total extra treatment cost (extra treatment cost + other cost/affected raw water volume): 0.23 €/m^3	Additional annual costs (e): Staff: € 0.32 million Analytical costs: € 0.48 million Depreciation: € 1.12 million	
Greece					
WTW 1 (Thessaloniki)	Capacity: 6,250	=<20 ng PFAS-20/L	0	0	0
Spain					
Country (AEAS data)	No exceedance known		0	0	0
Sweden					
Country (Svenskt Vatten data)	Probably less than 5 WTW	Sum of 20 PFAS >100 ng/l	CAPEX (e): €5,000,000 (depreciation over 15 years, 2% interest rate)		

b) Possible PFAS limit value for the 4 EFSA PFASs for drinking water: 20 ng/L

(e) = estimated

	WTW capacity (m^3/h) or WTW/people affected	**PFAS concentration in raw water (Sum of 20 PFAS) (ng/L)**	**Extra treatment cost (€/m^3)**	**Other costs (€)**	**Extra energy use (kWh/m^3)**
Germany					
Country (BDEW, DVGW: Treatment of PFAS - theoretical cost estimate for possible PFAS limits in the new Drinking Water Ordinance (2021 data))	83,000,000 inhabitants	0.9% of the raw water volume above 20 ng/L for the EFSA-4 PFAS (48.2 million m^3)	Annual costs for activated carbon: € 5.2 million Total extra treatment cost (extra treatment cost + other cost/affected raw water volume): 0.23 €/m^3	Additional annual costs (e): Staff: € 0.96 million Analytical costs: € 1.45 million Depreciation: € 3.37 million	

c) National PFAS limit value (Sweden) derived from the 4 EFSA PFASs for drinking water: 4 ng/L

	WTW capacity (m^3/h) or WTW/people affected	PFAS concentration in raw water (4 EFSA PFAS) (ng/L)	Extra treatment cost (€/m3)	Other costs (€)	Extra energy use (kWh/m^3)
Greece					
WTW 1 (Thessaloniki)	Capacity: 6,250	<10 ng/L (Lab quantification limit)	No known	No known	No known
Netherlands					
Vewin / RIVM data (https://pubs.acs.org/doi/epdf/10.1021/acs.est.2c06015)	Surface water (Rhine / Meuse) as a source for drinking water delivered to 7,000,000 consumers	Around 30 ng/L			
Spain					
Country (AEAS data)	13.9% people supplied (Extrapolation of data from a survey on various supply systems, which supply 17 million inhabitants)	PFAS-4: >4.0 ng/L	0.081 €/m3 Assumption: Breakthrough after 20,000 BV. (EBCT=10') Price for regGAC: 950€/m3 No CAPEX as WTW affected already use GAC filtration		

Sweden					
Country (Svenskt Vatten data)	About 75 WTW affected serving about 4.5m people	PFAS-4: >4.0 ng/L	Sum of CAPEX+OPEX = 0.3 €/m3 Assumption: CAPEX for 75 WTW: €563,000,000 (depreciation 15 years) Interest rate: 2% OPEX: 0.18 €/m3		

c) National PFAS limit value (Denmark) derived from the 4 EFSA PFASs for drinking water: 2 ng/L

	WTW capacity (m^3/h) or WTW/people affected	**PFAS concentration in raw water (4 EFSA PFAS) (ng/L)**	**Extra treatment cost (€/m3)**	**Other costs (€)**	**Extra energy use (kWh/m^3)**
Germany					
Country (BDEW, DVGW: Treatment of PFAS - theoretical cost estimate for possible PFAS limits in the new Drinking Water Ordinance (2021 data))	83,000,000 inhabitants	20% of the raw water volume above 2.2 ng/L for the EFSA-4 PFAS (1.071 million m^3)	Annual costs for activated carbon: € 115.68 million (technical feasibility not given) Total extra treatment cost (extra treatment cost + other cost/affected raw water volume): 0.23 €/m^3	Additional annual costs (e): Staff: € 21.42 million Analytical costs: € 32.13 million Depreciation: € 74.98 million	
WTW 1	10,000 inhabitants	20-40 ng PFAS-4/L (dominated by	GAC: 0.28 – 0. 36 (e)		0,04 (e) (assumption:

		PFOS+PFHxS)	(assumption: adsorber breakthrough after 10,000 – 15,000 bed volumes (BV)) or Ion exchange: 0.20 – 0.27 (e) (assumption: adsorber breakthrough after 50,000 – 75,000 BV)		additional pump height of 10 m)
Greece					
WTW 1 (Thessaloniki)	Capacity: 6,250	<10 ng/L (Lab quantification Limit)	No known	No known	No known
Netherlands					
Vewin / RIVM data (https://pubs.acs.org/doi/epdf/10.1021/acs.est.2c06015)	Ground water as a source for drinking water supplied to 10,500,000 consumers	Around 2 ng/l			
Spain					
Country (AEAS data)	37.2% of people supplied	PFAS-4 >2,0 ng/L	0.095 €/m3 Assumption: Breakthrough after 10,000 BV. (EBCT=10') Price for regGAC: 950€/m3 No CAPEX as WTW affected already use GAC filtration OPEX: Current		

			regeneration GAC: 0.014 €/m3 after 70,000 BV		

d) Other PFAS limit values set by national authorities (Italy): PFOA + PFOS<= 90 ng/l (PFOS<= 30 ng/l), sum of other PFAS <= 300ng/l (PFBA, PFPeA, PFBS, PFHxA, PFHpA, PFHxS, PFNA, PFDeA, PFUnA, PFDoA) – case studies

	WTW capacity (m^3/h) or WTW/people affected	**PFAS concentration in raw water (4 EFSA PFAS) (ng/L)**	**Extra treatment cost (€/m3)**	**Other costs (€)**	**Extra energy use (kWh/m^3)**
Italy					
Veneto region WTW1 (Utilitalia data)			Extra cost for activated carbon: 0.062	Cost for development of new drinking water pipeline € 2,572,500 Costs relating to two different supply points managed by the same operator € 18,400,000	
		If target zone below the limit of quantification is applied:	Extra cost for activated carbon: 0.002	Cost for development of new drinking water pipeline € 2,572,500 Cost for the medium-, long-term non-availability of the clean resource water: €36,994,000	
Veneto region WTW2			Extra cost for activated carbon: 0.137	Cost for development of new drinking water	

(Utilitalia data)		If target zone below the limit of quantification is applied:	Extra cost for activated carbon: 0.0013	pipeline: € 127,000 Cost for development of new drinking water pipeline: € 427,190€ Cost for the medium-, long-term non-availability of the clean resource water: € 18,000,000	

Contamination of wastewater:

PFAS arrive in wastewater through diffuse sources (background contamination from households or atmospheric deposition) and point sources or hot spots (landfill sites, production/transformation plants, fire drill sites). Data on PFAS in wastewater is scarce, limited to a few countries and covering a limited number of substances.

A monitoring campaign in eight Dutch wastewater treatment plants (WWTP)[11] concluded that PFAS and their precursors are found in all plant influents. As currently applied technologies are only able to remove a small part of them, most of them are released into the aquatic environment. What is more, wastewater treatment processes seem to transform precursors into persistent PFAS so that the PFAS concentration in the WWTP effluent can be higher than that of the influent.

This is confirmed by data from Flanders (Belgium)[12] where 139 samples were taken from 58 WWTPs, mostly in 2021. Influent concentrations amounted to 140 – 286 ng/L while effluent concentrations reached 41 – 1516 ng/L (PFAS Total covering 36 compounds). Another measurement campaign is ongoing with results expected in October 2023. Flanders plans to require purification to the lowest level possible, i.e. below the reporting limit for quantitatively measurable PFAS components (20 ng/L or 50 ng/L depending on the component) when this becomes technologically feasible.

Today, WWTPs do not have to comply with specific PFAS-related thresholds. The draft revised Urban Waste Water Treatment Directive (UWWTD)[13] is however likely to change this through the reference to Directive 2000/60/EC (the Water Framework Directive – WFD) in the risk assessment of WWTP. Probably depending on national requirements, additional treatment steps might have to be implemented to mitigate identified risks.

The WFD and its daughter directives 2006/118/EC (the Groundwater Directive – GWD) and 2008/105/EC (the Environmental Quality Standards Directive - EQSD) are also in revision. They are likely to set an environmental standard of 4.4 ng/L (PFOA equivalents) for both surface and groundwater bodies. Based on the few data at our disposal, we can expect many WWTP to release higher PFAS concentrations through their effluent.

However, there is currently no technology available that can effectively remove PFAS from wastewater. Even quaternary treatment with highly effective granulated activated carbon (GAC) filters will mainly remove some of the long-chained PFAS and to a much less extent the short-chained compounds. Most promising when dealing with short chain PFAS, but very costly, might be a combination of activated carbon with ion exchange.

Additional reading: Briefing note on wastewater and PFAS

[11] https://www.stowa.nl/publicaties/pfas-influent-effluent-and-sewage-sludge-results-monitoring-campaign-eight-wwtps
[12] Aquafin: The fate of PFAS throughout the WWTP process – Update (Research report KB210151
[13] Proposal for a directive concerning urban wastewater treatment (recast), COM(2022) 541 final

PFAS EQS as proposed by the JRC and not included in the draft EQSD: 0.5 µg/L for PFAS total

	UWWTP	PFAS concentration in the effluent (ng/L)	Extra treatment cost (€/m3)	Other costs (€)	Extra energy use (kWh/m³)
Sweden					
Country (Svenskt Vaten data) (e)	Assumption: 50% of the yearly wastewater flow would need to be treated.	EQS for PFOS to be achieved: 0.65 ng/L (may be more difficult to manage than 500 ng/L for PFAS total	Estimation based on granulated activated carbon (GAC) use for the reduction of diclofenac in UWWTP (approx. 30,000 bed volumes) and the adsorption capacity for PFOA (1/2) and PFHxA (1/4). GAC use would increase twice to remove PFOA and four times to remove PFHxA. Additional OPEX for PFAS: 0.2–0.4 €/m3 (e). Additional CAPEX: 0.02-0.04€/m3 Total additional cost: 0.22-0.44 €/m3 for 50% of the yearly wastewater flow: €100,000,000-200,000,000 / year (e)		

PFOS EQS as set in the current EQSD: 0.65 ng/L

	UWWTP	PFAS concentration in the effluent (ng/L)	Extra treatment cost (€/m3)	Other costs (€)	Extra energy use (kWh/m³)
Ireland and United Kingdom					
Two countries UKWIR data[14] (modelling)	Assumption: All WwTW wherein the effluent is estimated to contribute to at least 10% of the downstream PFOS EQS have additional treatment implemented		Rapid gravity filter followed by GAS treatment: Net Present Value of the investment is estimated at £21 billion	Management/disposal of an additional 150,000 tonnes of sludge. There would also be over 600,000 tonnes of GAC to dispose of and replace each year.	Operational CO2-eq emissions are 210,000 tonnes/year

Flemish PFAS target values pending technological feasibility: 20 ng/L or 50 ng/L depending on the component)

Note: *Current commercially available target analysis includes a limited number of compounds. Furthermore, a distinction is made between quantitative (20 ng/L) and indicative (50 ng/L) PFAS compounds related to matrix effects which are observed during sample preparation. Screening analyses, like for example adsorbable organic fluorine (AOF) or total oxidizable precursor (TOP) assay result in limits of quantification in the range of micrograms per liter instead of nanograms per liter. Carrying out these analyses does not always result in useful information as most of these results are below the reporting limit.*

Recently, the Toxicological Centre (University of Antwerp) conducted a suspect screening in collaboration with Aquafin. This analysis provides evidence of the presence of PFAS compounds in the wastewater which are not included in the target analysis. In both influent and effluent samples, this observation was confirmed. Even in samples which resulted in a PFAS total concentration of 0 ng/L (target analysis), individual PFAS compounds were semi-quantified up to 290 ng/L. Consequently, it is stated that current target analysis only indicates the so-called "tip of the iceberg". By further exploring non-target PFAS analyses, urban wastewater could be used as an indicator regarding upcoming regulatory perspectives concerning the restricted production and application of PFAS.

[14] UKWIR, PFAS and Wastewater – Prevalence, Reduction Options and Costs, Report Ref. No. 22/WW/14/2 (2022)

	UWWTP	PFAS concentration in the effluent (ng/L)	Extra treatment cost (€/m3)	Other costs (€)	Extra energy use (kWh/m³)
Belgium					
Flanders (Aquafin data, mostly 2021) (e)	58 UWWTP	Current effluent concentrations from 41 – 1,516 ng/L (PFAS Total covering 36 compounds)	0.2-0.4 €/m3 (e) for activated carbon. Due to insufficient removal, a combination with ion exchange seems necessary et the combined cost of 0.3-1.0 €/m3 (e) Estimation: about 1/3 of WWTP would have to install extra treatment amounting to costs of €50,000,000 to €800,000,000/year (excl. analytical cost).	€134/sample (analytical costs)	0.05 kWh/m3

PFAS EQS as proposed in the draft EQSD: 4.4 ng/L for 24 PFAS (PFOA equivalents)

	UWWTP	PFAS concentration in the effluent (ng/L)	Extra treatment cost (€/m3)	Other costs (€)	Extra energy use (kWh/m³)
Sweden					
Country (Svenskt Vaten data) (e)	Assumption: 50% of the yearly wastewater flow would need to be treated.	The proposed EQS for PFAS-24 (4.4 ng/L in PFOA equivalents) is as low or even below the PFAS concentrations in	If at all possible, at least twice the cost compared to the estimation on the impact of the JRC-proposed value.		

		rain water in remote areas and are therefore extremely difficult to comply with without extra treatment	OPEX and CAPEX: 0.4-1 €/m3 for 75% of the yearly wastewater flow: appr. €300,000,000-700,000,000/year		

Contamination of sewage sludge:

The benefit of a PFAS ban for sewage sludge management lies in the avoidance of heavy investments for the development of new and more expensive sludge management routes. Indirectly, agriculture can benefit from closed phosphorous, nitrogen and carbon cycles avoiding fertilisers from mineral sources. This benefit is however difficult to quantify even though there are some examples of calculations of the monetary value for farmers. In southern Sweden, the monetary value of farmers applying sludge on agricultural land, was in 2018 estimated to be €50-60 per hectare and year or €60-70 per tonnes of dry matter sludge per year.

PFASs seriously jeopardise nutrient and material recovery from wastewater and sewage sludge. Although today's WWTPs only remove a minor part of PFASs from wastewater, STOWA expects some 2.6 to 41% of (in particular long-chain) PFAS to be transferred to the sludge phase, resulting in 10 and 100 µg PFAS/kg dry matter (DM) and amounting to 15 – 45 kg PFAS/year in the Netherlands[15]. Flemish test series quantified the PFAS total concentration in sewage sludge at 10 to 265 µg PFAS/kg DM (n = 37 samples, 37 WWTPs)[16]. A Danish study found between 3.6 and 19.5 µg/kg DM for the sum of 4 PFAS and from 5.3 and 23.7 µg/kg DM for the sum of 22 PFAS.

If **sludge is applied on farmland** in order to increase its phosphorus, nitrogen and carbon content, a certain quantity of PFAS will therefore be transferred to the soil.

The Commission is expected to revise the Sewage Sludge Directive (around 2025) and set PFAS thresholds for sludge-to-farmland applications. Some European countries (regions) are already setting such limit values:

- Belgium (Flanders temporary framework): 8 µg/kg dry matter (DM)
- Denmark: Sum of 4 (PFOA, PFNA, PFOS, PFHxS): 10µg/kg DM; Sum of PFAS 22: 400µg/kg DM
- Norway (planned): Sum of PFOS and PFOA: 40 ug/kg DM

Today, about 56% of sewage sludge is used in agriculture or for land reclamation[17]. According to the Flemish data quoted above, none of the Flemish sewage sludge would be compliant and sludge to farmland applications would not be possible.

Another popular (and growing) sludge management route **is mono-incineration with phosphorous recovery** from the ashes (27%[18] of total sludge production). This happens at temperatures of 750 to 850°C with the exposure time limited to a few seconds. There is no consistent data today on the fate of different PFAS molecules

[15] https://www.stowa.nl/publicaties/pfas-influent-effluent-and-sewage-sludge-results-monitoring-campaign-eight-wwtps

[16] Aquafin: The fate of PFAS throughout the WWTP process – Update (Research report KB210151

[17] https://www.eureau.org/resources/publications/eureau-publications/5824-europe-s-water-in-figures-2021/file

[18] idem

in this process (degradation, combustion gases). Higher temperatures (up to 930°C) will be possible at certain new mono-incinerators. However, there might be trade-offs with other parameters as for example N_2O generation at higher temperatures.

European wastewater operators are spending billions of Euros in mono-incinerators with phosphorus recovery. They must have certainty that PFAS contamination does not put these investments in question.

We have no data on the fate of PFAS when sewage sludge is treated through pyrolysis in order to recover phosphorus from bio-char.

Additional reading: Briefing Note on Sludge and the Circular Economy – the Impact of PFAS

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Danish limit values for sewage sludge: Sum of 4 (PFOA, PFNA, PFOS, PFHxS): 10µg/kg DM; Sum of 22: 400µg/kg DM

	UWWTP	PFAS concentration in the effluent) (µg/kg dry matter)	Alternative sludge treatment cost (€/ton)	Other costs (€)
Sweden				
Country (Svenskt Vatten data) (e)	Assumption: 25-50% of the sludge applied on farmland or for land-scaping today has to be incinerated: 50,000-100,000 tons of sludge (DM) / year	Assumption: Compliance with Danish limit values	500€/ton sludge (DM) leading to additional to annual cost of €25,000,000 to €50,000,000	

(Future) Norwegian limit values for sewage sludge: Σ PFOS and PFOA: 40 ug/kg DM

	UWWTP	PFAS concentration in the effluent) (µg/kg dry matter)	Alternative sludge treatment cost (€/ton)	Other costs (€)
Sweden				
Country (Svesnkt Vatten data) (e)	Assumption: Less than 5% of the sludge applied on farmland or for land-scaping today has to be incinerated: Less than 5,000 tons of sludge (DM) / year	Assumption: Compliance with Norwegian limit values for PFOS and PFOA	500€/ton sludge (DM) leading to additional to annual cost of €2,500,000	

Belgium (Flanders temporary framework): 8 µg/kg dry matter (DM) for PFAS total

	UWWTP	PFAS concentration in the effluent) (µg/kg dry matter)	Alternative sludge treatment cost (€/ton)	Other costs (€)
Belgium				
Flanders (Aquafin data, mostly 2021) (e)	58 UWWTP	10 - 265 µg/kg	95,000 ton sludge / year Dewatering: 108 €/t Drying = 45 €/t Mono-incineration: 45 €/t (calculated)	

About EurEau

EurEau is the voice of Europe's water sector. We represent 70,000 drinking water and waste water operators from 32 countries in Europe, from both the private and the public sectors.

Our members are 37 national associations of water services. At EurEau, we bring national water professionals together to agree European water sector positions regarding the management of water quality, resource efficiency and access to water for Europe's citizens and businesses. The EurEau secretariat is based in Brussels.

EurEau