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# EEB comments on the revision of the lists of pollutants affecting surface and groundwater and the corresponding regulatory standards

## Summary

Europe's waters are under pressure from a wide range of chemicals resulting from use of human and animal pharmaceuticals, agriculture, fire suppression, energy production and industry. The EEA 2018 State of Water Report showed that only 38% of the EU surface water bodies are in good chemical status while the chemical status of 74 % of the groundwater was reported by the EU Member States as good.[1] However, there is a growing number of pressures and challenges such as pollutants of emerging concern.

The fitness check evaluation of the Water Framework Directive (WFD) and its daughter Directives on Environmental Quality Standards (WFD-EQSD) and Groundwater Directive (WFD-GD)) have concluded that they are broadly fit for purpose and the fact that the WFD's objectives have not been fully reached yet is largely due to insufficient funding, slow implementation and insufficient integration of environmental objectives in sectoral policies for the purpose of preventing pollution at the sources (e.g. IED, REACH, PPPR). Chemical pollution was specifically highlighted as one of the areas where significant improvement was needed, in particular mixture effects and pollutants of emerging concern.

Chemical status under the WFD is assessed against a list of individual substances or groups with associated quality standards (EQS). Some improvements in relation to the priority substances have been noted, for example the number of surface water bodies failing to meet standards for some metals (cadmium, lead and nickel) and some pesticides has decreased between the first and second river basin management cycles (EEA, 2018).

However, the WFD assessment of chemical status inevitably cover only a small proportion of the substances present in the environment and does not explicitly consider the combined effects of mixtures. The WFD, WFD-EQSD and WFD-GD[2] establish that the list of priority substances and Annex I and II of the GWD are reviewed every 6 years in order to account for new scientific evidence. While this new update provides an opportunity to add critical substances to the list, and align it with the recent recast Drinking Water Directive, it is also an opportunity to highlight application of the measurement techniques that provide measures of toxicity or harm (effect-based monitoring) to address chemical mixtures in the WFD implementation.

[1] European Environmental Agency (EEA), European waters: Assessment of status and pressures 2018 (EEA, 2018)
[2] WFD - Article 16(4) and 16(7) · WFD-EQSD- Article 8 · WFD-GD - Article 10

In addition, the purpose of the WFD is to protect and restore aquatic ecosystems that our society, economy, and wildlife depend on. As EEA puts it "The challenge presented by chemical mixtures highlights the need to fundamentally review which chemicals we use and how we use them". Regulating environmental quality standards in water will always be a step behind as long as harmful chemicals are put on the market or emitted by industry. Therefore the revision of the lists of water pollutants must be accompanied by a move towards substitution of manufacturing and avoiding the use of hazardous substances[3] in line with the Zero Pollution ambition of the Green Deal.

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# Intro

Freshwater systems are home to a wide range of species as well as our main source of drinking water, but they are under pressure from anthropogenic impact. The decades since 1970 have seen an 84% collapse in freshwater species populations due to habitat loss and pollution. Improving water quality is one of the six priorities for action to halt freshwater biodiversity loss defined by scientists and conservation organisations.[4]

In Europe, water pollution is still a key issue 20 years after the adoption of the Water Framework Directive. After the completion of the 2nd River Basin Management Plans, less than 40% of Europe's surface water bodies were in good chemical status. The number for groundwater bodies was higher (74%), but with some large regional differences. The 2016 reporting under WFD showed that almost 80% of groundwater area in Luxembourg, close to 50% of groundwater area in Czech Republic and 27% in Belgium are in poor status due to pesticides and biocides.[5]

The WFD, the EQSD and the GWD are the key pieces of legislation for the protection of water from harmful effects of chemicals. Good surface water chemical status under WFD is assessed against a

[3] In the broad meaning of the definition in the regulation on classification, labelling and packaging of substances and mixtures (EC 1272/2008) Art. 3, which guides the ZPAP and the EGD as well as most related European legislation. It is worth recalling that the WFD's (Art. 2 (29)) definition of the word 'hazardous' is somewhat narrower.
[4] Tickner *et al.*, BioScience **70**, 330–342 (2020), doi.org/10.1093/biosci/biaa002
[5] EEA, Pesticides in European rivers, lakes and groundwaters – Data assessment (EEA, 2020)



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ID number: 06798511314-27 ● BCE ID number: 0415.814.848 ● RPM Tribunal de l'entreprise francophone de Bruxelles

list of 45 substances that pose a significant risk to the aquatic environment across the EU (the Priority Substances). For groundwater, only nitrates and pesticides – including their relevant metabolites, degradation and reaction products – have EU-wide quality standards (GQS). This sub-set of substances only represents a fraction of the chemicals that are known to cause chemical pollution of water.

Member States are required to monitor the concentration of the Priority Substances and take measures to meet their associated Environmental Quality Standards, expressed as Annual Average, Maximum Allowable Concentration and/or concentration in biota. However, this substance-by-substance approach is not taking into account effects of chemical mixtures that can impact aquatic life at lower doses than individual substances. A 2014 study based on monitoring data from 4000 sites reported that 14% of European freshwater systems are at acute risk and 42% are at chronic risk from organic pollutants mixtures.[6]

This does not only pose a risk to aquatic life, it is also impacting drinking water sources. A survey by the French Ministry of Health showed that from 1994 and 2015, 8 627 wells for drinking water were abandoned, the most common reason being poor quality of the source, most commonly by nitrates and/or pesticides and the number of abandonments due to poor quality is not decreasing.[7] There is also a growing risk for antimicrobial resistance where hospital effluents, CSOs and possibly WWTP effluents as well as animal farming all select for multi-resistance.

Much more ambition is needed to protect aquatic and human health and to achieve the WFD requirements to restore Europe's water bodies to good status by 2027 at the latest. A recent NGO assessment of draft RBMPs showed that many member states are set to miss this legally binding target.[8] As an example, German NGOs are alarmed by the high loads of brominated diphenyl ethers and mercury in the Elbe and its tributaries that will make less than 1% of the rivers achieve good chemical status by 2027.

The WFD, WFD-EQSD and WFD-GD require the list of Priority Substances to be reviewed every six years. Last time the lists was updated was in 2013 for surface water and 2014 for groundwater. The current update is overdue as it was postponed due the fitness check evaluation of the EU water laws. This also means that the update currently being considered would only apply to the fourth river basin management cycle (2028-2032).

Since the last revision of the list of PS substances, there has been a recast of the **Drinking Water Directive** that saw the addition of e.g. PFAS and bisphenol A to the list of substances used to assess the quality of water intended for human consumption. The **Urban Wastewater Treatment Directive** is also currently being revised, thus it is important that threshold values are coherently set also for surface and groundwater. A review of source control legislation such as the **Industrial Emissions Directive**, and the **EU Chemicals Strategy for Sustainability** will provide further opportunities for tightened source control measures in line with the hierarchy of measures under the Zero Pollution Action Plan in water, air and soil. The lowest cost compliance and protective strategy is to avoid contamination of water in the first place, this is particularly necessary for substances that meet

[6] Malaj *et al*., PNAS **111**, 9549–9554 (2014) doi.org/10.1073/pnas.1321082111

[7] French Ministry of Health, *Abandons de captages utilisés pour la production d'eau destinée à la consommation humaine*, 2012, available here

[8] Living Rivers Europe (LRE), The final sprint for Europe's rivers, (2021)

persistent or bio-accumulative properties, requiring a ‘zero tolerance’ approach at the manufacturing stage.

Since the last revision of the list of substances the European Commission has also put forward the **Pharmaceutical Strategy** as well as **Biodiversity, Farm to Fork Strategies** and **Zero Pollution Action Plan** that aim to reduce the use of pesticides by 50% in the next decade, the sales of antimicrobials for farmed animals by 50%, and the use of fertilizers by 20%, by 2030. The lists of pollutants for surface and groundwater should be updated with the relevant substances as well as propose measures to reflect the effect of these strategies. This also requires an improved knowledge base as to the identification of new substances, moving from a narrow focus on ‘toxicity’ as the main criteria towards “a non-deterioration” approach that also considers properties like persistence and mobility.

# Surface water – policy options

*Addition of substances to the list of Priority Substances (and setting of corresponding EQS)*

Emissions data and research show that the aquatic environment wildlife and humans are exposed to a wide range of chemicals and the associated mixture effects. These pollutants originate from urban, industrial and agricultural activities, from point and diffuse sources, and include pollutants from storm waters, transport and atmospheric deposition. Due to a large number of substances present in our waters, a substance-by-substance approach to assess the risks and set quality standards is not sufficient. Both due to the mixture effects but also because sibling substances with similar properties are continuously put on the market. **Using effect-based methods (EBM) to determine the risk from pollutants and adding substances as a group** are ways to account for the combined effect of substances. However, EBMs should only be used to support substance-by-substance chemical methods. Especially because the analyte-by-analyte approach has a high degree of specificity in targeting specific contaminants and contaminant groups. The priority substance approach (single substances or groups of substances with similar Mode of Action [MoA]) also permits continuity of implementation and provides a basis for comparison.  It is therefore important to keep this approach to limit the concentration of substances that have been identified as causing harm to human health and the aquatic environment,

**Below EEB comments on the candidate substances considered listed in the expert survey:**

<u>**“Industrial chemicals”**</u>

**PFAS** are a large group of several thousand very persistent chemicals (so-called forever chemicals). The longer chain PFAS accumulate in the environment and in humans and were phased out years ago; shorter-chain alkylated substances and perfluorinated polyethers have replaced them and are under increased regulatory scrutiny, based on high persistence and mobility. An EU-level ban on all remaining PFAS is necessary.

The Commission is considering adding PFAS as a group of 22 substances, mostly environmental degradation products of historical and present pollutants. It is positive that GenX substitute for PFOA, is among the 22 substances considered to make up the “sum of PFAS” parameter for surface water.

We recommend that other substitutes of PFOA such as ADONA and C6O4[9] are also added. To avoid this, PFAS should be measured as a sum of PFAS using a broad analytical suite. The recast DWD list (in Annex III, Part B) includes a limit value of 0.10 µg/l of a sum 20 PFASs that are used as a parameter until technical guidelines have been developed for the monitoring of 'PFAS Total' (i.e. the totality of per- and polyfluoroalkyl substances).[10] This is an unnecessary delay as there are many analytical techniques for measuring PFAS, mostly based on LC/MS-MS. ISO 21675 for example has a broad standard set of substances that can be extended as needed, following the standard's guidance. PFOS (PFAS) is already listed as a Priority Hazardous substance and has to be monitored, it will not be much more costly to analyse also other PFASs, as they are just new members in well-established suites, with up to 55 different analytes. A recent survey on analytical capabilities in Europe[11] gives an indication of the price.

**Bisphenol A** is used in plastics and resins, some of which are used in food-packaging material. The European Chemicals Agency (ECHA) considers that bisphenol A can affect fertility and it has been identified as an endocrine disruptor, a substance that affects the hormonal systems of humans and animals,[12] such as the feminisation of fish. Many endocrine disrupting chemicals, are considered non threshold chemicals, for which no safe levels of exposure can be determined. The ECHA Committee for Risk Assessment (RAC) has also supported the classification of BPA as toxic to aquatic organisms, both acute and chronic Therefore, the production and use of endocrine disrupting substances must be limited and emissions to water should be excluded.[13] Bisphenol A is included in the recast DWD (Annex 1 – B) with the value 2.5 µg/L. Given the similar toxicity profiles of all the bisphenol group (BPS, BPF, BPAF, BFPH, BPZ) the whole group should be considered for inclusion.[14] RAC has already supported the classification of BPS and BPAF as reproductive toxicants.

**Pharmaceuticals (for human and veterinary use)**

Pharmaceuticals are designed to give a biological effect at low concentrations while minimising acute toxicity. Metabolites can sometimes be more bioactive than the pharmaceutical itself. EEA acknowledged pharmaceutical residues in water as a cause of concern already in 1999, in particular in relation to antibiotic resistance and exposure of endocrine disrupting substances that can have significant effect on human and ecological health at very low levels.[15] A decade later, several cases of feminisation of male fish due to the oestrogen derivate ethinyl estradiol were reported during an EEA workshop,[16] but the European Commission proposal to include three endocrine-disrupting pharmaceuticals on the list of Priority Substances was met with strong opposition from Member States, pharmaceutical companies and was voted down by the European Parliament. Since then,

[9] such as ADONA (EC 480-310-4), C6O4 (EC 682-239-6) and perfluorinated diglycol acetate (EC 700-323-3), used by 3M/Dyneon, Solvay and Asahi, respectively. See Z. Wang, I.T. Cousins, M. Scheringer, K. Hungerbühler (2013), Environment International, 60, 242-248, doi: 10.1016/j.envint.2013.08.021 for further information.
[10] The recast DWD (Art 13.7) requires the Commission to establish technical guidelines for 'PFAS total' and 'Sum of PFAS' by January 2024
[11] carried out by ECHA and submitted into the restriction process on PFHxA, its salts and related substances, available here as comment RCOM 3115
[12] ECHA, Bisphenol A (data accessed 2021-09-28)
[13] As suggested by UBA in their Scientific Opinion paper on ZPAP (2021)
[14] See CHEMTrust report From BPA to BPZ: a toxic soup? for further details
[15] EEA 1999
[16] EEA, Pharmaceuticals in the environment — Result of an EEA workshop, (EEA 2010)

evidence has only grown about the risk pharmaceutical residues pose for aquatic life and in particular the threat posed by mixture effects.

Pharmaceuticals span a wide range of substances, in Germany alone, there are around 2,500 active ingredients for pharmaceuticals and over 400 for veterinary medicine, on the market and 269 different active pharmaceutical ingredients, their metabolites or transformation products have been detected in freshwater.[17] The amount of pharmaceuticals used is estimated to increase with an ageing population**.** It is therefore very worrying that there are yet no EU-wide environmental quality standards for pharmaceuticals in freshwater.

Main pathways for pharmaceuticals to water is via urban wastewater treatment plants and via spreading of manure**.** Current wastewater treatment does not sufficiently remove pharmaceutical residues and therefore an upgrade of those urban WWTPs that represent the greatest load of pharmaceuticals and other micropollutants should be upgraded to advanced treatment**,** such as has already been implemented in Switzerland.[18] A significantly reduced use of antibiotics for farmed animals is also needed to reduce the risk of antimicrobial resistance.

Pharmaceuticals with similar modes of action should be added as a group with an associated EQS to account for the combined effect. This should be the case for **estrogenic substances** (EE2, E2 and E1, commonly referred to as "hormones") and **antibiotics**. Estrogenic substances (EE2, E2 and E1) as well as macrolide antibiotics have been on the Watch List since 2015. Additionally, in 2018 three more antibiotics were added to the Watch List. There should now be sufficient monitoring data to add them to the list of Priority Substances. Due to the biological effect of estrogenic substances already at very low levels, effect-based monitoring measuring estrogenic activity might be needed for monitoring.[19]

Additionally, **Diclofenac (**anti-inflammatory**), Carbamazepine (**anti-epileptic**), Ibuprofen (**anti-inflammatory) should also be included on the list of Priority substances as there is evidence fish can be affected by antidepressants and antiepileptics. A study on the presence of micropollutants in Sweden's three largest lakes and their tributaries detected carbamazepine and desvenlafaxine (anti-depressant) in all samples.[20]

**Pesticides and biocides for agriculture and household use**

**Pesticides and biocides** are substances designed to kill and can act also on organisms beyond those they are used against. Many such substances therefore have a negative effect on aquatic life.

Pesticides can reach water bodies via infiltration to groundwater, run-off or via evaporation/deposition to surface water. These pathways also allow for the formation of transformation products that sometimes have an even higher toxicity than the mother compound itself. In some cases, insecticides are applied directly on water to control mosquitos. Most exposed are those water bodies in regions with intense agriculture. Invertebrates are particularly at risk for exposure of insecticides. Depending on the properties of the pesticides and their metabolites, they can bioaccumulate. Aquatic fauna is particularly exposed as they are subjected to chronic exposure via the skin, the gills and ingestion of

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[17] German Environment Agency (UBA), *Arzneimittelrückstände in der Umwelt* (data accessed 2021-09-13)
[18] For more details see EEB position paper on the UWWTD
[19] Kase et al., Screening and risk management solutions for steroidal estrogens in surface and wastewater (2018) https://doi.org/10.1016/j.trac.2018.02.013
[20] Swedish University of Agricultural Sciences (SLU), *Förekomst av organiska miljöföroreningar i svenska ytvatten*, 2021

plankton or invertebrates or other organisms. Frogs are also exposed as their vulnerable early-stage development takes place in water. Exposure to toxic pesticides is known to cause (birth) defects on fish, amphibians and invertebrates. Many of the observed effects are not due to one single substance, but rather to the mix of pesticides and other man-made substances. These mixture effects can cause effects at lower concentrations than the individual substances themselves.

An analysis of water quality in Spain showed presence of toxic pesticides in all the river basins analysed.[21] Altogether, 47 different pesticides were detected in 2016, multiplying the toxicity.

The list of Priority Substances contains 21 pesticides, which reflects just a fraction of the number of pesticides on the market in Europe. and does not take into account the accumulative effect that the presence of multiple pesticides pose. The WFD-GW and the DWD both set a maximum value of 0.5 µg/L for active substances of pesticides (including their relevant metabolites, degradation and reaction products)[22]. Such a maximum value for the sum of all detected pesticides is currently lacking for surface water. In particular, the following groups are of concerns and should be added to the list of Priority Substances as a group:

**Neonicotinoids** are a group of insecticides and have been on the Watch List since 2015, there should therefore be sufficient monitoring data to add them to the PS list. Since their withdrawal from EFSA approval in 2020, clothianidin, imidacloprid, thiacloprid and thiamethoxam remain in use via national temporary derogations under Art. 53 PPPR, with likely devastating impacts on insects. Effect-based monitoring could possibly be used. **Neonicotinoids should be added to the PS list as a group.**

**Pyrethroids** are used as insecticides. Substances include Deltamethrin, Permethrin, Esfenvalerate. They are highly toxic to invertebrates and fish in freshwater and marine environments, which has been known for several decades.[23] For example, researchers at the University of California derived acute and chronic water quality criteria for the pyrethroids bifenthrin, cyfluthrin, cypermethrin, X-cyhalothrin and permethrin in 2012.[24] **Pyrethroids should be added to the PS list as a group.**

We currently have the case that often, the substances monitored in water, with some exceptions, are not reflecting the pesticides most used. It could be appropriate to have a list of the most used pesticides as a basis for the selection of Priority Substances.

For example, **Glyphosate (herbicide),** the most sold pesticide in the world does not yet have quality standards nor for surface, nor for groundwater. In Spain, glyphosate has been detected in concentrations more than a hundred times above the "total pesticides" quality standard for drinking and groundwater (0.5 µg/L). For example, in the Canal Laguna Herrera (Málaga) glyphosate was detected at concentration of 71 µg/l and in Rambla del Albujón (Murcia) in concentration of 43,2 µg/l.[25] Additionally, there are also cases where glyphosate is not monitored (e.g. in the Ebro river basin in Spain) with reference that it is not currently required by existing regulation. It is urgently needed that

[21] PAN Europe, *Ríos hormonados*: Contamination of Spanish Rivers with Pesticides, 2018
[22] The DWD directive specifically sets a stricter individual value of 0,030 µg/l for aldrin, dieldrin, heptachlor and heptachlor epoxide
[23] Kuivila *et al*., Environ. Sci. Technol. **46**, 4297−4303 (2012), doi.org/10.1021/es2044882
[24] Fojut *et al*., Rev Environ Contam Toxicol. **216**, 51-103 (2012), doi: 10.1007/978-1-4614-2260-0_2
The acute and chronic water quality criteria derived were **bifenthrin** (4 and 0.6 ng/L, respectively), **cyfluthrin** (0.3 and 0.05 ng/L, respectively), **cypermethrin** (1 and 0.2 ng/L, respectively), **X-cyhalothrin** (1 and 0.5 ng/L, respectively), and **permethrin** (10 and 2 ng/L, respectively)
[25] Ecologistas en Acción, Glifosato Una plaga para la salud de nuestros ríos, el medio ambiente y las personas (2020)

this commonly used toxic herbicides is recognised as a priority substance for water and that Member States take measures to reduce its presence in water.

Other biocides / pesticides that should be added to the list of Priority Substances with individual EQS are **Nicosulfuron (herbicide), Triclosan (antimicrobial agent).**

**Silver nanoparticles** are used in a wide range of products, from clothes and cosmetics, to bandages and building materials due to their antimicrobial action. These same properties make them a threat to aquatic life as the release of silver ions interferes with processes in living cells. Despite company claims, sportswear have been demonstrated to leach silver during washing.[26]

**Apart from the substances considered in the expert survey, EEB considers the following substances should be prioritised:**

**Microplastics** – Reflecting the wide use of plastics in society, microplastics can reach surface water via multiple routes (agriculture, sport pitches, domestic waste water, industry…) and requires monitoring. In many EU countries tyre wear represents the biggest source of microplastics to the environment. Apart from harming the environment, plastic particles also contain toxic chemicals, such as PAHs in tyres. The recast DWD requires the Commission to develop a methodology to measure microplastics by January 2024 after which it might be included as a parameter in the DWD watch list (Article 13.6).

**6PPD-quinone** is a metabolite of the substance 6PPD (EC 212-344-0) used in the tyre industry. The use of 6PPD is registered between 10 000 and 100 000 t/y in the EU alone. The aquatic acute toxicities of the quinone was recently derived by a research team.[27] Compared to the registration dossier of the mother compound, the acute toxicity is roughly 1000 times higher. The high quantities, ubiquitous use and the clear pathway (runoff of tyre wear) makes it a clear candidate for the Watch List.

**Phthalates (as a group)**

Phthalates is a group of chemicals that are used plasticisers in a wide range of products. Four chemicals of the group (DEHP, BBP, DBP, DIBP) are reprotoxicants that have been identified as endocrine disrupters under REACH.28 Other members of the group have a CLP classification as reprotoxicants. All members of the group can potentially degrade to endocrine disrupting metabolites. Some phthalates are restricted for indoor consumer goods but they are widely present as plastic ingredients in agriculture and industrial settings that lead to diffuse releases to the environment. DEHP is listed as a Priority Hazardous Substance, but phthalates should be added as a group to monitor. A meta-analysis of six phthalates (DMP, DEP, DnBP, BBP, DEHP and DnOP) showed median concentrations between 1.16 µg/L -1.18 µg/L in European surface waters for the sum of the phthalates.[29] The study concluded that phthalates are ubiquitous environmental contaminants and also recommends monitoring of chemicals used to replace phthalates after the implementations of

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[26] In a study by the Swedish Water & Wastewater Assiciation (Svenskt Vatten), sportswear had leached between 31 and 90 percent of their silver treatment after ten washes, see Svenskt Vatten, Silver Leaching: A report on Silver in Sportswear for more details

[27] Tian *et al*. Science **371**, 185-189, (2021), DOI: 10.1126/science.abd6951

[28] The REACH restriction report on these four phthalates includes monitoring data in water, see the Annex XV restriction report four phthalates (DEHP, BBP, DBP, DIBP) prepared by the Danish EPA and ECHA

[29] Bergé et al. Environmental Science and Pollution Research **20**, 8057–8076 (2013) doi.org/10.1007/s11356-013-1982-5



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restrictive regulations worldwide, such as Di-iso-nonyl phthalate (DiNP) and Di-iso-decyl phthalate (DiDP) + DPHP (di-propylheptylphthalate).

**Certain River Basin Specific Pollutants (RBSP)** WFD Annex VIII sets out an indicative list of pollutants for which Member States set threshold values, the River Basin Specific Pollutants. It could make sense to add those substances that are listed by "several" member states as River Basin Specific Pollutants PS list to ensure "level safety field" (EU safety net) for everyone across Europe. In particular taking into account the large variability of EQS values applied for RBSPs. For example, **zinc** is listed as a RBSP with 25 different values, the ratio between max and min value is over 400 (see table 1).

**Table 1:** Substances for which at least 10 member states have set EQS values[30]

| Substance | Nbr values | Ratio max/min value |
|---|---|---|
| Zinc | 25 | 419 |
| Bentazone | 14 | 5000 |
| Ethylbenzene | 14 | 65 |
| Selenium | 12 | 385 |
| 1,4-Dichloro-benzene | 12 | 80 |
| Malathion | 11 | 500 |
| Chlorobenzene | 10 | 32 |
| 1,2-Dichloro-benzene | 10 | 80 |

**Substances with persistent, mobile and toxic properties** Highly polar compounds, referred to as "mobile" as their water-soluble and non-adsorption to nonpolar surfaces make them easily pass water treatment, with persistent and toxic properties are causing increasing concern. The Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) issued a statement in 2018 on emerging health and environmental issues (2018)[31] referring to pollutants that possess concern due to their mobility. Some examples relevant for drinking water are: trifluoromethanesulfonic acid and its halogenated homologues; 1-naphthalenesulfonic acid; 1,3-di-o-tolylguanidine and GenX 2,3,3,3-Tetrafluoro-2-(heptafluoro-propoxy)propanoic acid; aka FRD-903 or HFPO-DA). Those substances should be added based on their properties of being persistent and mobile with toxic properties to the environment.

*Deselection of Priority Substances*

Criteria for deselection have been developed by the Common Implementation Strategy (CIS) working group for Chemicals.[32] One of the criteria for deselection is that AA-EQS at 95th percentile level happened in less than 4 reporting MS and, if the substance is banned there is no upward trend in neither concentration (mean or 95$^{th}$ percentile) nor in the number of exceedances. For such criteria to

[30] Danish Centre for Environment and Energy, European Environmental Quality Standards (EQS) variability study, 2016
[31] https://ec.europa.eu/health/sites/health/files/scientific_committees/scheer/docs/scheer_s_002.pdf
[32] Common Implementation Strategy (CIS) WG Chemicals, Deselection criteria for existing Priority Substances based on STE assessment method (2016), updated September 2021 (in this link)

make sense, there has to be harmonisation between testing data, such as specification on the number of samples taken and the detection limit. In Spain for example, each river basin has different detection limits some being so high that no exceedances are found. More transparency related to monitoring is also needed. In Spain the river basins can choose from which sites they report.

Before deselecting a substance it must be ensured that a stable or decreasing trend in inland surface water is not due to substances is simply being **washed out to sea**. The decreasing trend should be compared to monitoring data from coastal areas to ensure it is not due to transfer from one point to the other. Such wash-out effects have been noted for atrazine, a triazine herbicide on the Priority Substance list, that has been banned since 2004 in the EU, but which was found in high concentrations (tens of nanograms per liter) together with other triazines in samples from the Black Sea.[33]

Although a substance is banned, its concentrations in water may increase or remain high. For example, atrazine moves quickly through soil but decays only slowly in water, so its concentrations have increased in groundwater, continuing even after its use was banned. Similar trends have been observed in the US.[34]

A review of the presence of toxic pesticides in Spanish rivers revealed that the vast majority of the pesticides detected are not authorised in the EU, including Tetrachloroethylene, lindane, atrazine and endosulfan.[35]

While a substance is banned, products with similar properties can still be in use. This is for example the case with alachlor, a herbicide banned since 2006 in the EU, but where other chloroacetamides pesticides are still on the market. Or simazine and atrazine, herbicides banned since 2004, while other triazine herbicides are still in use. A way to address this could be to monitor and implement EQS values for whole classes of pesticides rather than for individual substances. Many pesticides have similar effects, for example triazines and phenylurea herbicides both act as photosynthetic inhibitors. Effect-based approaches that sets and measure an EQS for photosystem II (PSII) inhibiting substances could be used to capture such effects.

*Amendments to provisions for Watch List monitoring and future reviews*

Lack of analytical methods should not stand in the way for adding substances to the Watch List. Inspiration could be taken from the rapid implementation of covid-19 detection in wastewater. If there is political will, monitoring can be put in place swiftly.

Once a methodology to measure microplastics is developed (within three years) the Commission may include the parameter in the DWD watch list. Any substance that is added to the DWD Watch List should automatically be added to the PS Watch List (and to the GWD Watch List), unless it is a substance clearly related to drinking water treatment.

However, as highlighted in the fitness check evaluation of the water policy - the lack of an automatic link between the Watch List and the Priority Substances list is problematic and resulted that new substances have not been added to the list swiftly. Other reasons highlighted include length of the

[33] EMBLAS project https://emblasproject.org/
[34] See EWG's Tap water database
[35] PAN Europe and Ecologistas en Accion, Ríos hormonados: Contamination of Spanish Rivers with Pesticides (2018)

process to gather the necessary scientific evidence and requirement to update the lists via the ordinary legislative procedure.

# Groundwater – policy options

Around 75% of EU inhabitants depend on groundwater as a drinking water resource. Additionally, it is an important source for irrigation as well as supporting surface water systems and wetlands. Many rivers derive more than 50% of their annual flow from groundwater, and in summer this can increase to 90%. Therefore, poor groundwater status can directly influence surface water quality.

Yet, groundwater is much less well monitored than surface water. There are EU-wide standards only for nitrates and pesticides, which represents only a fraction of the anthropogenic substances that can pollute groundwater. Monitoring for other substances is limited or not carried out at all. This leaves this important irrigation and drinking water source in a vulnerable situation. As a paper on the development of the groundwater watchlist (GWWL) describes it "on one hand there is insufficient monitoring data to underpin and inform development of European groundwater regulation, whilst on the other hand there is no formal requirement to monitor for anthropogenic organic substances that might be of potential concern."[36] The fact that groundwater is reported to be in better chemical status than surface water is therefore partly a result of the number of substances monitored.

Contaminants can reach groundwater in different ways, including seeping through soil after application but also indirectly via run-off and surface water / groundwater interaction. Leakage from sewage systems and managed aquifer recharge are also two important pathways.

Groundwater chemical status is assessed against substances listed in GWD Annex 1 (that sets EU-wide standards for pesticides and nitrates) and Annex II, Part B that lists the minimum pollutants for which member states have to consider setting threshold values for. The reasoning behind Annex II is that background concentrations of naturally occurring substances vary between regions and that therefore there is need to establish separate threshold values for different Member States.

However, it should be noted that several of the substances in Annex II can both occur naturally or as a result of human activity, such as mercury, chloride and sulphate. Additionally, Annex II contains two man-made synthetic substances (trichloroethylene and tetrachloroethylene) of which there should be no natural background. Threshold values for these substances vary greatly between countries with a max/min ratio of 193 for Tetrachloroethylene and 276 for Trichloroethylene,[37] while the DWD sets an EU-wide maximum value for the sum of these two substances. This example shows the risk of adding man-made substances to Annex II.

*Addition of substances to the list of groundwater pollutants*

As a general rule, any substance that is man-made should be added to Annex I of the GWD to ensure a 'level protection field' across the EU. Adding substances that pose a threat to groundwater systems to Annex II (where member states set their own threshold values) would mean the protection of public health and ecosystems would vary across the EU, which must be avoided.

[36] Lapworth et al., Environmental Research Letters, **14**, (2019) doi.org/10.1088/1748-9326/aaf4d7
[37] Arcadis and Environment Agency Austria (UB) available here



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Below arguments linked to substances that should be prioritised in the addition to the GWD Annex I:

**Below EEB comments on the groundwater candidate substances listed in the expert survey:**

## PFAS

PFASs are Persistent, Mobile and Toxic (PMT) chemicals. These properties make them susceptible to move between compartments, which makes them a concern for water, not least for groundwater as many groundwater bodies are transboundary. It would therefore not make sense to add them to Annex II and let member states set their own threshold values. **PFAS should be added a group to Annex I of the WFD-GD as a group** based on the DWD recast.

The European Commission considers adding "sum of PFAS" based on 10 substances to Annex I or II or the GWD. This is less than half the number of substances considered for the "sum of PFAS" parameter for the surface water PS list (22 PFAS substances)[38], and substantially fewer than what can be routinely analysed in a single analytical run (55 PFAS) at little additional cost. The reason for this is that the PFAS substances for the GWD were selected based on their occurrence in groundwater in those Member States that participated in the voluntary exercise of the Groundwater Watch List (GWWL) process. In contrast, the group of 22 PFAS selected as candidates for the surface water PS list that were selected based on human health criteria.

## Pharmaceuticals

The presence of pharmaceuticals in groundwater has been known for a long time. A 2011 UBA study identified 55 pharmaceuticals substances in groundwater samples from Germany, and 15 active substances in samples from other countries, in concentration, many of them measured in concentration between 0.1 and 1 mg/L and for some even above 1 mg/L.[39] Yet, there are no EU-wide standards for pharmaceuticals in groundwater.

The European Commission is now considering to add either two pharmaceuticals (Carbamazepine) and Sulfatmethoxazole) or all detectable pharmaceuticals as a group to the list of groundwater pollutants. The longer residence times for groundwater allow more time for breakdown to a wider range of substances, therefore it is important to not only add individual substances but also take into account the transformation products and metabolites. A study by UBA found 92 different pharmaceutical compounds, transformation products and metabolites in groundwater. 36 of them were found in concentrations between 0.1 and 1.0 μg/L, and 17 of them in concentration above 1.0 μg/L.[40] Adding only two substances to the list would miss the effect of the wide mix of pharmaceutical substances that can be found in groundwater.

The GWWL data collection exercise[41] found that carbamazepine was the most widely analysed substance by the 12 participating countries, while paracetamol was the most frequently detected substance, followed by carbamazepine, diatrizoic acid (contrast agent), primidone (anti-seizure medicament), ibuprofen and clofibric acid (metabolite of lipid-lowering medicine).

## Pesticides

[38] Note also that for the DWD, the "sum of PFAS" parameter includes 20 PFAS.
[39] UBA *Zusammenstellung von Monitoringdaten zu Umweltkonzentrationen von Arzneimitteln* (2011)
[40] UBA, *Arzneimittelrückstände in der Umwelt*, (data retrieved 2021-09-13)
[41] Lapworth 2019



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Currently pesticides are listed in Annex I together with their relevant metabolites[42], degradation and reaction products with an individual threshold of 0.1 µg/L and a total threshold of 0.5 µg/L. The 0.1 µg/L threshold is higher than for many pesticides and fungicides on the list of Priority Substances for surface water (eg. Endosulfan, Dicofol, Cypermethrin and Diclorvos).[43] It is currently not defined which pesticides that Member States have to monitor, nor which pesticides, or how many, that are making up the "total pesticides" value. This has resulted in cases where some of the most commonly used pesticides are not being monitored in groundwater. For example, data obtained by Ecologistas en Acción from the Environmental Ministry of Spain didn't include any analytical data for glyphosate, despite it being the most used pesticide.[44] To counter this, Annex I of the GWD should indicate which active substances of pesticides and biocidal products that are to be monitored, including as a minimum the most commonly used ones.

The European Commission is now considering to add also the 'non-relevant' metabolites of pesticides (a group of 16 substances). Non-relevant metabolites (nrM) is the technical term for degradation products of pesticides that are harmful but where the properties are different from the parent compound. However, these 16 substances were selected on the basis of their occurrence in groundwater in those member states that participated in the voluntary GW WL process and therefore present a limited set of substances. **For pesticides, the individual GQS should apply for all individual substances (i.e. to be extended to include also non-relevant metabolites). The pesticides total value should be extended to include the nrM.** EU-wide threshold values for the most commonly used pesticides could be set to monitor compliance with risk management and progressive reduction measures.

*Review of the Watch List process*

Lack of analytical methods should not stand in the way for adding substances to the Watch List.

The Groundwater Watch List (GWWL) is voluntary while the surface water Watch List is mandatory. This limits the collection of data on pollution of groundwater, which then is used as an argument for not setting thresholds values for substances due to "lack of monitoring data". To break this cycle, **the GWWL should be made mandatory** as a coordinated European-wide approach to identify and monitor substances or groups of substances that pose a risk for groundwater. The results from such an approach would serve as evidence base for policy development, e.g. setting threshold values for groundwater.

The EEB rejects the CIS WG Groundwater proposal to add four further PFAS to the GWWL (4:2 and 6:2 FT-phosphatemonoester, as well as C8 and C10 phosphonic acids), as long as the scientific basis for this proposal is unclear. The background documents reveal no environmental data justifying systematic monitoring. None of these substances are registered under REACH, indicating at most marginal use (below 1 t/y across the EU). If any release occurs from historical stocks, measures beyond mere monitoring may be more appropriate.

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[42] Relevant metabolites is the technical term for metabolites with the same properties as the mother compound

[43] This was also noted by EEA in their ETC/ICM Technical Report 1/2020 [Pesticides in European rivers, lakes and groundwaters – Data assessment]

[44] See the glyphosate report by Ecologistas en Accion (2020)

# Costs and benefits

Analysing more substances does not necessarily have to incur much larger costs. For example, to analyse PFAS as a group there is little additional cost is involved, because PFOS is already a PS. The other ones are just new members in well-established suites.

Apart from helping fulfil e.g. the objectives of the WFD and the ZPAP, there are economic, social and environmental benefits associated with robust monitoring of pollutants in water as well as with the mandatory measures to reduce emissions, discharges and losses of Priority Substances and to cease the Priority Hazardous Substances.

Benefits include

- Less treatment needed for providing water for agriculture, livestock, industry or human consumption - > less energy needed for drinking water and wastewater treatment
- Reduced risks for illness due to exposure to harmful substances
- Opportunity for other sectors (tourism, fishing…) as health of water improves

The French environmental ministry estimated that the cost to clean up one kilogram of pesticides from a drinking water source to be between €60 000 and €200 000.[45]

While the discharge of micropollutants to the environment can be reduced by upgrading urban WWTPs to advanced treatment, the most common removal techniques (activated carbon and/or ozonation) do not work well on highly polar compounds. Such compounds are highly soluble in water, and do not adsorb to nonpolar surfaces and therefore easily pass both drinking water and wastewater treatment. These properties are summed up under the name “mobile” substances. Reverse osmosis and nanofiltration can capture such polar substances, but these treatments are energy-intense, and costly. Additionally, they also remove minerals from the water, which means the water would have to be re-mineralised before being able to serve as drinking water. EurEau estimates that reverse osmosis treatment would raise the price of water treatment by more than 1 €/$m^3$, resulting in circa 200 €/year additional cost for the average household. Additionally, reverse osmosis and nanofiltration do not destroy the removed chemicals, but the waste created (which could represent 25% of the treated water) has to be treated separately.[46]

The lowest cost for pollution remediation is to avoid contamination in the first place. Remediation costs for pollution caused by substances already listed as Priority Substances can show examples of this. The ECHA committees opinion on PFOA[47], a Priority Substance, include information on costs related PFOA pollution in groundwater caused by an EU plant in the EU that formerly produced PFOA. Discharges from the plant led to a “continuous and severe pollution” of the groundwater in an area wider than 150 km2 resulting in an average concentration of 360 ng/L, and the maximum concentrations in many sites >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 decades.

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[45] Ministry of Environment, France *Plan micropolluants 2016 - 2021 pour préserver la qualité des eaux et la biodiversité*

[46] EurEau Briefing Note: Moving Forward on PMT and vPvM Substances (2019)

[47] ECHA RAC and SEAC Opinion on an Annex XV dossier proposing restrictions on Perfluorooctanoic acid (PFOA), its salts and PFOA-related substances (2014)

Another example is mercury, a priority hazardous substance that cause failure of good chemical status in over 45 000 water bodies. Most commonly via atmospheric deposition with coal combustion as the largest anthropogenic source of mercury to the environment in the EU. Due to the vast scale of the problem, and the difficulties and cost related to remediation (remediation cost for contaminated sediments were estimated to be 16 800 –21 000 € per kg Hg in the early 2000s.[48]), there are no large-scale efforts in cleaning up the mercury in our rivers and lakes. Instead, the cost is borne by society. The societal cost of mercury pollution in the EU is estimated to be 8-9 billion euros a year due to reduced IQ among children.

# Complementary measures

*New monitoring methods / Improvements to current monitoring*

The fitness check conclusion did not see any legal barriers in the WFD "that would prevent the uptake of innovative monitoring technologies". The CIS Guidance doc 19 also mentions passive sampling combined with ecotoxicology as a way to assess effects of chemical mixtures.

Effect-based monitoring can provide more information about chemical mixtures, but they should only be used as a complement to traditional chemical monitoring of substances. Only by measuring the substances (and their metabolites and transformation products) can the effects of measures to reduce the discharges, emissions and losses of the Priority Substances and the cessation/phase-out of the PHS.

The Commission could produce guidelines on effect-based monitoring to facilitate the use across Member States.

Mixture toxicity could also be used as a parameter to assess the chemical status of water, i.e. integrated as a quality standard in the Priority Substance Directive. (Possibly also as to determine ecological status under WFD).

The requirements to monitor priority substances in sediments and biota should be strengthened with mandatory standards for a minimum number of analyses in the sediment matrix and biota matrix. This is especially important in the former, since many of the priority substances, especially pesticides, are very insoluble. This means that low detection of these substances, or even lack of detection, in the water fraction does not indicate that the water bodies are free of these substances, unless it can be proven that they are not present in the river bed, or the sediments.

It has been observed that river basin authorities make very varied monitoring efforts[49]. On this basis, it is necessary that, together with environmental quality standards, a common minimum reference framework per unit area is implemented. In other words, there should be a minimum number of sampling points per unit area.

*Improvements to data management, risk management and transparency*

[48] Hylander and Goodsite, Science of the Total Environment **368**, 352-370 (2006), doi:10.1016/j.scitotenv.2005.11.029
[49] See for example the glyphosate report by Ecologistas en Accion (2020)

Lack of analytical methods is often used as an excuse for waiting to address pollution. Analytical methods generally exist, as they have been used to gather initial data. Where needed, refinement and optimisation can generally be achieved with moderately low effort by skilled analytical chemists.

Environmental information from industrial discharge permits should be made centrally accessible to the public in a user-friendly way and include temporal trends of PS emissions, discharges and losses. Similarly, monitoring data from Watch List exercise should be made public in a transparent manner.

There is a need to improve the effectiveness of relevant EU policy instruments to work together instead of in parallel: improving the knowledge base should be ensured through better infrastructure and access to the data generated under various policy instruments (e.g; products, source regulation, chemicals regulations) and improve interfaces. If substances not on the lists of surface or groundwater pollutants are detected in the water in one country it should be possible to organise a knowledge transfer to the relevant regulatory bodies to verify whether that presence can be outruled in other water bodies.

The objective of data generation (through improved monitoring) and sharing shall lead to re-prioritisation of pollution prevention at source measures, which requires better cooperation of the respective communities (e.g. REACH, product policy, source control and standards making communities and the main producers /users). The pollution prevention and pays principle should ensure that the extended producer responsibility does account and internalise all the monitoring, clean up and restoration costs linked to the production or use of products (articles, pesticides, biocides) containing substances of concern, or release of those substances. Where the findings point to diffuse source emissions (from products / wide dispersive use), this should trigger EU wide substance restrictions measures (REACH Restriction combined with use restriction and other products restrictions). The hierarchy of regulatory options need to take account of the Zero Pollution hierarchy of actions.[50]

*Measures for progressive reduction of PS and cessation or phase-out of PHS*

The WFD Article 1(c) requires that "specific measures for the progressive reduction of discharges, emissions and losses" must be implemented for Priority Substances. For the priority hazardous substances, discharges, emissions and losses must be stopped or phased-out.

There is ambiguity regarding the timeline for phase-out / cessation of priority hazardous substances. We regard the EQSD to be intended to fulfil Article 16.6 (i.e. the timeline is 20 years from the adoption of the 2008/105/EC, i.e. 2028) but this should be clarified by the Commission.

There are also binding cross-references to the WFD's objectives in other EU policies. For example, Article 18 of the IED requires stricter Emission Limit Values (ELVs) (beyond the BAT) to be set in the case that environmental quality standards (EQS) are not met. Similarly, the PPPR (Article 21) requires member states to review permits in cases where the objectives of the WFD cannot be met. However, the WFD fitness check identified insufficient integration of environmental objectives in sectoral policies (together with insufficient funding and slow implementation) as key reasons for the fact that Europe is still far from reaching the objectives of the WFD. The Integrated Assessment of the 2nd River Basin Management Plans (November 2019) also pointed out that collaborative opportunities are

[50] See EEB input to the ZPAP roadmap consultation

often missed, partly due to poor communication between different regulatory bodies or perceived mis-alignment of objectives.

For examples, where the pathway is atmospheric deposition, water policy managers rely on their colleagues that set permit limits for emissions to air, but such interactions seem to be limited when developing the Program of Measures of the RBMPs.

The Large Combustion Plants BREF (LCP BREF) states 1-7 ug/Nm3 as BAT for mercury. However, several countries still only aim for the upper range limit, or allow their plants to operate even above this.[51]

EQS exceedance of Priority Substances does not automatically trigger action under Chemicals legislation. This was also concluded in the fitness check of the Chemicals legislation[52] that pointed out this to be a reason for delay as there may be no action in response to monitoring data until a substance is up for renewal. A link between WFD/ EQS and REACH should be established so when water monitoring is showing levels above EQS in several MS a restriction of the chemical under REACH should be triggered. For now, this is only happening in isolated cases, such as the REACH restriction of nonylphenol ethoxylates (a pre-cursor to nonylphenol, a Priority Hazardous Substance), which was based on detection of nonylphenol in marine and fresh waters.[44]

Risk assessment data linked to the authorising legislation are not always available for the priority substances review.

The Integrated Assessment of the 2nd River Basin Management Plans (November 2019) found that the majority of measures adopted are aimed at point source emissions in relation to permitting and tighter controls on regulated sites under the Industrial Emissions Directive (IED) and less on addressing pressures from diffuse sources or discharges from UWWTPs. However, the IED registry data[53] only contains 76 records out of 154,362 that indicate 'stricter permit conditions' for all reference years (0,05% of the entries). Similarly, even if the PPPR allows for the possibility of monitoring, it is rarely (if ever) requested.[54]

The European Commission, as the guardian of the treaties, also has an obligation to track the efforts done by member States to fulfill the obligation of reducing the emissions of priority Substances. However, published data does not always give the complete picture. For example, there is a new Commission website on agricultural chemicals sales and risk[55], but it is lacking emergency derogations as well as pesticide use data.

# Conclusions

Europe's freshwater reserves are polluted with a wide range of substances originating from human activities, and chemical pollution still poses a pressure on surface and groundwater. Even if less than half of Europe's waters fail good chemical status under the Water Framework Directive, the lists of

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[51] EEB, Industrial Plant Data Viewer factsheets, 2021
[52] https://ec.europa.eu/environment/chemicals/better_regulation/index_en.htm
[53] EEA, Industrial Reporting under the IED and PRTR (version December 2020, rev2)
[54] COM 2019 Integrated Assessment of 2nd RBMPs
[55] European Commission, Food and Health Quality Protection - (EU27) - European Union 27 (excluding UK)

surface water and groundwater pollutants of concern for ecological health only represents a fraction of the substances that are found in, and does not account for mixture effects. While the substance-by-substance approach is useful for evaluating measures to reduce emissions, it should be expanded to reflect a Zero Pollution Ambition. This can be achieved by assessing a wider set of properties than only toxicity, including properties such as persistence, accumulation and mobility as well as endocrine disrupting properties. Adding substances as a group as well as effect-based monitoring techniques are also steps to address the effects of chemical measures.

The update of the lists of pollutants is overdue and since then the Commission has put forward the Pharmaceutical Strategy as well as the Biodiversity, Farm to Fork and Zero Pollution Strategies as well as updated the Drinking Water Directive. The lists of pollutants for surface and groundwater should be updated with relevant substances to reflect these strategies. This should include as a minimum PFAS, pharmaceuticals and an expanded set of pesticides (including all their harmful metabolites).

More ambition is needed from Member States to reduce the emissions, discharges and losses of PS to achieve good water status by 2027 the latest and the cross-links to WFD in other sectoral legislation should be better implemented. Monitoring must be improved, in particular for groundwater where the GWWL should be made obligatory. Data on monitoring of Watch List substances should be made public in a centralised, user-friendly way (by EEA).

Analytical challenges related to detection and quantification of (polar) mobile substances should not be an argument to minimise emissions of Persistent and Mobile substances citing lack of monitoring data.