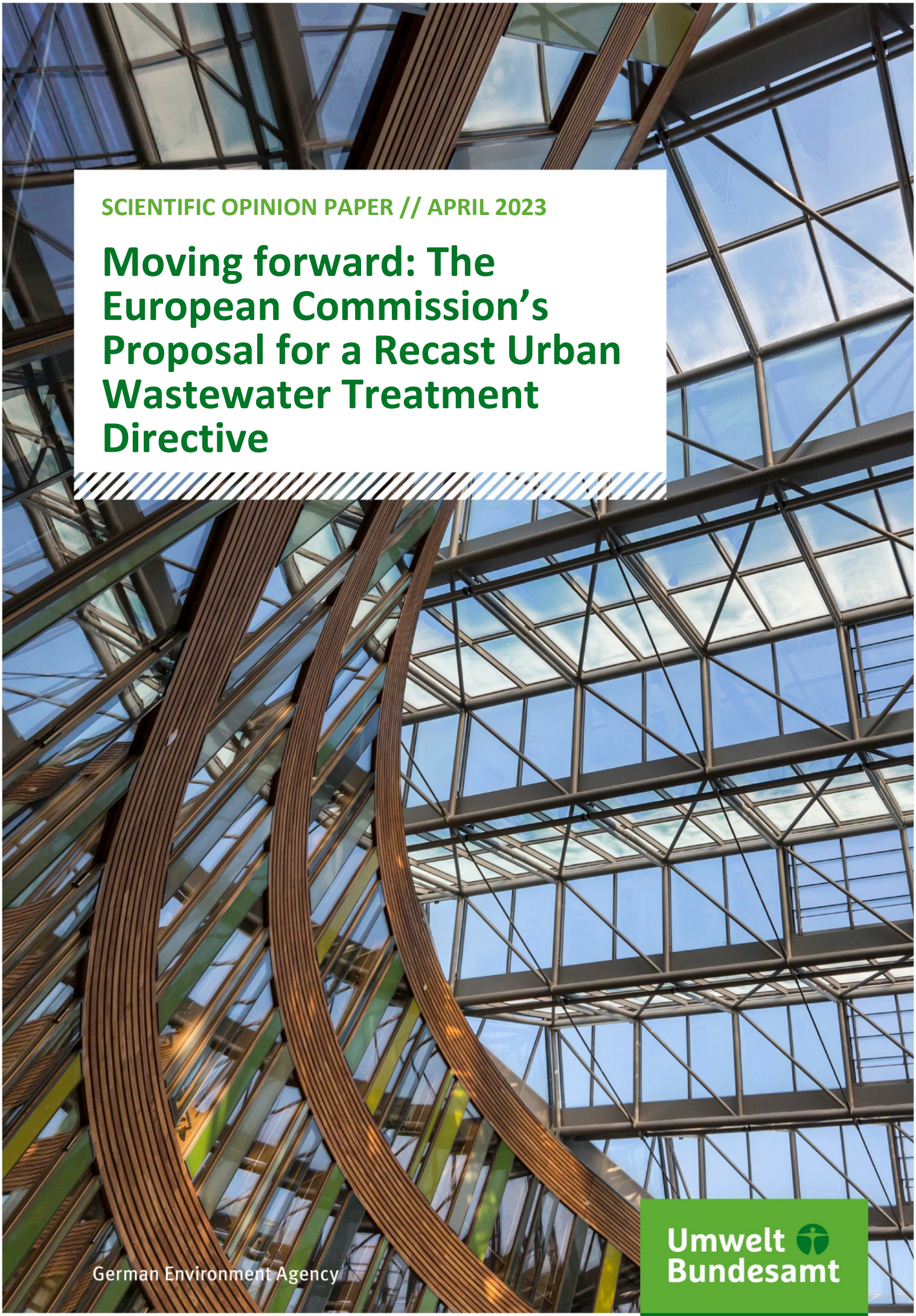

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Moving forward: The European Commission's Proposal for a Recast Urban Wastewater Treatment Directive

German Environment Agency

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Moving forward: The European Commission's Proposal for a Recast Urban Wastewater Treatment Directive

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Executive Summary

The Urban Wastewater Treatment Directive (UWWTD) was published more than 30 years ago and is one of the first pieces of European environmental protection legislation. The directive ensures that wastewater is treated adequately before being discharged into the environment and sets minimum requirements for wastewater infrastructure.

Since 1991, our knowledge about the negative effects of wastewater on the environment, substances in wastewater, and treatment technologies has grown. In addition, climate change and the correlating effects are challenging the wastewater infrastructure and the quality of the receiving water bodies as well as putting limits on the energy and resource demand of wastewater treatment. Relatively new topics, like the SARS-CoV2 pandemic, show that wastewater can be an important public health monitor. All these new challenges and possibilities could not be foreseen in 1991, a revision of the UWWTD is therefore fundamental for contemporary wastewater treatment. We think that the European Commission´s (EC's) proposal for a Recast UWWTD (from here on shortened as the EC's proposal) is a very important step towards better protection of the environment and sustainable wastewater treatment. We strongly support the foundation of the EC's proposal: the precautionary principle, a circular economy, and the polluter pays principle.

While the previous directive's focus was largely on basic wastewater treatment (collection of wastewater, carbon, and nutrient removal), the EC's proposal now has a much wider scope including the removal of micropollutants, the reduction of stormwater and combined sewer overflows (CSO), the interaction of individual appropriate systems (IAS) and wastewater treatment plants (WWTP), energy on WWTP, improved monitoring, and financing aspects. Setting up appropriate minimum requirements in these different areas will further reduce the remaining pollution of wastewater treatment systems and improve the quality of European surface water bodies and marine areas.

While there have been no significant changes with respect to the UWWTD in the last decades, the member states adjusted legislation on the national level to fulfil criteria set up by other directives, such as the Water Framework Directive, the Environment Quality Standards Directive, and the Groundwater Directive. In Germany, many WWTP exceed the requirements by the current UWWTD significantly and fulfil several of the additional requirements of the EC's proposal already.

In this paper, we want to discuss the key topics of the EC's proposal and show, how the planned changes could affect wastewater treatment in Germany. We also highlight further refinement needs and some missing definitions without meticulously reviewing each article. The sections are as follows:

1 Key Messages

We endorse the EC's proposal. The planned changes will significantly reduce the remaining pollution emitted by European wastewater treatment plants (WWTP). In addition, the EC's proposal will lead to more sustainable wastewater treatment and implement an integrative approach towards more comprehensive wastewater management. We want to highlight the following aspects:

- We support the idea of wastewater management plans. The management of wastewater, run-off, individual appropriate systems, indirect discharges, and blue-green infrastructures are complex tasks and need adequate tools to further maximize efficiency and reduce combined sewage overflows as well as other unwanted emissions.
- A further reduction of nutrient boundary values will reduce the eutrophication potential of WWTP effluents, nutrient loads in rivers, and protect the receiving seas. The Baltic Sea and coastal waters of the North Sea are especially vulnerable.
- The implementation of a quaternary treatment step will significantly reduce the micropollutant emission of WWTP and consequentially, of the receiving water bodies.
- The extended producer responsibility (EPR) is an important financing mechanism that follows the polluter pays-principle. We think that producers listed in Annex III (currently cosmetics and medicinal products) should contribute accordingly, not fully. The proposed enforcement needs data that are currently unavailable and a simplified, low-cost enforcement alternative should be derived.
- Mandatory energy audits and the demand for energy neutrality are leading toward a more sustainable wastewater treatment. Reaching onsite electricity neutrality largely depends on the available space at the WWTP.
- Phosphorous is a finite resource and we welcome recovery rates in general. However, we do think that with respect to pollution reduction, treating sewage sludge in mono-incineration plants is preferable to the agricultural use of sewage sludge.
- WWTP are valuable public health monitoring stations and we support the implementation of these additional monitoring parameters. Therefore, close cooperation between public health experts and wastewater treatment experts is mandatory.
- Adjusting the monitoring is important to either track the success of the various measures or to implement additional measures. We also support the use of more sustainable methods. Methods, which are harmful to the environment should no longer be permitted.

2 Shifting from Wastewater Treatment to Wastewater Management

Managing wastewater includes more than building and operating sewage collection systems and WWTP. We think, that it is very important to treat wastewater based on an integrative approach that links wastewater treatment with other sectors such as water, energy, climate, and a circular

economy. The EC's proposal adopts this approach and there are several articles explicitly dealing with aspects of wastewater management.

Urban wastewater management plans (article 5) are an important instrument to define measures against the untreated discharge of wastewater through stormwater and CSO, contaminated run-off discharges, and to manage rainwater collection and treatment with e.g. blue-green infrastructures. Currently, there is neither data on the German nor the European level describing the contamination and scale of these events. Droughts, heat waves, and heavy rainfall will become more frequent, and incorporating these aspects of climate change into wastewater management plans helps to reduce the vulnerability of our cities and water bodies. In addition, the management of water resources, including water reuse (article 15), helps to reduce water stress.

The treatment efficiency of IAS (article 4) cannot be compared to WWTP; however, IAS provide cost-efficient solutions in sparsely populated areas. In Germany, there is an obligation for households to connect to collecting systems, IAS are thus mostly in place when the connection to existing networks is not feasible. Due to the numerous IAS and the limited technical possibilities to adjust their settings, the routine monitoring of correctly installed IAS is mostly an expensive task while environmental benefits remain unclear.

In Germany, additional requirements for collection systems (article 3) will not lead to significant changes, if the German definition of agglomerations remains valid.

3 New Requirements for Wastewater Treatment

Wastewater treatment technologies have developed in the last decades and we think it is time to update the minimum requirements of the UWWTD. We support the UWWTD's threshold reduction from 2 000 Population Equivalent (PE) to 1 000 PE (article 6). Reducing both, boundary values for N and P is a major step towards reducing eutrophication and the nutrient load in surface water bodies and the sea (article 7). However, a reduction also depends on other factors such as the nutrient limitation of the receiving water body and diffuse sources. Linking activities of WWTP with other pollution sources is therefore pivotal and needs high-quality data. In Germany, nutrients finally end up in the North Sea, the Baltic Sea, as well as the Black Sea and the status of these water bodies is an important indicator. The Baltic Sea, and the coastal waters of the North Sea, including the Wadden Sea, are particularly prone to eutrophication, and reducing nutrient loading is therefore very important.

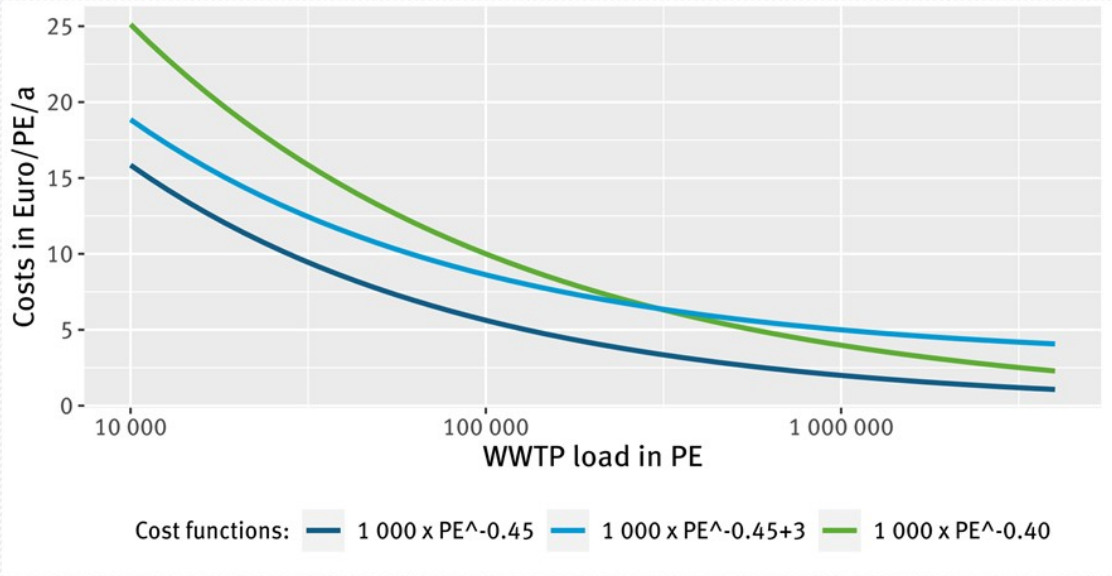
The introduction of a quaternary treatment (article 8) for WWTP with more than 100 000 connected PE will significantly reduce the discharge of micropollutants into water bodies. A risk-based implementation of a quaternary treatment for WWTP with 10 000 PE – 100 000 PE helps to reduce pollution in sensitive areas (article 18). In an integrative approach, end-of-pipe measures such as a quaternary treatment must be combined with measures at the source to maximize efficiency. These measures include e.g. the pre-treatment of industrial/highly contaminated wastewater, the reduction of CSO, and measures to reduce the consumption of pharmaceuticals/chemicals in general.

The boundary at 100 000 PE seems rather arbitrary but first, it is based on a risk assessment, which was carried out by the EC's JRC and second, there is no other parameter available on the European level to describe a WWTP's micropollutant load. In Germany, large WWTP (> 100 000 PE) are discharging more than 50% of the wastewater. Their micropollutant load is significant, and their share of the receiving water body is high, as is the damage potential. During

low water, many rivers in Germany have stretches where the wastewater share is 50%-100%[1]. Implementing the best available techniques for WWTP is therefore reasonable in times when climate change leads to an even higher concentration of substances in the water bodies. This effect enlarges hazards for drinking water production as well as for the environment. It is important to realize that within ecosystems, short periods of harmful concentrations are enough to inflict serious damages as we witnessed in the 2022 Oder river environmental disaster.

We state that the EC´s cost calculation probably underestimates the costs for a quaternary treatment: According to article 8 of the EC's proposal, all wastewater treatment plants must be equipped with additional quaternary treatment by 2035 if a population equivalent of 100 000 is exceeded. In addition, the EC's proposal includes smaller WWTP if certain criteria are met. This would require an upgrade of several hundred additional WWTP by 2040. For Germany, the EC forecasts annual costs of €238 million in 2040 (which would mean accumulated total costs of around €4 billion). The cost function used in the EC's impact assessment (1 000 x PE^-0.45) is based on few data points with respect to WWTP with more than 500 000 PE[2]. We used two adjusted cost functions (1 000 x PE^-0.40 and 1 000 x PE^-0.45+3) that imply additional costs due to higher energy and construction prices (Illustration 1).

Illustration 1:
The original cost function (1 000 x PE ^-0.45) and adjusted cost functions



Cost functions: 1 000 x PE^-0.45 1 000 x PE^-0.45+3 1 000 x PE^-0.40

* PE based cost functions for a quaternary treatment

Source: Umweltbundesamt

[1] Drewes, J. E. et al. „Dynamik der Klarwasseranteile in Oberflächengewässern und mögliche Herausforderungen für die Trinkwassergewinnung in Deutschland (Stand: Juli 2018 ed.)". http://www.umweltbundesamt.de/publikationen/dynamik-der-klarwasseranteile-in

[2] Pistocchi, A. et al. "Treatment of micropollutants in wastewater: Balancing effectiveness, costs and implications." The Science of the total environment vol. 850 (2022): 157593. doi:10.1016/j.scitotenv.2022.157593

With these cost functions, the additional costs for upgrading all WWTP with a load of more than 10 000 PE are €1 025 million/a and €885 million/a respectively. Upgrading all WWTP that have a load of more than 100 000 PE leads to €305 million/a and €318 million/a.

In Germany, there is an additional difference when the WWTP's load in PE is used instead of the WWTP's capacity. There are 63 WWTPs in the UWWTD database with a capacity of more than 100 000 PE but a load of less than 100 000 PE. The median capacity is 130 000 PE (mean: 141 154 PE), while the median load is 80 441 PE (mean: 77 497 PE). As operational costs are rather based on the load, we used the WWTP's load in our cost calculations.

A 2018 study by civity Management Consultants on behalf of the BDEW[3] arrived at costs of €1.2 billion annually (€36 billion for 30 years), even though it also considered the additional expansion of some WWTP with less than 10 000 PE.

4 Extending the Producers' Responsibility

Several measures stated in the EC's proposal will increase the quality of wastewater discharges significantly. Without a doubt, this comes with additional costs. These costs can be integrated into wastewater treatment fees, can be paid by the taxpayers, or covered by other financing mechanisms such as an extended producer responsibility (EPR).

The basic idea behind an EPR is to reallocate external costs stemming from negative effects due to the use of various products. The EPR thus follows the polluter pays principle, one of the core principles of the European Union's environmental policy. We, therefore, welcome the EPR as an important instrument for financing the quaternary treatment stage and for internalizing negative external effects.

In the proposal, the EPR's main function is to generate revenue that can be used to refinance the quaternary treatment stage, also including the transaction costs required to collect the levy. In general, the enforcement costs for both, the authorities and the producers should be kept as low as possible, and legal certainty in enforcement should be guaranteed. The proposal's EPR also intends to have a targeted effect on economic decisions along the polluter chain by changing relative prices, so that the quantity and composition of products covered by the EPR are reviewed in the interest of water protection.

Even though we primarily see a financing function for the EPR, we anticipate a steering effect, particularly in the domain of care products and selected over-the-counter medications (e.g. diclofenac). The anticipated changes in relative prices and heightened costs of certain products are likely to initiate decentralized adjustment processes among producers and consumers.

In the EC's proposal, producers of products listed in Annex III (currently medicinal products for human use and cosmetic products) should carry the full costs of the quaternary treatment step and other correlating tasks. Producers can apply for a product-specific exclusion if producers prove that their products do not generate micropollutants or if the product's mass is below 2 tonnes per year.

We think that producers of all water contaminating products should contribute to the EPR. Pharmaceutical products and cosmetics are major sources of pollution and they should contribute accordingly instead of paying the full costs. Therefore, we prefer a proportional allocation of the costs to all producers of water-contaminating substances. Consequentially, the proportion of the costs that cannot be allocated properly must be financed differently. This

[3] civity Management Consultants, *Kosten und verursachungsgerechte Finanzierung einer vierten Reinigungsstufe in Kläranlagen. Ökonomische Instrumente zur Reduktion von Arzneimittelrückständen*

approach would lead to a higher acceptance of the EPR since no relevant substance producers are excluded and the financial burden of each sector will be less because it is distributed on a larger group of producers.

We think that the limitation to products placed on the market in amounts above 2 tons per year should be focussed on the active (pharmaceutical) ingredient and not on the product. However, many active compounds like the endocrine active substances are highly relevant both with respect to toxicity and ecotoxicity in extremely low concentrations. The amount of these active substances is in the range of kilograms and not tonnes per year, the threshold must be adjusted accordingly or such substances should be considered as relevant regardless of the amount placed on the market. To ascertain the appropriate parameters for regulatory limitations on substances, it is imperative to engage in a process of differentiation and evaluation. Specifically, a careful analysis is required to determine which substances of interest are excluded by the 2 tons per year threshold. Alternative thresholds for active substances might be derived based on the environmental risk assessment (ERA) data within the authorization process. For the existing substances, where the environmental data are not available, the data gap needs to be closed. This highlights the importance of the implementation of a catching up procedure for existing substances within the recent revision of the general pharmaceuticals legislation.[4]

We know of more than 2000 active (pharmaceutical) substances in Europe, resulting in an even larger number of products containing one or more of these active substances. According to UBA's internal database there are no environmental data (validated in authorisation procedures) available for 281 active substances, which might have adverse effects in the environment because of the predicted concentrations in surface water or specific substance characteristics like endocrine active substances. This is mainly because pharmaceutical products approved before 2006 generally lack an ERA and the authorization is not time-limited as is the case for biocides or plant protection products. Therefore, we doubt that a cost allocation based on individual active substances is currently doable. It will be a great challenge to find a classification method to categorize groups of active ingredients according to their potential risk and to allocate costs accordingly. The use of the available authorization data for this purpose should be considered. In cases where the risk associated with an active substance is not sufficiently known, a standardized evaluation must be used for an initial classification as long as environmental data are not provided within the catching up procedure.

The national collection of funds by the EPR includes to a large extent money from the pharmaceutical sector, which is mainly financed by health insurance funds. Consequently, it is reasonable to assume that the financial burden will be distributed across all individuals possessing health insurance coverage, rather than being disproportionately borne by those who are ill or socially disadvantaged. It also puts the funding model on a broad base.

Last, we do not expect market distortions between producers inside and outside the EU. The EPR is specific for the European market, regardless of the place of a product's production.

5 Increasing Circularity: Energy and Resources

The collection and treatment of wastewater is an energy-intensive process and the EC's proposal demands energy neutrality of WWTP and an energy audit of both, the WWTP and the collection system. Energy audits help to develop and monitor an efficient wastewater treatment system and are already common in Germany. Reaching energy neutrality, especially electricity

[4] See also our Scientific Opinion Paper "Improving environmental protection in EU pharmaceutical legislation": https://www.umweltbundesamt.de/publikationen/improving-environmental-protection-in-eu.

neutrality, is a significantly harder task, particularly for small WWTP where anaerobic digestion is not economically feasible. It is unclear, how energy neutrality could be reached on a national level and which entity is responsible for the allocation. Many WWTP only have limited space to implement additional renewable energy systems and further requirements on wastewater treatment will increase the energy demand. The customer generation of electricity is significantly cheaper compared to the electricity's market price. Hence, there certainly are economic incentives to generate additional renewable electricity on-site. We state that WWTP should use renewable energies but they should be able to purchase them if they cannot reach neutrality onsite.

Phosphorous is a finite resource that should be recovered and used. A potential phosphorous source is sewage sludge and we state that phosphorous recycling rates should be set up in the sewage sludge directive, not in the UWWTD (article 20). We further state that a link to the waste hierarchy might lead to the misleading conception that using sewage sludge in agriculture is environmentally preferable compared to thermal pre-processing and subsequent phosphorous recycling. In Germany, the agricultural use of sewage sludge will be heavily restricted in 2029 and a phosphorous recovery will be mandatory.

Water and treated wastewater are also valuable resources and we agree that both water reuse (article 15) and the use of rainwater within blue-green infrastructures is important to tackle water scarcity and reduce the stress on wastewater systems.

6 New Assignments: Public Health Surveillance

The monitoring of public health data (article 17) such as SARS-CoV 2 is an opportunity to improve our knowledge about public health, to adjust possible public health-related measures, and to protect ourselves from potentially dangerous diseases. These tasks demand a close collaboration of public health and wastewater authorities. The underlying cooperation and financing structure remain unclear and should be defined at the member-state level. Monitoring requirements should be based on up-to-date scientific assessments (e.g. due to the rather large data spread, the minimum SARS-CoV2 sampling frequency in Germany is twice per week, not once, as proposed by the EC's proposal).

7 Monitoring and analytical methods

Monitoring (article 8, article 14, and article 21) is necessary to measure the success of the UWWTD's requirements. Appropriate methods for these tasks are key and enable local authorities to act accordingly.

In general, we prefer 24-hour samples, because they are more representative than a random sample. Furthermore, WWTP operators continuously monitor much more data and the inclusion of self-monitoring data would largely improve the overall data quality.

We welcome the implementation of oxygen and carbon-related sum parameters (Annex D, Table 1) and state that the use of environmentally friendly methods should be mandatory.

The detection including sample preparation of phosphorus and nitrogen using molecular absorption spectroscopy should be listed in more detail (Annex D, Table 2), including available standards on the CEN or ISO level. The monitoring of micro-pollutants for the assessment of the quaternary treatment should cover a broader scope of chemical compounds, including their properties (Annex D, Table 3). Less soluble substances, chemicals from industry and daily use as well as biocides should be monitored. More specific reference methods should be recommended, including available standards on the CEN or ISO level to get harmonised results. This can include

optional recommendations for single substances and sum parameters, as well as chemical test methods, and effect- and substance-specific biological test methods.

Measuring diffuse greenhouse gas emissions is challenging and a WWTP-specific calibration is needed. We think that providing detailed information on how to carry out the respective measurements is pivotal.

8 Conclusion

We support the integrative and comprehensive approach in the EC's proposal towards not only an improved wastewater treatment but also an interlinked wastewater treatment. The clear shift from basic wastewater collection and treatment to efficient wastewater management will have a positive influence on various environmental targets. It will also reduce the impact of wastewater treatment on the receiving water bodies as well as the impact of climate change on both, our cities, and the environment. After getting the basics done in the last decades, it is time to move on and set ambitious new targets for the next 30 years.