June 2023

Fact Sheet

Baltic Sea Centre | Stockholm University

Effects of the proposed UWWTD on nutrient inputs to the Baltic Sea

The tightening of the removal requirements proposed in the new Urban Wastewater Treatment Directive is unlikely to have a decisive effect on the nutrient inputs, since most wastewater treatment in the total Baltic Sea drainage basin has improved to the proposed requirements in recent decades. The suggested actions on stormwater overflows and urban runoff could, however, be of importance. Further reductions on nutrient inputs from wastewater could be achieved through measures beyond the directive, such as regulations on private sewages in scattered dwellings and mandatory tertiary treatment of both nitrogen and phosphorus in the whole drainage basin.

Human wastewater has historically been one of the largest contributors to the anthropogenic nutrient inputs causing eutrophication in the Baltic Sea. However, large improvements in the wastewater sector during the last decades have reduced this pressure on the environment. Firstly, the vast majority of households in the Baltic Sea catchment area are now connected to a wastewater treatment plant, and secondly the treatment of wastewater has improved significantly.

Nevertheless, wastewater remains second biggest contributor to the nutrient inputs to the Baltic Sea. Based on the latest HELCOM assessment (PLC7), we estimated domestic wastewater to make up about 15 percent of the anthropogenic nitrogen and 31 percent of the anthropogenic phosphorus load, i.e. the load exceeding the natural background.

Based on data reported from Denmark, Finland, Germany, Poland and Sweden, municipal wastewater treatment plants contributed 77 percent and 64 percent respectively of the wastewater related flows of nitrogen and phosphorus, stormwater overflows 6 percent and 16 percent, and households in scattered dwellings not connected to wastewater treatment plants 17 percent and 20 percent.

New EU regulation on the table

The nutrient emissions from wastewater are primarily regulated in the EU Wastewater Treatment Directive (UWWTD). The requirements on wastewater treatment plants differ depending on how many persons the plant is serving, or more accurately how many per-

Wastewater treatment in urban areas is generally fairly advanced in the EU member states in the Baltic Sea drainage basin. Here is an aerial view of the wastewater treatment plant in Poland Wroclaw. Photo: Marius Szczygieł/Mostphotos

son equivalents, PE, the total stream of wastewater corresponds to (a large fraction of small-scale industries connected to the plant can, for example, lead to an increase of the PE in a smaller city or village).

The European Commission proposed a recast of the directive in October 2022 (Procedure 2022/0345/COD), which is currently negotiated in the European Parliament. Also the Council of Ministers has started discussing the proposal. The recast aims to streamline the UWWTD with related directives, and also extends treatment and collection requirements to agglomerations generating loads between 1,000 and 2,000 PE, introduces stricter treatment requirements including the removal of micropollutants (quaternary treatment) and requires integrated urban wastewater management plans addressing storm water overflows and urban runoff.

Requirements on small towns and cities

The new UWWTD draft will expand the obligation for centralised wastewater treatment to agglomerations between 1,000 and 2,000 PE, requiring at least secondary treatment, i.e. biological treatment and secondary settlement or other process that reduces wastewater nitrogen by around 35-55 percent and phosphorus by around 45-60 percent.

It is unclear how many of these small settlements already have access to sewage treatment. For example, Poland has taken large efforts to expand sewage treatment to rural areas. In 2000, only 11 percent of the population in rural areas were connected to wastewater treatment plants; this fraction increased to 47 percent in 2021.

Overall, approximately 21 percent of the population in the EU countries in the Baltic drainage basin live in settlements with less than 2,000 inhabitants. However, most of them (about 78 percent) live in towns and villages with less than 1,000 inhabitants, and will therefore not be subject to the new rules.

Expansion of tertiary treatment

The new UWWTD draft defines the entire Baltic Sea drainage basin as sensitive to eutrophication, an assessment that was previously the responsibility of each member state. Thereby the directive requires nutrient removal through tertiary treatment in cities generating a load larger than 10,000 PE by 31 December 2040. However, whether removing both nitrogen and phosphorus in waste-water treatment is required, or if removal of only one of these nutrients is sufficient, remains to be determined depending on what is needed to restore ecological status.

The new UWWTD draft also tightens the requirements on the effectiveness of the tertiary treatment, from 80 percent to 90 percent for phosphorus removal, and from 70 percent to 85 percent for the removal of nitrogen. Natural nitrogen retention until loads reach sensitive water bodies can no longer be accounted for by Member States as a means to reach the removal requirement.

The UWWTD permits national and local authorities to require stricter effluent limits to ensure that water bodies receiving wastewater effluents fulfill the requirements of other regulations, primarily the Water Framework Directive.

Effects of stricter requirements

Wastewater treatment in urban areas generating more than 2,000 PE is already today fairly advanced in the EU member states in the Baltic Sea drainage basin, meaning that the stricter rules proposed in the new UWWTD might not have much impact on the nutrient inputs to the sea. Nearly all large cities (more than 10,000 PE) apply tertiary treatment, and even most smaller cities (2,000 – 10,000 PE) are equipped with tertiary treatment.

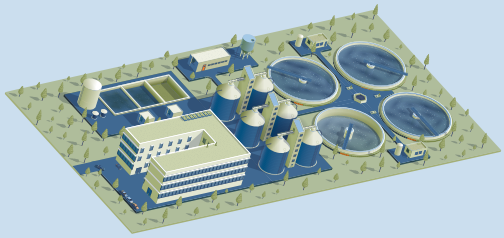
HELCOM has since 2007 stipulated tertiary treatment in wastewater treatment plants with a load larger than 2,000 PE. The phosphorus reduction requirements have been set to 80 percent in plants smaller than 100,000 PE and 90 percent in plants larger than 100,000 PE. In areas sensitive to nitrogen, removal efficiencies of 30 percent for plants smaller than 10,000 PE and 70-80 percent in plants larger than 10,000 PE have been recommended.

Previous estimates have given at hand that an implementation of 90 percent removal of phosphorus in all larger wastewater treatment plants in the HELCOM Contracting Parties would reduce the yearly phosphorus load to the Baltic Sea by 1,000 tonnes. Appropriate data to assess removal efficiencies actually achieved in the treatment plants are not reported to the EU Waterbase from all countries. The five countries that have reported measured nitrogen and phosphorus loads to EU for 2022 – Germany, Denmark, Lithuania, Latvia and Poland – achieved removal efficiencies of 84-90 percent for nitrogen and 92-95 percent for phosphorus in tertiary treatment, indicating the future potential of phosphorus reductions from the wastewater sector to be smaller than the previous estimate.

Removal of phosphorus or nitrogen

Today, the countries in the southern part of the Baltic Sea drainage basin mostly choose to remove both nitrogen and phosphorus in tertiary treatment, whereas Sweden and Finland mainly focus on phosphorus removal. The reason for this is that the Gulf of Both-

Nutrient removal in wastewater treatment plants



Primary treatment

Removal of suspended solids.

≈20-25 % N
≈ 10-30 % P

Secondary treatment

Biological treatment of wastewater to reduce the load of oxygen consuming substances.

≈ 35-55 % N
≈ 45-60 % P

>1,000 PE in new UWWTD

Tertiary treatment

Additional treatment step that increases nitrogen and/or phosphorus removal.

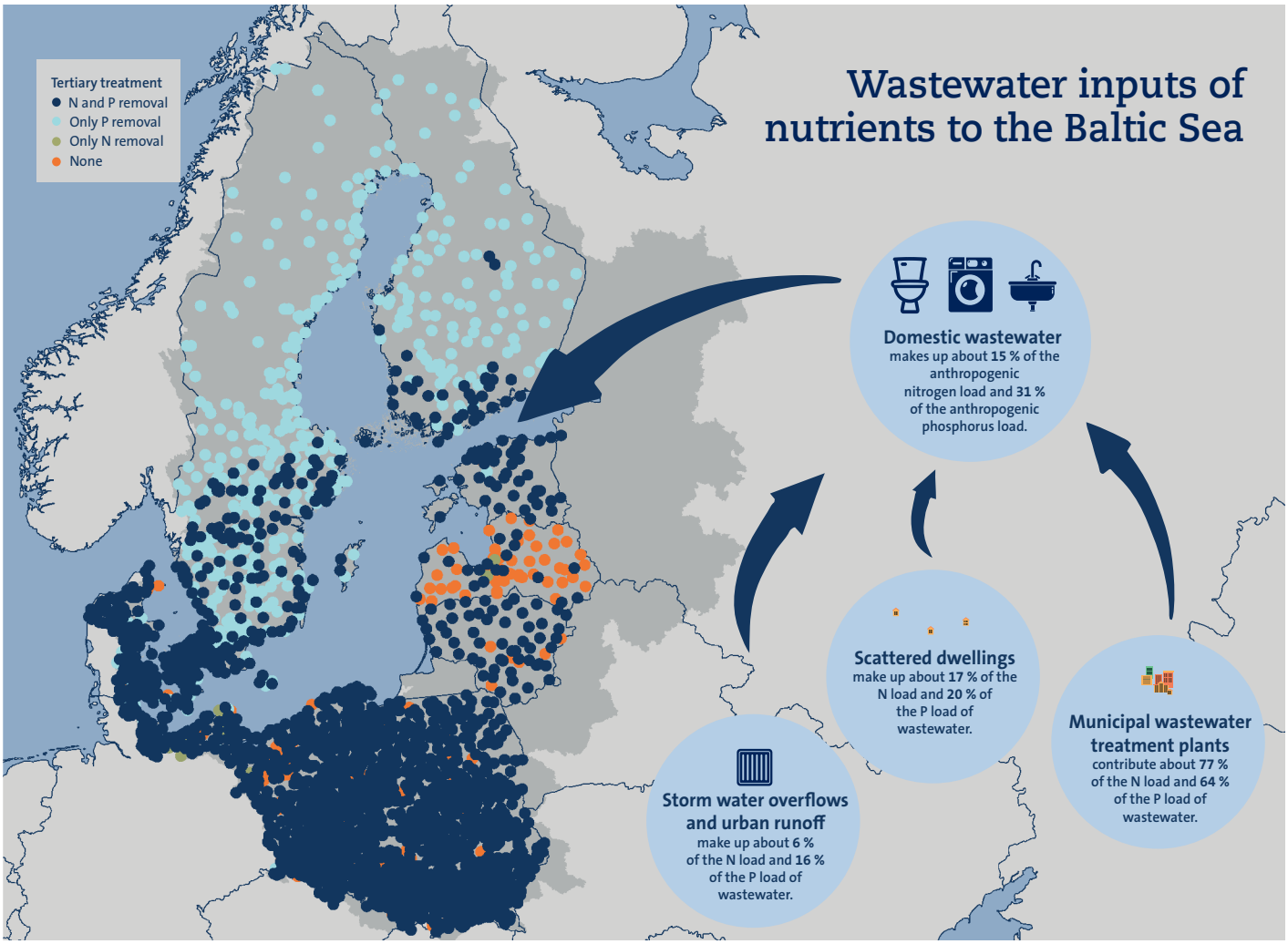
≈ 80 % N
≈ 90 % N

>10,000 PE in new UWWTD

Quaternary treatment

Removal of micropollutants, i.e. substances that are hazardous for public health and the environment even at low quantities.

>100,000 PE in new UWWTD



Most wastewater treatment plants that apply tertiary treatment remove both nitrogen and phosphorus, but Sweden and Finland often remove only phosphorus. The map shows municipal wastewater treatment plants in the EU part of the Baltic Sea drainage basin reported to EU Waterbase for 2022. The fractions of wastewater are based on data reported from Denmark, Finland, Germany, Poland and Sweden.

nia has been considered not sensitive to nitrogen, meaning that the concentration of nitrogen in the water is not limiting primary production.

More recent studies, however, show that at least parts of the Bothnian Sea have been nitrogen limited for some time, probably due to import of phosphorous-rich water from the neighbouring heavily eutrophied Baltic Proper. Quantitatively the wastewater related nitrogen load to the Gulf of Bothnia is not negligible, but its effect on eutrophication is not properly assessed. Implementation of tertiary treatment nitrogen removal in this area would lead to a nitrogen load reduction corresponding to about one third of the deposition from shipping in the whole Baltic Sea.

Wastewater treatment in non-EU countries

Coalition Clean Baltic has collected information about sewage treatment from non-EU countries within the Baltic Sea catchment. Many projects have been implemented to upgrade wastewater treatment plants in major cities also in the non-EU parts of the Baltic Sea drainage basin. For example, the two major municipal pollution sources in St. Petersburg and Kaliningrad, Russia, are now removed from the HELCOM list of hot spots. Removal of phosphorus has reached 90 percent in St. Petersburg, while in the city of Kaliningrad removal rates of 78 percent for nitrogen and 81 percent for phosphorus were achieved. Nevertheless, a number of WWTPs remains to be re-constructed in the Pskov and Leningrad Oblasts of Russia.

Likewise, the situation in the Baltic Sea catchment of Belarus were improving with the financial support for modernisation of major WWTPs in HELCOM municipal hotspots (incl. Brest, Vitebsk, Grodno) until 2020, when foreign grants and loans to Belarus were frozen (the same applies to cooperation with Russia since late February 2022).

Ukraine is striving towards harmonisation with EU legislation and respective application of EU UWWTD standards. However, lack of funding caused a number of delays in practical implementation. Currently, the WWTPs in the Ukrainian part of the Baltic Sea catchment serve ca. 935 thousand people, out of 1.4 million in the catchment. The WWTPs are mainly equipped with secondary treatment. Plans for reconstruction and modernisation of WWTPs will be included into the Green Recovery programme for rehabilitation of environmental infrastructure in Ukraine.

Phosphorus use in household detergents

The EU banned the use of phosphates in household laundry and dishwasher detergents in 2013 and 2017, respectively. In the 1980s, detergents were a large source of phosphorus in wastewater with per capita emissions in Denmark, Finland, Germany, Finland and Poland between 0.38 – 0.59 kg phosphorus per year, which is substantial compared to the average human excretion rate of about 0.6 kg phosphorus per year.

In Russia, Belarus and Ukraine, however, phosphorus use in laundry and dishwasher detergents is still not banned. Implementing a ban on phosphate in detergent in those countries could potentially lead to a correspondingly significant reduction of the phosphorus load to the Baltic Sea. Certain steps have been undertaken by Belarus and

Summary of treatment levels

Size category (PE)	UWWTD in force	UWWTD draft	HELCOM 28E/5
300-1,000	No requirement	No requirement	N* 35 mg/l (30%) P 2 mg/l (70%)
1,000-2,000	No requirement	Secondary	N* 35 mg/l (30%) P 2 mg/l (70%)
2,000-10,000	Secondary	Secondary	N* 30 % P 1 mg/l (80%)
10,000-100,000	Tertiary in sensitive areas, N and/or P depending on local situation N 15 mg/l P 2 mg/l	Tertiary in sensitive areas = whole Baltic Sea, N and/or P depending on local situation N 6 mg/l (85%) (85%) P 0.5 mg/l (90%)	N* 15 mg/l (70-80%) P 0.5 mg/l (90%)
> 100,000	N 10 mg/l P 1 mg/l	N 6 mg/l (85%) P 0.5 mg/l (90%)	N* 10 mg/l (70-80%) P 0.5 mg/l (90%)

*Only in sensitive areas

Russia within the Eurasian Customs Union by introducing technical regulations to be enforced by 2024, while Ukraine will implement rules on phosphorus in household detergents within the process of aligning to EU legislation.

Stormwater and urban runoff

Waterborne nutrients and contaminants from urban areas reach the Baltic Sea also in form of urban runoff, i.e. rainwater that enters sewers and is discharged to waterbodies. In some cities, rainwater is collected together with wastewater in combined sewers. In cases of heavy rain, the sewerage system might be unable to handle all the incoming water, leading to a so-called stormwater overflow, letting both storm water and wastewater reach the waterbodies untreated.

Denmark, Finland, Germany, Poland and Sweden reported that urban runoff and stormwater overflows made up 2-22 percent of their wastewater related nitrogen input to the Baltic Sea and 1-47 percent of the respective phosphorus input. However, the large scatter in the data shows that the load estimation from urban runoff and storm water overflows is highly uncertain.

The new UWWTD draft tries to address this issue by making integrated urban wastewater management plans mandatory in agglomerations larger than 10,000 PE where storm water overflow corresponds to more than 1 percent of the collected wastewater load or poses environmental or human health problems. Although difficult to quantify, these measures can potentially be of large importance for reducing the loads of both nutrients and contaminants to the sea.

TO BRIDGE THE GAP BETWEEN SCIENCE AND POLICY

This fact sheet is produced by Stockholm University Baltic Sea Centre.

Scientists, policy and communication experts work together to bridge the gap between science and policy.

We compile, analyse and synthesise scientific research on Baltic Sea related issues and communicate it at the right moment to the right actor in society.

Data on sewage treatment in non-EU countries have been provided by Coalition Clean Baltic.

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