RIWA-Meuse

Annual Report 2024
The Meuse

Urgently better protect the Meuse!

RIWA - Vereniging van Rivierwaterbedrijven

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Introduction

Water quality in the Meuse
A complex challenge that requires transparency and decisiveness

We take safe and healthy tap water for granted. But we shouldn't: drinking water companies work hard to purify our water because drinking water sources, including the Meuse, are being polluted with harmful substances.

RIWA-Meuse continued its efforts to improve the quality of water in the Meuse in 2024. Our members and Rijkswaterstaat (the executive agency of the Ministry of Infrastructure and Water Management) measure water quality on an annual basis. These measurements show that the river contains numerous chemicals, many of which can be harmful even at very low concentrations. Some examples are industrial discharges, plant protection products, consumer products and pharmaceutical residues. Some newly-developed substances and the extent of their harm are not even known yet.

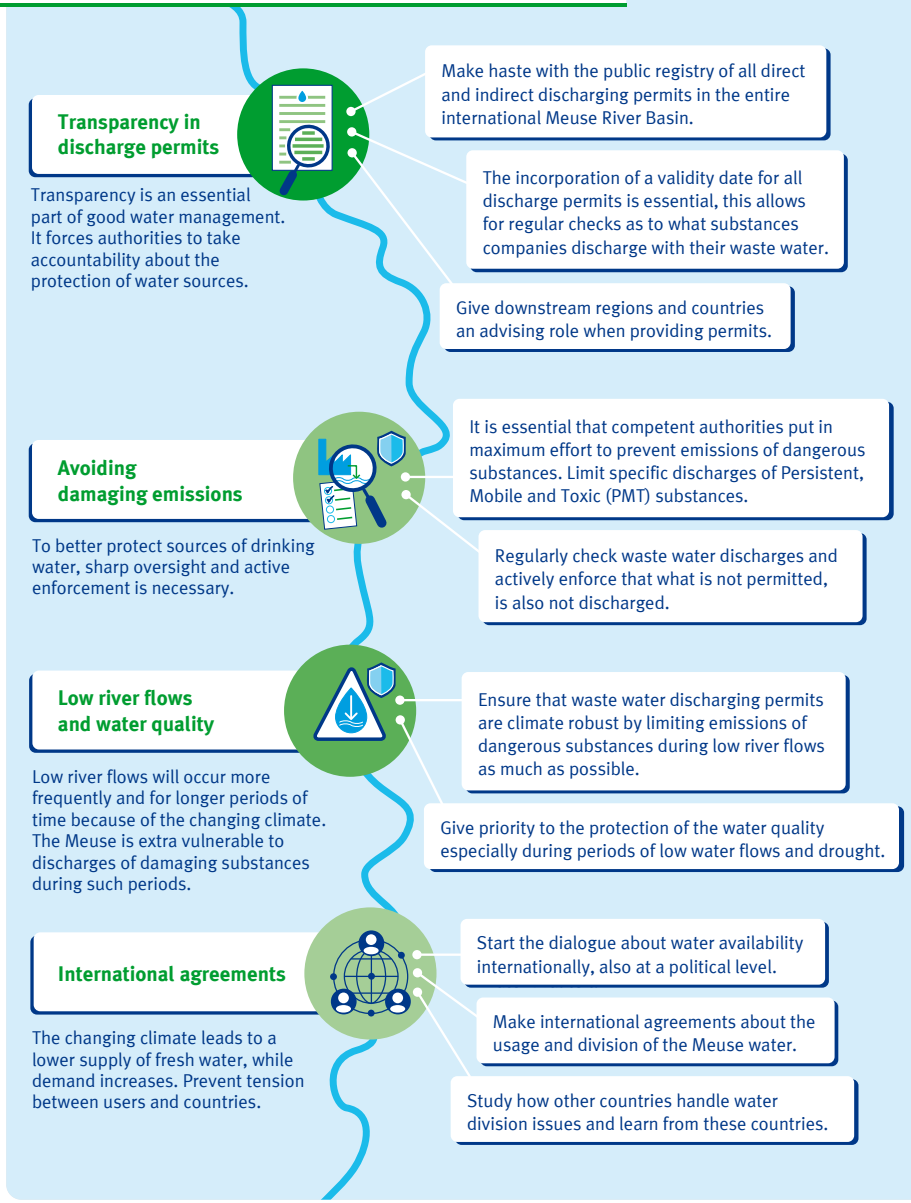
"Transparency is an essential part of good water management."

The changing climate is exacerbating the problem. The expectation is that low river flows will become more frequent in the future: less water in the river, often leading to higher concentrations of difficult-to-degrade substances. As a result, drinking water companies will regularly be forced to stop their abstraction of Meuse water.

What can we do?

How can we better protect the quality of water in the Meuse as a source of drinking water for 7 million people in Belgium and the Netherlands? We posed this question to professionals in the water sector and beyond: the governor of Antwerp, an innovator from the Dutch police force, two professors, an expert

What is needed to better protect the Meuse as a source of drinking water for 7 million people?



from Rijkswaterstaat, the Director of Evides Waterbedrijf and our own association's data analyst. The interviews in this annual report reveal their different perspectives on what one of them calls a "huge problem".

Transparency is an essential part of good water management. It forces the government to take accountability and enables society to scrutinise government actions. Transparency can also help the government perform better. For example, when stakeholders use public information to develop concrete solutions that can help governments protect water quality. An example of such a concrete solution is the National Police's water contamination hackathon in 2024. It brought scientists, water experts and police officers together to develop new detection methods. These methods proved effective and were even used to identify the perpetrators of water contamination.

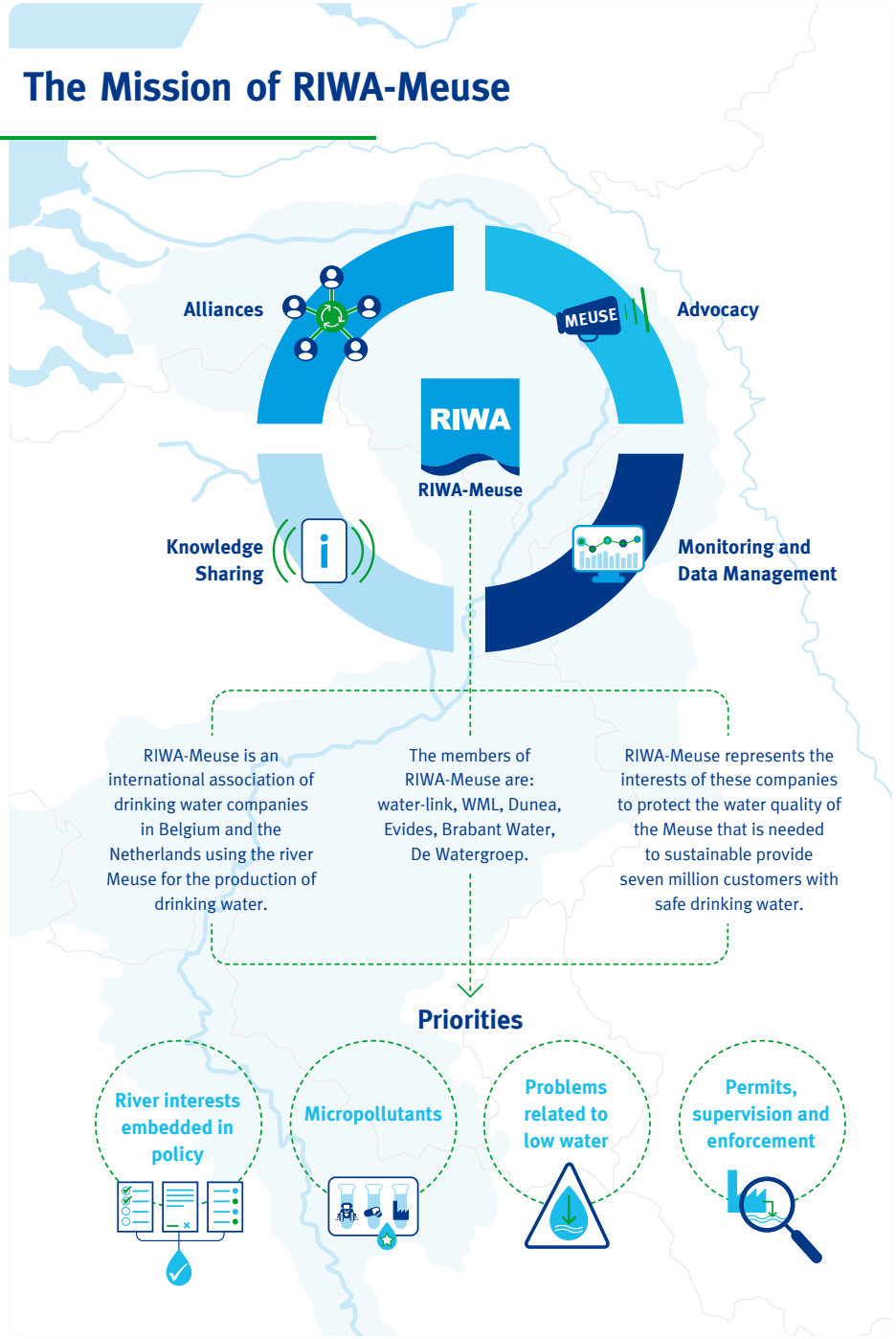
A better insight into discharges

To protect and improve the water quality, it is important to know which companies are discharging wastewater and which substances are being discharged and where, both into surface water and the sewer network. A comprehensive overview is lacking but desperately needed. Currently, none of the various relevant authorities possess a complete insight into which harmful substances are being discharged into the water and where. This insight is essential for the effective monitoring of water quality in the Meuse and to reach the water quality improvement objectives. The Atlas for a Clean Meuse, an initiative of the Clean Meuse Water Chain partnership (SMWK), is a good step in the right direction. It visualises direct discharge data from companies in the Dutch and Flemish parts of the Meuse River Basin. The next step will be to add all wastewater discharges into the sewer network and expand the Atlas to include other countries in the Meuse River Basin .

Robust, transparent, and climate-proof permits?

Greater insight is also needed into the extent to which discharge permits adequately protect the Meuse during periods of low flow. RIWA-Meuse commissioned consultancy 'HKV lijn in water' to study the robustness, transparency and

The Mission of RIWA-Meuse



climate sensitivity of the water quality assessment for discharge permits. This research assesses the harm to water of the discharges as they enter. As is clear later in this report, the study shows that if permits are not reviewed regularly, the current procedure insufficiently protects the Meuse as a source of drinking water during prolonged periods of low river flows. It has been proven difficult for the relevant authorities to regularly review permits in practice: the question is whether the current system should now be reviewed to ensure the Meuse is adequately protected when river flows are low (which has already become a more frequent occurrence)? This situation also raises the question of what other countries in the Meuse River Basin are doing to protect river water during prolonged periods of low river flows?

International River Basin

Transparency is also necessary regarding water abstractions: who is using water from the Meuse, where and why? This insight is essential to facilitate fact-based, well-considered decisions at times when river flows are very low. To date, these decisions have mainly been made at the regional and the national level. However, the Meuse River Basin spans multiple countries. It would be wise to include the broader international dimension in water management: observe how other countries solve water distribution problems and learn from them.

By definition, good water management requires close cooperation with your neighbours: sharing information, engaging in dialogue and making clear international agreements. A good example of this is the Meuse Discharge Treaty between the Netherlands and Flanders. This treaty has been in place for 30 years now and regulates water distribution between the two parties during periods when river flows are low. International agreements of this nature should be applied more in a broader sense; the Meuse River Basin . Why is this important? International agreements provide clarity on how to respond to water shortages and help prevent potential problems and conflicts between users and regions. Much work still remains to be done!

Prioritising water quality

In this report, we also highlight that while water quality policy is fundamentally sound—with solid guidelines and legislation at the European and national levels—its implementation, and therefore its practical application, often falls short. The government has a role to play in championing this collective interest. As one of the interviews shows, this occasionally means making difficult decisions.

"The government has a role to play in championing this collective interest."

Unfortunately, water quality is still not being given the priority it deserves, although there are a growing number of interesting social initiatives: hikers along the Meuse River who try to raise awareness of water quality, companies that are developing technology to monitor discharges and the Plastic Soup Surfer, who is surfboarding through France to encourage more countries to impose deposits on cans and plastic bottles. Good river water quality is not essential for the drinking water supply alone; it is a collective interest: essential for residents and nature but also to agriculture and industry.

In the past, numerous measures have been taken to improve the water quality in the Meuse. Municipal wastewater has been treated since back in the 1970s and, thankfully, dead fish floating down the river as a result of toxic and oil discharges are a thing of the past. With the introduction of the European Water Framework Directive (WFD), objectives have become more stringent and water quality has improved considerably. Pesticide levels in the water have been reduced and swimming is possible in many stretches of water too. If significant steps to improve water quality were taken in the past, they should be possible now as well!

Maarten van der Ploeg, Director of RIWA-Meuse

A

The Meuse as a source of drinking water

RIWA-Meuse
Association of River Water Companies, Meuse section

Who we are

RIWA-Meuse unites six drinking water companies in the Netherlands and Belgium. Together, they extract approximately 450 billion litres of water from the Meuse every year. These companies supply drinking water to urban areas around Antwerp, Rotterdam and The Hague, amongst others, as well as parts of Limburg, Zeeland and West Flanders.

Our mission

RIWA-Meuse aims to protect the quality of surface water in the Meuse River Basin as a source of drinking water for seven million people. A well-protected source enables water companies to produce clean drinking water sustainably, using natural purification technologies. The water quality that RIWA-Meuse aims to achieve is set out in the European River Memorandum (ERM).

What we work on

RIWA-Meuse identifies developments and trends that could pose a risk to water quality in the Meuse. For example, the numerous sources of pollution. To ensure the sufficient availability of Meuse water, RIWA-Meuse studies the impact of climate change on the drinking water production.

RIWA-Meuse draws on facts to inform a broad public on developments that impact water quality and quantity in the Meuse River Basin . RIWA-Meuse is actively collaborating with partners on joint solutions to reduce pollution and strengthen preparedness for the impacts of climate change.

Efforts to protect the Meuse as a source of drinking water cover a wide range of policy areas, are divided into various fields and span four countries. RIWA-Meuse is able to rely on a broad international network to achieve its objectives.

Our members

- **Water-Link**
- **Dunea**
- **Brabant Water**
- **WML**
- **Evides Waterbedrijf**
- **De Watergroep**

Want to know more?

See riwa-maas.org.

How did things go in 2024 for the Meuse as a source of drinking water? What events affected the water quality?

A1 A list of the facts about measurements in the Meuse

In 2024, the members of RIWA-Meuse and Rijkswaterstaat (the executive agency of the Ministry of Infrastructure and Water Management) conducted a total of 104,470 measurements on 1,040 parameters at various monitoring points along the Meuse. Of these 1,040 parameters, 648 were testable, and of these, 67 (10.3%) exceeded the European River Memorandum (ERM) target value once or more at one or more of the monitoring points. In 2020, 170 drinking water companies in the river basins of the Meuse, Rhine, Danube, Elbe, Ruhr and Scheldt in 18 countries drafted this agreement. It is possible to produce drinking water in a sustainable way with natural purification methods from water that meets the ERM target values. The reason that 392 parameters were not testable in 2024 has to do with the fact that there is no ERM target value for them.

Of the 67 exceeded parameters, 34.3% (23) belong to the category industrial pollutants and consumer products and 25.4% (17) to the category pharmaceuticals and endocrine-disrupting chemicals. These two categories consist mainly of non-standardised substances; also known as ‘emerging’ or new substances.

A2 Insight into abstraction restrictions

When the quality of the source that drinking water companies use is inadequate, water abstraction from the source in question is temporarily suspended or reduced; this is a so-called abstraction stop or restriction. In 2024, the joint drinking water companies that use the Meuse as a source of drinking water implemented a total of 94 abstraction stops and restrictions for the Meuse. Sixty-one of these stops and restrictions were due to water pollutants. Normal operations were interrupted or disrupted due to pollutants for a total of 6,169 hours (257 days, cumulative for six abstraction points). A summary of the number of abstraction restrictions and their duration in the period 2007 to 2024 appears in Figure 1.

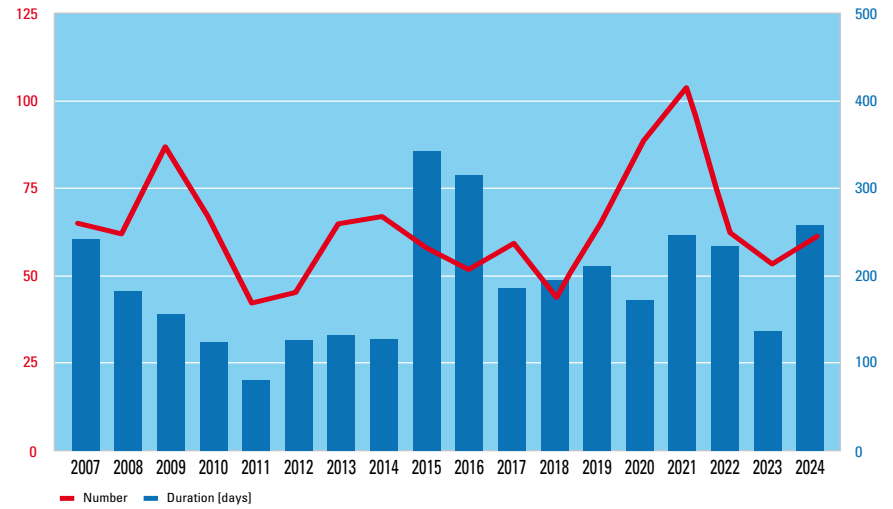


Figure 1: Number and duration of abstraction restrictions due to pollutants (cumulative) along the river Meuse, 2007-2024.

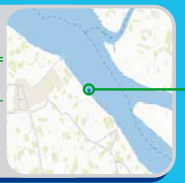
Whether and how often drinking water companies shut off their water abstraction (an abstraction stop) differs from location to location. The abstraction point furthest upstream at Tailfer in Wallonia is never shut off. Further down the river, in Flanders, the Belgian drinking water company Water-Link rarely needs to stop water abstraction from the Albert Canal due to the canal system’s cushioning effect on water quality. Because the water stays in the canal longer and passes through the locks gradually, pollutant peaks are levelled out. Across the Dutch border, at the Heel abstraction point, drinking water company WML frequently closes the gate. In 2024 there was just one long-term abstraction restriction at the Brakel abstraction point. Dunea started to use a number

The Meuse as source of drinking water

HARINGVLIET

Abstraction: Evides

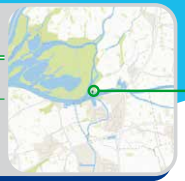
Profile: Dune infiltration



BERGSCHE MAAS

Abstraction: Evides/WBB

Profile: Reservoirs in the Biesbosch

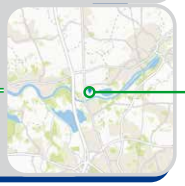


ALBERT CANAL

Abstraction: water-link

Profile: Provides 40% of Flanders with drinking water (also through deliveries to Watergroup, Farys and PIDPA)

NETE CANAL



BERGAMBACHT

Abstraction: Dunea

Profile: Dune infiltration (emergency intake from the Lek)

BRAKEL

HEEL

Abstraction: WML

Profile: Infiltration into riverbank (by infiltration from Lange Vlieter at Heel)

ROOSTEREN

TAILFER

Abstraction: Vivaqua*

Profile: Direct intake from the Meuse

SURFACE WATER AS SOURCE FOR DRINKING WATER

RIWA-Meuse member utilities	*Surface water extraction (%)*	*Surface water extraction (10^6 m^3/year)*	*Customers supplied with surface water*
Evides (+WBB)	85%	203,3	2,0 million
water-link	100%	150,2	2,5 million
Dunea	100%	66,1	1,5 million
Vivaqua*	30%	34,4	750.000
WML	25%	5,9	280.000
Total		**459,9**	**7,0 million**

* Vivaqua is no longer a member of RIWA since 2021, however water quality data continues to be exchanged.

of different sources in 2024, which has made it less reliant on the availability of Meuse water. For example, water from the Afgedamde Maas (Dammed-up Meuse) and the Lek (Rhine water) is mixed.

The Evides abstraction points at Gat van de Kerksloot/Keizersveer[1] (until 2021) and the Bergsche Maas/Hank (from 2021) would seem to be the best gauge for the condition of the river, because only Meuse water is available there. The water abstraction from the Haringvliet consists mainly of Rhine water.

A3 Monitoring and measurement results

Every three years, RIWA-Meuse evaluates the substances in the Meuse that are relevant to the drinking water sector. RIWA-Meuse does this based on a broad monitoring programme. The most recent evaluation took place in 2024.

Since 2007, in addition to a set of legally defined parameters, RIWA-Meuse has been working with a priority system. The system aims to facilitate targeted substance monitoring and to leverage emerging developments more effectively. Every three years, RIWA-Meuse evaluates the system, with the most recent evaluation taking place in 2024. The report 'Drinking water-relevant substances in the Meuse 2024' describes how this was done.[2]

For this monitoring, RIWA-Meuse has applied a classification into three categories of substance since 2015:

- Drinking water-relevant substances: the substances RIWA-Meuse prioritizes in its advocacy efforts..
- Candidate drinking water-relevant substances: substances that have not been measured yet, or not sufficiently.
- Substances that are no longer relevant to drinking water.

The results from this monitoring in 2024 can be found in Annex 1. Given the importance of substance properties like persistence, mobility, and toxicity in drinking water production, we will begin by exploring these characteristics further. After this, we will discuss which substances were detected in the Meuse in 2024 in concentrations above the target value in the European River Memorandum (ERM target value). It is possible to produce drinking water in a sustainable way with natural purification methods from water that meets the ERM target values.

PMT scores thanks to RIVM screening tool

During an interview in the RIWA-Meuse annual report on 2022, Julia Hartmann of the National Institute for Public Health and the Environment (RIVM) referred to a method of screening PMT properties. These Persistent, Mobile and Toxic (PMT) substances have been listed in the European CLP (classification, labelling and packaging) Regulation since 20 April 2023.

It will take some time before manufacturers have this information on the labels, but in the interim the RIVM has developed a method for screening potential PMT substances. "We hope that this will help in identifying harmful substances as early as possible," said Julia Hartmann in that interview. In this chapter, we will outline some developments around the screening tool.

Quantity of PMT substances and practice

The PMT screening tool has now been expanded to include PBT screening, and is therefore renamed the 'PBT and PMT screening tool'.. PBT stands for persistent, bio-accumulative and toxic. Substances that have been identified as PBT under the REACH (Registration, Evaluation and Authorisation of Chemicals) Regulation of the European Union are included in the RIVM candidate list of Substances of Very High Concern (SVHCs) for authorisation.

There is a difference in the P-score for PMT screening and PBT screening. This is because the PBT assessment focuses on substances that accumulate in the soil and sediment - these are highly absorbent, hydrophobic substances (substances that are water-repellent or do not mix (or mix very poorly) with water). The PMT assessment focuses on substances that tend to stay in the water: hydrophilic substances.

1 *The actual abstraction point was situated at Gat van de Kerksloot; the Keizersveer measurement point was representative for this abstraction point.*
2 *https://www.riwa-maas.org/publicatie/an-update-of-the-lists-with-substances-that-are-relevant-for-the-production-of-drinking-water-from-the-river-meuse-2/*

The PMT theme group, under the Approach to Emerging Substances working group (WAOS), has proposed expanding the database, which forms the basis of the screening tool. Currently, the PMT screening tool includes scores of about 6,000 substances, based on properties of around 65,000 substances. RIVM is basing its scores on the properties of approximately 750,000 substances. This is expected to lead to a significant increase in the number of substances with a PMT score. The total now stands at well over 10,000.

Scores from the PMT screening tool are based on an estimation of the properties of a substance. "The screening is based on models and not on experimental data," Julia Hartmann explained in the interview in the annual report on 2022. The models in question are mathematical models for structure-activity relationships (SARs) and quantitative structure-activity relationships (QSARs), collectively known as (Q)SARs. These models can be used to make predictions about the physico-chemical and biological properties of compounds and their environmental fate based on knowledge of their chemical structure.

The PMT theme group has proposed to compare the measurement data of the drinking water companies with the PMT scores from the screening tool. This will make it clear whether the outcomes of the (Q)SAR models behind the PMT scores correspond to real-world measurement data. In 2025, the drinking water companies launched a project to gain this insight. It will run until the end of 2025 and provide more clear insight on possible differences between the predicted persistence and mobility of substances and the properties observed in practice.

A3.2 Per- and polyfluoroalkyl substances (PFAS)

A special category of substances with PMT properties are the per- and polyfluoroalkyl substances (PFAS). The target value set out in the European River Memorandum for anthropogenic non-natural substances with an impact on biological systems is 0.1 micrograms per litre, unless a lower value is required as a result of advancing toxicological understanding. This is the case for PFAS. The new EU Drinking Water Directive[3] offers a choice PFAS standard: PFAS total (500 nanograms per litre) or the sum of 20 PFAS (100 nanograms per litre). Belgium and the Netherlands chose the sum of 20 PFAS, as shown in Table 1. Figure 2 shows an example of the development in concentrations of the sum of these 20 PFAS in the Meuse at Liège in 2024. The 20 PFAS listed in Part B of the EU Drinking Water Directive were assessed as a relevant group of drinking water in 2021. On 15 November 2024, PFAS were added to the RIVM list of SVHCs.[4]

Table 1: 20 PFAS from Part B of the EU Drinking Water Directive 2020/2184 and their PMT scores from the RIVM screening tool.

20 PFAS EU Drinking Water Directive	PMT score	P score	M score	T score
Perfluorobutanoic acid (PFBA)	0.57	0.62	0.61	0.48
Perfluoropentanoic acid (PFPeA)	0.63	0.83	0.55	0.54
Perfluorohexanoic acid (PFHxA)	0.65	0.93	0.49	0.61
Perfluoroheptanoic acid (PFHPA)	0.63	0.98	0.42	0.61
Perfluoroctanoic acid (PFOA)	0.60	0.99	0.36	0.61
Perfluorononanoic acid (PFNA)	0.57	1.00	0.31	0.61
Perfluorodecanoic acid (PFDA)	0.54	1.00	0.25	0.61
Perfluoroundecanoic acid (PFUnDA)	0.50	1.00	0.21	0.61
Perfluorododecanoic acid (PFDoDA)	0.47	1.00	0.17	0.61
Perfluorotridecanoic acid (PFTrDA)	0.44	1.00	0.14	0.61
Perfluorobutane sulfonic acid (PFBS)	0.63	0.92	0.51	0.53
Perfluoropentane sulfonic acid (PFPeS)	0.69	0.97	0.45	0.77
Perfluorohexane sulfonic acid (PFHxS)	0.60	0.99	0.39	0.55
Perfluoroheptane sulfonic acid (PFHpS)	0.57	1.00	0.33	0.55
Perfluorooctane sulfonic acid (PFOS)	0.53	1.00	0.27	0.55
Perfluorononane sulfonic acid (PFNS)	0.50	1.00	0.23	0.55
Perfluorodecane sulfonic acid (PFDS)	0.47	1.00	0.18	0.55
Perfluoroundecane sulfonic acid (PFUdAS)	0.43	1.00	0.15	0.55
Perfluorododecane sulfonic acid (PFDoAS)	0.40	1.00	0.12	0.55
Perfluorotridecane sulfonic acid (PFTDAS)	0.37	1.00	0.09	0.55

<0.33 low to moderate P/M/T concern, 0.33-0.5 high P/M/T concern, >0.5 very high P/M/T concern

3 *Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (recast)*

4 *https://rvszoeksysteem.rivm.nl/ZZSlijst/ZZSgroep/ZZS_PFAS*

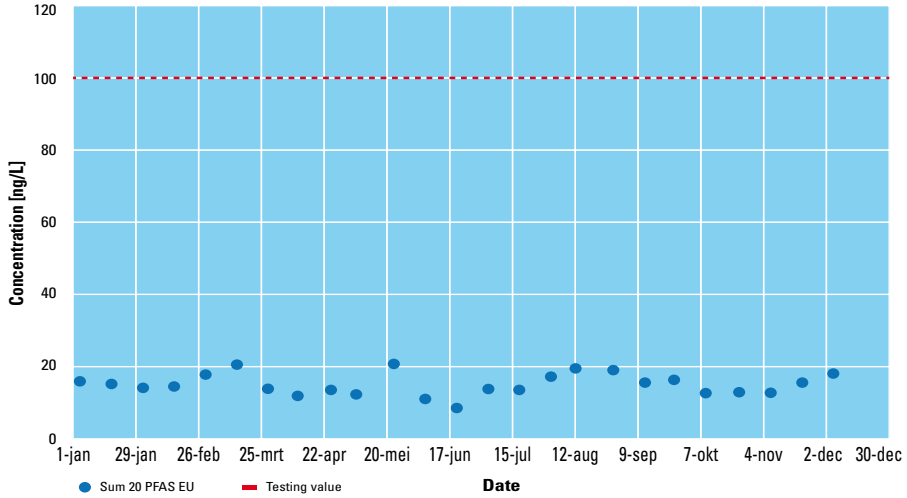


Figure 2: Concentrations of sum PFAS 20 EU in the Meuse at Liège in 2024.

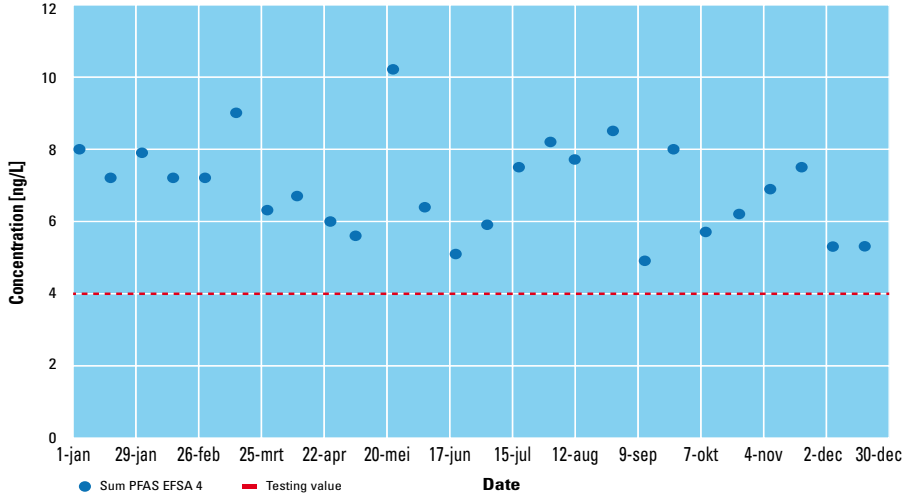


Figure 3: Concentrations of the sum PFAS EFSA 4 in the Meuse at Liège in 2024.

There is currently a discussion among scientists and policy makers regarding the assessment against what is known as EFSA 4, the sum of four PFAS: PFOA, PFOS, PFNA and PFHxS. In Belgium, the sum of the concentrations is used and tested against 4 nanograms per litre. See figure 3 for an example of how the concentrations of these four PFAS have developed in the Meuse at Liège. In the Netherlands, the sum of the PFOA equivalents (PEQ) is used and tested against 4.4 nanograms PEQ per litre for all PFAS.[5] The Netherlands includes as many PFAS as possible in a risk assessment. RIVM has developed the RPF method (Relative Potency Factors) for this purpose. This allows PFAS to be assessed as a group in mixtures that people ingest.

A3.3 Trifluoroacetic acid: a 'forever chemical' with more sources than just PFAS

Trifluoroacetic acid (TFA) is regularly measured in concentrations above 1 microgram per litre, or 1,000 nanograms per litre, in the Meuse; as also seen in figure 4. Like PFAS, this substance is called a 'forever chemical' because of its persistence: it remains in the water. When choosing PFAS total under the EU DWD, it is crucial to know whether TFA is considered PFAS, as it is in the definition of the Organisation for Economic Cooperation and Development (OECD). TFA is not included in the sum of 20 PFAS.

To date, RIWA-Meuse has grouped TFA with the category Industrial pollutants and consumer products in its annual water-quality reports. This is because TFA is used:

- in the production of trifluoroacetic fluoride and 2,2,2-trifluoroethanol;
- in some HPLC analyses, to reduce the occurrence of tailing;
- as a building block in the synthesis of pharmaceutical substances and agricultural chemicals and as a catalyst in polymerisations and condensation reactions;
- during in vitro peptide synthesis, to remove the tert-butoxycarbonyl protecting group from amino groups;

5 *https://www.rivm.nl/pfas/drinkwater*

- in the production of ceramic materials;
- as a solvent in NMR spectroscopy and in mass spectrometry.

TFA is also a breakdown product of hydrofluorocarbons (HFCs), which are used in applications including air conditioners, foam blowing agents and propellant gases in aerosols.

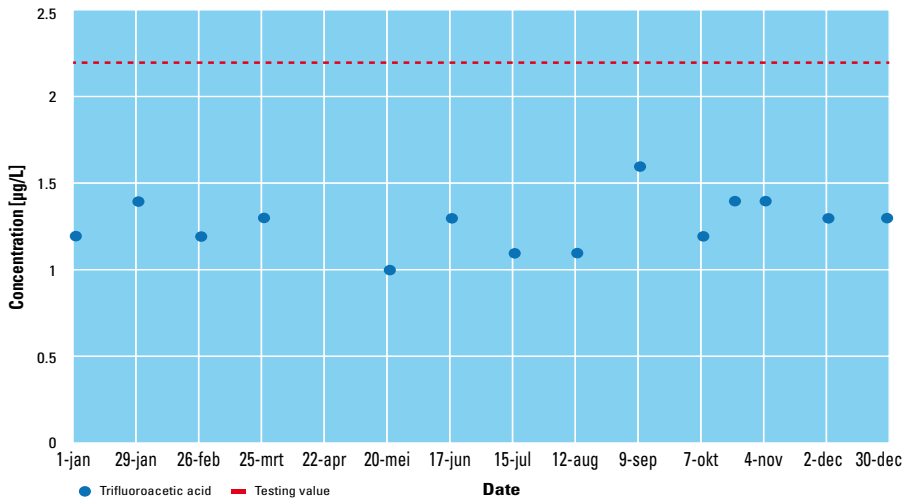


Figure 4: Concentration of TFA in the Bergsche Maas in 2024.

However, it has recently become clear that TFA as a metabolite of plant protection products is a much more significant source than previously assumed. An article in the scientific journal Environment International states that the use of plant protection products with a C-CF3 group in agriculture results in the formation and emission of a substantial amount of TFA.[6] Besides being a source of TFA, some plant protection products are themselves PFAS according to the OECD definition.

On 9 November 2023, Pesticide Action Network Europe (PAN Europe) and Générations Futures published a report on authorised plant protection products that can be classified as PFAS[7]. Some findings from this report follow below:

- Currently, 12% (37) of synthetic active substances authorised for pesticide use in the European Union are PFAS. These substances all contain strong carbon-fluoride bonds, which increases the amount of breakdown products (metabolites) or their persistence in the environment;
- An analysis of French sales figures for these substances raises concerns about the growing popularity of PFAS pesticides. Sales in France showed a significant increase, tripling between 2008 and 2021.

On 21 January 2024, an article was published in Het Financieele Dagblad (a Dutch newspaper) about plant protection products based on active ingredients that the OECD defines as PFAS[8]. In this article, both Vewin and RIWA expressed the concerns of drinking water companies about the possible exemption of PFAS from a ban on use. On 10 October 2024, an article entitled 'Pesticides can be a substantial source of trifluoroacetate (TFA) to water resources' was published in Environment International[6].

This isn't news, is it?

As more and more emerged about the harm of PFAS-use, RIWA used the data available to the organisation to analyse the fluorinated compounds back in 2020. This analysis also included European plant protection product authorisations and revealed that 33 fluorinated active substances had been authorised at the time. In the same year, the analysis was discussed in the technical consultation between the drinking water companies and the Board for the Authorisation of Plant Protection Products and Biocides (CTGB). The consultation resulted in the decision to add TFA as a metabolite of plant protection products and biocides to the annual analysis of breaching, authorised substances.

6 https://www.sciencedirect.com/science/article/pii/S0160412024006470?via%3Dihub

7 https://www.pan-europe.info/sites/pan-europe.info/files/public/resources/reports/PFAS Pesticides report November 2023.pdf

8 https://fd.nl/samenleving/1503329/drinkwaterbedrijven-ontstemd-boeren-mogen-pfas-blijven-spuiten

In 2022, RIVM published a report entitled 'Inventory of Dutch Substances of Very High Concern in pesticides'[9]. A number of results from this report follow below:

- Approximately 20% of pesticides in the Netherlands contain SVHCs. Approximately 10% contain substances that are suspected SVHCs, while approximately 5% contain PFAS;
- The German institutes BAUA and BVL have concluded that 9 of the active substances for biocides and 34 of the active substances for plant protection products that were approved in 2021 met the OECD definition of PFAS; 3 active substances appear on both lists. A total of 40 active substances fall under the OECD definition of PFAS.
- Flocoumafen is the only one of the active substances above currently on the (RIVM) Netherlands' list of SVHCs because it is classified as toxic to (human) reproduction. The other 39 substances are not currently on the Netherlands' list of SVHCs despite potentially being SVHCs; this is because they fall under the PFAS group;
- Twenty-seven of the 40 active substances that meet the OECD PFAS definition are in the CTGB authorisation database.

Plant protection products with TFA formation potential vary in type and use profile but are ubiquitous. The importance of plant protection products as TFA sources is supported by data from a field study in a region of Germany that showed a significant increase in TFA concentrations in groundwater in agricultural areas compared to other land uses. The article mentions the following 18 (formerly) EU authorised plant protection products as sources of TFA: acrinathrin, benfluralin, bifenthrin, cyflufenamid, diflufenican, fluazifop-p-butyl, fluazinam, flufenacet, fluopicolide, flurtamone, isoxaflutole, metaflumizone, oxyflurfen, penoxsulam, picolinafen, tau-fluvalinate, tembotrione and trifloxystrobin.

TFA was added to the OSPAR list of Substances of Very High Concern (Convention for the Protection of the Marine Environment of the North-East Atlantic) on 15 November 2024 because it falls under the SVHC group of per- and polyfluoroalkyl substances (PFAS). TFA has an RIVM-advised indicative drinking water guidance value of 2.2 µg /l if no other PFAS are present (the RPF of TFA is 0.002, because of which 2.2 µg/l (micrograms per litre) is equivalent to 4.4 ng /l PEQ).

At the time of writing this report, it became known that the German authorities had submitted a dossier to the European Chemicals Agency (ECHA) under the CLP Regulation to harmonise the hazard classification of TFA[10]. Because the German authorities consider TFA toxic to reproduction and environmentally critical, it must be classified as such. ECHA is currently engaged in consultations and conducting an expert assessment of the German proposal.

Umwelt Bundesamt (UBA) had previously classified TFA as a very persistent, very mobile substance (vPvM). Professor Hans Peter Arp, an internationally-renowned environmental chemist, TFA researcher and leader of the ZeroPM EU Horizon 2020 project, views the huge and accelerated accumulation of TFA in water, soil and plants as a serious threat to planetary boundaries[11]. In a UBA press release, he states: "We are seeing a rapid global increase in TFA levels in ecosystems, humans and animals. As such, the time has come to discuss how to curb this rapid increase before the pollution crosses planetary boundaries and has toxic effects on vulnerable populations."

9 https://www.rivm.nl/bibliotheek/rapporten/2022-0027.pdf

10 https://www.umweltbundesamt.de/presse/pressemitteilungen/trifluoressigsaeure-tfa-bewertung-fuer-einstufung

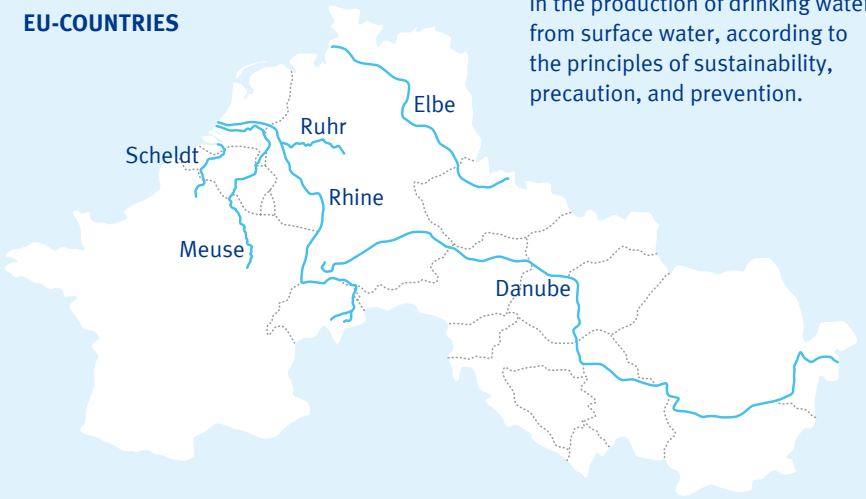
11 The concept of planetary boundaries was introduced in the scientific journal Nature in 2009. The authors identify nine planetary boundaries within which humanity must navigate to ensure the continued sustainable use of the planet's resources.

Target Values of the European River Memorandum

Drinking water companies from the river basins of the Meuse, Rhine, Danube, Elbe, Ruhr and Scheldt have had the European Memorandum River (ERM) formulated in order to safeguard the quality of surface water that is used for the production drinking water. Surface water that meets the ERM Target Values can be used to sustainably produce drinking water, making use of natural purification technologies.

EUROPEAN RIVER MEMORANDUM

18
EU-COUNTRIES



JOINED STRATEGY AND VISION

in the production of drinking water from surface water, according to the principles of sustainability, precaution, and prevention.

Important ERM principles

- Prioritising drinking water supply
- Sustainable management of water resources
- Insight into harmful substances
- Preventative protection of water bodies
- Responsible discharging of wastewater

TARGET VALUES

- ERM – Industrial pollutants
- ERM – Pharmaceuticals
- ERM – Pesticides / Other

WATER QUALITY ASSESSMENT

Water quality indicators for

170
DRINKING WATER COMPANIES

188
MILLION CUSTOMERS

A3.4 Measurement results in 2024

Table 2: Summary of substances that exceeded the ERM target value in 2024 (maximum concentrations), in order of percentage of breaching measurements.

Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
Industrial pollutants and consumer products																**832**	**3031**	**27,4%**
sulfamic acid	5329-14-6	0,1	µg/l					12		20		19		32	47	62	62	100%
ethylenediaminetetraacetic acid (EDTA)	60-00-4	1	µg/l		5,4	7,7	4,8	8		6,1		18		23	11	86	90	95,5%
trifluoroacetic acid	76-05-1	1	µg/l				1,55	1,4		1,6		1,5	1,64	1,6	1,5	74	84	88,1%
cyanuric acid	108-80-5	0,1	µg/l				2,53	2,1		5,7		1,2	2,09	2,1	1,7	75	88	85,2%
sucralose	56038-13-2	1	µg/l				1,35	1,4		2	3,9	3,5	4,13	4,9	2,4	56	92	60,8%
dichloro-methanesulfonic acid	53638-45-2	0,1	µg/l					0,4		0,3		0,16		0,29	0,26	33	62	53,2%
nitriloacetic acid (NTA)	139-13-9	1	µg/l				8	1		7,8		1,4		1,1	14	42	82	51,2%
trichloroacetic acid	76-03-9	0,1	µg/l								0,37	0,14		0,2	0,19	27	70	38,5%
methenamine	100-97-0	1	µg/l		3,79	17,6	2,65	4,4		11		1,4	1,58	2,2	1,7	47	122	38,5%
diisopropyl ether	108-20-3	1	µg/l			5,56	4,7	11	3,2	6,2	1,2	0,02	0,88	1,1	0,21	116	417	27,8%
diethylenetriaminepentaacetic acid (DTPA)	67-43-6	1	µg/l									8,8		5,4	1,4	24	90	26,6%
1,4-dioxane	123-91-1	0,1	µg/l					0,97		5,7		0,15		0,19	0,37	79	337	23,4%
dimethyl ketone (acetone)	67-64-1	1	µg/l					6,6		7,1						44	224	19,6%
8-Hydroxypenillic acid	3053-85-8	0,1	µg/l											0,66	0,12	8	41	19,5%
tetrahydrofuran	109-99-9	0,1	µg/l					0,26		0,87				0,77	0,24	35	311	11,2%
aniline	62-53-3	0,1	µg/l					0,07		0,05		0,06		0,09	0,16	5	49	10,2%
dibromoacetic acid	631-64-1	0,1	µg/l									0,12		0,31		3	70	4,2%
dicyclopentadiene	77-73-6	0,1	µg/l				0,21			0,01		0,1			0,01	2	64	3,1%
melamine	108-78-1	1	µg/l		0,32	0,30	0,36	1,4		1	1,1	2,6	1,17	1,5	1,3	10	387	2,5%
bromochloracetic acid	5589-96-8	0,1	µg/l											0,24		1	58	1,7%
ethyl hydrogen sulphate	540-82-9	0,1	µg/l												0,13	1	62	1,6%
dichloroacetic acid	79-43-6	0,1	µg/l								0,06	0,05		0,3	0,05	1	75	1,3%
monobromoacetic acid	79-08-3	0,1	µg/l								0,07	0,08		0,14		1	94	1,0%

Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
Residues of pharmaceuticals and endocrine-disrupting chemicals																**157**	**1257**	**12,5%**
oxypurinol	2465-59-0	0,1	µg/l								0,78	0,72				28	30	93,3%
vigabatrin	60643-86-9	0,1	µg/l					0,83		0,96				0,84	0,55	24	45	53,3%
2-hydroxibuprofen	51146-55-5	0,1	µg/l				0,15						0,1			13	26	50%
valsartanic acid	164265-78-5	0,1	µg/l					0,07		0,11	0,18	0,16		0,28	0,25	19	75	25,3%
theobromine	83-67-0	0,1	µg/l					0,12		0,18				0,13	0,09	8	45	17,7%
N-formyl-4-aminoantipyrine	1672-58-8	0,1	µg/l					0,01		0,01	0,09	0,06		0,09	0,18	13	75	17,3%
metformin	657-24-9	1	µg/l		1,17	1,26	1,23	1,9		1,1	0,8	0,4	0,72	0,92	0,59	16	136	11,7%
guanylurea	141-83-3	1	µg/l				0,61	0,92		0,92	0,75	0,29	0,84	1,3	1,7	12	109	11%
N-Acetylaminoantipyrine	83-15-8	0,1	µg/l					0,01		0,02	0,05			0,05	0,12	6	75	8%
di(2-ethylhexyl)phthalate (DEHP)	117-81-7	0,1	µg/l									0,41				1	17	5,8%
paracetamol	103-90-2	0,1	µg/l	0,14				0,13		0,07	0,07			0,08	0,04	5	101	4,9%
ER-CALUX		0,25	ng E2-eq/l		0,09	0,12		0,15		0,17				0,61	0,61	2	49	4%
lamotrigine	84057-84-1	0,1	µg/l		0,08	0,08		0,07		0,07	0,1	0,07		0,11	0,1	4	101	3,9%
candesartan	139481-59-7	0,1	µg/l					0,01		0,01	0,08	0,05	0,05	0,08	0,12	3	77	3,9%
levetiracetam	102767-28-2	0,1	µg/l					0,1		0,05				0,04	0,02	1	44	2,2%
ibuprofen	15687-27-1	0,1	µg/l		0,04	0,20					0,03					1	125	0,8%
valsartan	137862-53-4	0,1	µg/l		0,06	0,07		0,04		0,07	0,08			0,08	0,11	1	127	0,7%

ERM-tv = ERM target value, TAI = Tailfer, NAM = Namêche, LUI = Liège, EYS = Eijsden, ROO = Roosteren, STV = Stevensweert, HEE = Heel, BRA = Brakel, HEU = Heusden, KEI = Keizersveer, BSM = Bergsche Maas, HAR = Haringvliet.

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Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
Plant protection products, biocides and their metabolites																**267**	**2818**	**9,5%**
aminomethylphosphonic acid (AMPA)	1066-51-9	0,1	µg/l	0,2	0,24	0,16	0,56	0,75	0,93	0,82	0,93	0,732	0,80	0,69	0,44	116	142	81,6%
chloridazone-desphenyl	6339-19-1	0,1	µg/l	0,07	0,19	0,19		0,24		0,25	0,29	0,23		0,29	0,19	87	127	68,5%
fluopyram	658066-35-4	0,1	µg/l								0,02	0,22				5	30	16,6%
flonicamid	158062-67-0	0,1	µg/l									0,23				3	30	10%
propamocarb	24579-73-5	0,1	µg/l					0,4		0,33	0,09			0,13		16	382	4,1%
dimethenamide(-p)	163515-14-8	0,1	µg/l	0,12	0,11	0,14	0,08	0,07		0,07	0,26	0,06	0,21	0,24	0,04	7	183	3,8%
(S)-metolachlor	87392-12-9	0,1	µg/l		0,07			0,04		0,03	0,18	0,12		0,04	0,02	7	201	3,4%
propyzamide	23950-58-5	0,1	µg/l								0,22					1	32	3,1%
glyphosate	1071-83-6	0,1	µg/l		0,04	0,05	0	0,13	0,48	0,09	0,11	0,05		0,08	0,04	4	142	2,8%
flufenacet	142459-58-3	0,1	µg/l		0,08	0,20										1	38	2,6%
dimethomorph	110488-70-5	0,1	µg/l								0,08	0,05		0,24		3	118	2,5%
metazachlor OXA	1231244-60-2	0,1	µg/l		0,17	0,12					0,06			0,06	0,07	2	97	2%
metazachlor ESA	172960-62-2	0,1	µg/l		0,13	0,1				0,07	0,09	0,06		0,08	0,09	2	97	2%
thiabendazole	148-79-8	0,1	µg/l		0,14											1	54	1,8%
metolachlor-OA	152019-73-3	0,1	µg/l		0,04						0,13	0,08		0,14	0,06	2	123	1,6%
N,N-Dimethylsulfamide	3984-14-3	0,1	µg/l								0,05	0,10				1	81	1,2%
chlorotoluron	15545-48-9	0,1	µg/l	0,11	0,05	0,10				0,05	0,08		0,06	0,07	0,05	2	178	1,1%
prosulfocarb	52888-80-9	0,1	µg/l	0,12				0,11		0,1	0,1			0,09	0,08	4	379	1%
dicamba	1918-00-9	0,1	µg/l		0,05			0,34			0,02					1	111	0,9%
diethyltoluamide (DEET)	134-62-3	0,1	µg/l		0,02			0,04		0,05	0,07			0,13	0,03	1	113	0,8%
MCPA	94-74-6	0,1	µg/l							0,02	0,04	0,12	0,05	0,04		1	160	0,6%

Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
General parameters and nutrients																**438**	**879**	**49,8%**
perchlorate	14797-73-0	0,1	µg/l									0,7		0,51	0,5	45	45	100%
Dissolved Organic Carbon (DOC)		3	mg/l C				5,1		5,5	4,7	5,52	5,55	6,3	6,8	4,5	166	197	84,2%
Total organic carbon (TOC)		4	mg/l C		15,9	145,7	10	4,4		4,9		6,8	11	6,7	4,9	152	225	67,5%
bromide	24959-67-9	0,07	mg/l Br		0,05	0,30	0,26			0,09		0,122		0,09	0,12	42	99	42,4%
chlorate	7790-93-4	1	µg/l ClO3					30		25		16		52	22	31	80	38,7%
ammonium		0,3	mg/l NH4			0,18	0,18		0,14	0,3		0,50	0,21	0,18	0,15	2	233	0,9%

ERM-tv = ERM target value, TAI = Tailfer, NAM = Namêche, LUI = Liège, EYS = Eijsden, ROO = Roosteren, STV = Stevensweert, HEE = Heel, BRA = Brakel, HEU = Heusden, KEI = Keizersveer, BSM = Bergsche Maas, HAR = Haringvliet.

A3.5 Number of measurements

In 2024, the members of RIWA-Meuse and Rijkswaterstaat[12] conducted a total of 104,470 measurements on 1,040 parameters at various monitoring points along the Meuse (see Table 3). The substances monitored were tested against the target values in the ERM. These target values are mainly used to test emerging substances that do not have (or do not yet have) a legal standard in the context of drinking water legislation.

Table 3: Summary of numbers of water quality measurements on the Meuse in 2024

Monitoring point (km)	Number of measurements	Number of parameters	Number of testable measurements	Number of testable parameters
Tailfer (520)	3.046	143	2.997	142
Namêche (540)	3.708	353	2.447	254
Liège (600)	6.620	405	2.874	255
Eijsden (615)	10.216	454	2.611	244
Roosteren (660)	14.726	564	14.149	479
Stevensweert (675)	3.123	260	2.021	164
Heel (690)	22.174	750	18.789	524
Heusden (845)	6.623	411	4.968	332
Brakel (845)	9.947	656	6.354	426
Keizersveer (865)	4.957	437	2.432	239
Bergsche Maas (868)	9.317	600	6.920	462
Haringvliet (870)	10.013	745	6.830	514
Total	**104.470**	**1.040**	**73.392**	**648**

12 Based on the data supplied on 2025-04-7

A3.6 Testing against the ERM

To test the measured substances, drinking water companies use the ERM target value. This is the yardstick in the ERM. Drinking water companies in the river basins of the Meuse, Rhine, Danube, Elbe, Ruhr and Scheldt drafted the ERM for surface water. It is possible to sustainably produce drinking water using natural purification methods, provided the water meets the ERM target values.

Drinking water companies also test plant protection products, biocides and their metabolites against the ERM target value. For active substances and their metabolites that are toxicologically relevant to humans, the ERM target value is equal to the legal standard of 0.1 micrograms per litre (µg/L).

It is stated in the ERM that toxicologically 'well-assessed substances' must be tested against 1 µg/L, while for a number of these substances, testing was previously done against a target value of 0.1 µg/L. That is why, in 2021, the drinking water companies that use Meuse water decided to adopt different ERM target values for several parameters from that point onward. Substances with an indicative drinking water target value over 10 µg/L have been tested against 1 µg/L since 2021. This concerns the substances listed in Annex 3.

Of the 1,040 parameters monitored in 2024, 648 were testable. Of these, 67 (10.3%) exceeded or met the ERM target value one or more times at at least one monitoring location (see table 2). The reason 392 parameters were not testable is that no ERM target value has been defined for them. In total, a breach of the ERM target value was observed 1,694 times; this is 2.3% of the testable measurements (73,392).

Result: number of ERM breaches

Table 4 shows the quantities and percentages of the substance categories for which the ERM target values were breached in 2024.

Table 4: Summary of breaches of ERM target values by substance category.

	Industrial pollutants and consumer products	Residues of pharmaceuticals and endocrine-disrupting chemicals	Plant protection products, biocides and their metabolites
Permanent 100%	1 (4.4%)	0 (0%)	0 (0%)
Structural 50-99%	6 (26.1%)	3 (17.7%)	2 (9.5%)
Frequent 10-49%	9 (39.1%)	5 (29.4%)	2 (9.5%)
Incidental 1-9%	7 (30.4%)	9 (52.9%)	17 (81.0%)
Total	**23 (100%)**	**17 (100%)**	**21 (100%)**

In 2024, sulfamic acid exceeded the ERM target value in all measurements.

Classification of a substance into a category depends on the main route by which the substance can end up in water. For example, AMPA is therefore classified under Plant protection products, biocides and their metabolites, while cooling water additives are also known to break down into AMPA. However, we chose not to classify AMPA under Industrial Pollutants and Consumer Products, because this application does not lead to the highest emissions and we want to avoid doubly counting it.

We're seeing something similar with certain PFAS as well. Some active substances in pharmaceuticals (sitagliptin) or plant protection products (fluopyram, flonicamide) meet the OECD definition of PFAS. Although PFAS are classified as Industrial pollutants and consumer products, we still classify these substances in their specific categories to avoid double counting. This also applies to the breakdown product TFA, which we do not classify under plant protection products, biocides and their metabolites, but under Industrial pollutants and consumer products (also see Section A3.3). The industrial substances

DEHP, di-isobutyl phthalate and bisphenol-A are known as Endocrine Disrupting Chemicals (EDCs) and are therefore classified under Remnants of drugs and endocrine-disrupting chemicals.

Analysis: severity of a breach

Not every breach of the ERM yardstick is equally relevant. RIWA-Meuse distinguishes between three types of breaches:

- Chronic breaches: substances that breach the ERM target value every year.
- 'Flashing light' breaches: substances that breach the ERM target value one year and not the next year
- New breaches: substances that we are seeing for the first time (e.g. due to new analysis methods).

A summary of the number of breaching substances since 2015 is presented in Figure 5 for all monitoring points. Because different substance categories were sometimes used in previous annual reports, the breaches were determined again based on the choice of categories in 2021. This presentation may therefore deviate from what was stated in previous reports. It may also show new substances compared to before. This is due to the assignment of ERM target values to substances that were not included in the testing in the past, because they already had a (legal) drinking water standard (see appendix 1).

Besides the number and the type of substances that exceed the ERM target values, it is relevant to investigate how often these substances are above the ERM target values. For this reason, the percentage of breaches was determined. Figure 6 shows a summary of the breach percentages of the ERM target values within the substance categories since 2015 for all monitoring points.

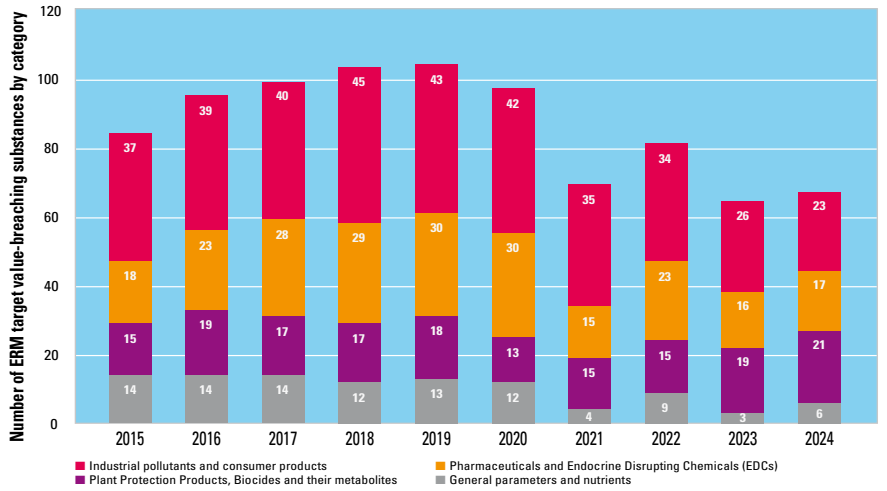


Figure 5: Number of ERM target value breaches for all monitoring points, by category 2015-2024.

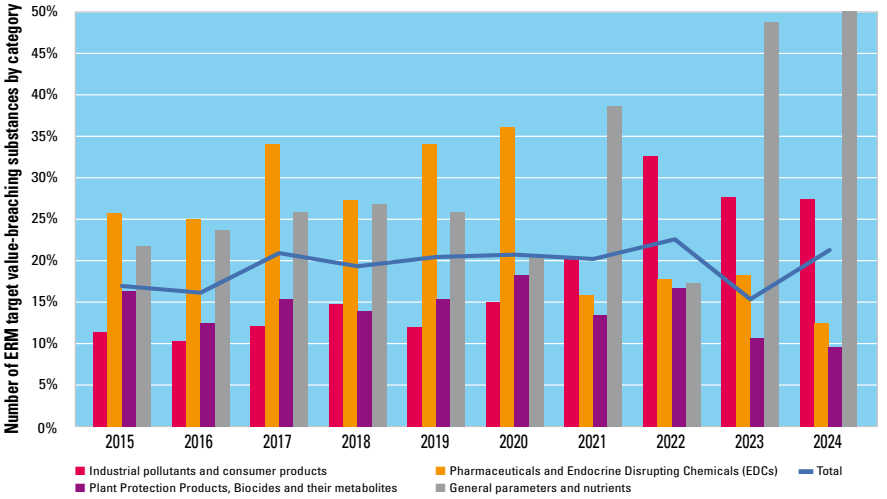


Figure 6: Percentage of ERM target value breaches for all monitoring points, by substance category, 2015-2024.

Trends and other developments

After testing against the ERM, it emerges that - just as in previous years - the number of breaching substances in the category Industrial pollutants and consumer products is the highest (23). Just as in 2023, the number of breaching substances in the category Pharmaceuticals and endocrine-disrupting chemicals (16) proves to be lower than in 2023 (23). It can further be concluded that the number of breaching substances in the category Plant protection products, biocides and their metabolites is the highest it has been since 2015.

It is also striking that the percentage of breaching measurements in the General parameters and nutrients category is the highest again in 2024, but this can be explained almost entirely by the parameters dissolved and total organic carbon (DOC 77.3% and TOC 66.9%). After this, the percentage of breaching measurements in the category Industrial pollutants and consumer products is the highest. The percentage of breaching measurements in the category Medicinal products and endocrine-disrupting chemicals' has again decreased slightly. The decrease in this category after 2020 was mainly caused by opting to test some substances against a different ERM target value. It is also noteworthy that while the number of substances exceeding the ERM target value in the category Plant protection products, biocides and their metabolites is the highest it has been since 2015, the number of breaching measurements in this category is low compared to previous years.

Figure 7 shows a continued downward trend in the percentage of breaches for melamine and also an increase in the percentage of breaches for TFA. The decrease for melamine after 2021 may be related to decreasing discharges from the integrated wastewater treatment plant (IAZI) of the Chemelot complex in Limburg, which is the largest melamine plant in the world. The dilution of this substance in 2024, a relatively wet year, may have played a role too. The increase in the percentage of breaches for TFA is due to the reduction of the ERM target from 1 to 0.1 µg/l in 2021. There does not appear to be a clear trend for EDTA, DIPE and methenamine.

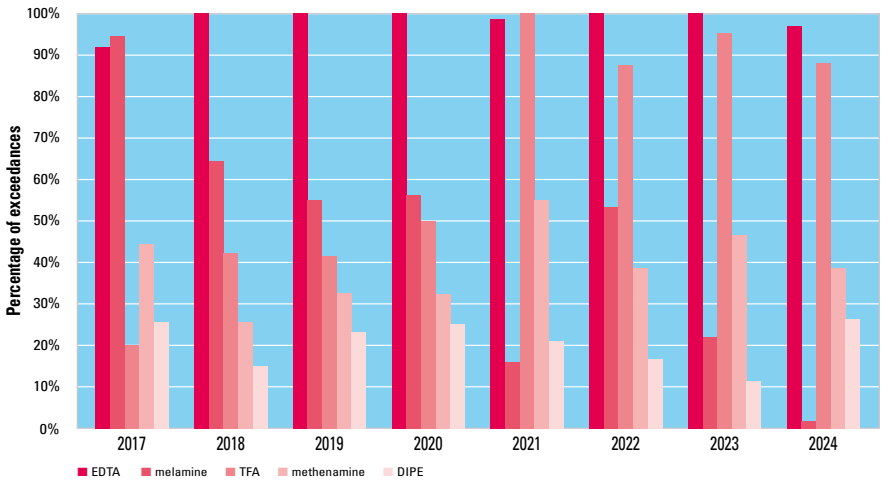


Figure 7: Percentage of ERM target value breaches for five substances from the category Industrial substances and consumer products, 2017-2024.

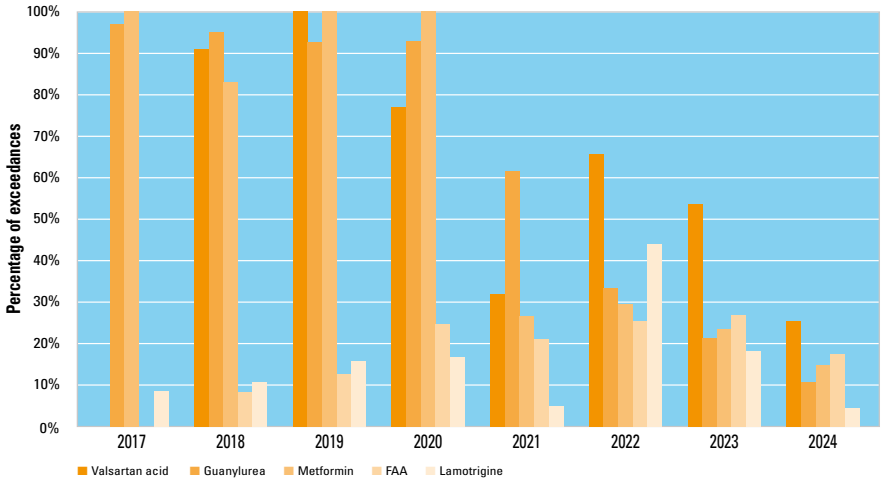


Figure 8: Percentage of ERM target value breaches for five substances from the category Residues of pharmaceuticals and endocrine-disrupting chemicals, 2017-2024.

Monitoring the water quality of the Meuse

RIWA-Meuse assesses the water quality of the Meuse according to the target values of the European River Memorandum. Surface water that meets the ERM Target Values can be used to sustainably produce drinking water, making use of natural purification technologies.

104.470 measurements

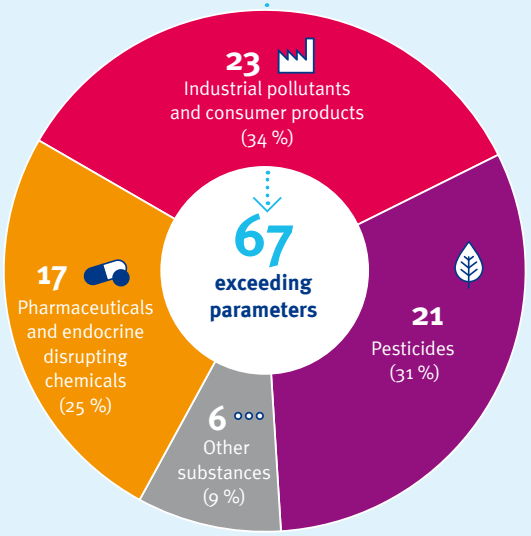
73.392 verifiable measurements

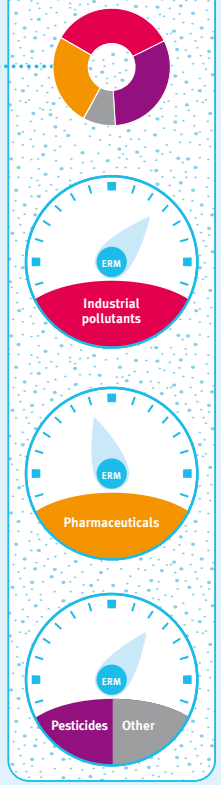
648 parameters

67 exceeding parameters

1.694 exceedances per sub-category

Proper monitoring and data management are crucial to safeguard the water quality of the Meuse as a source of drinking water.





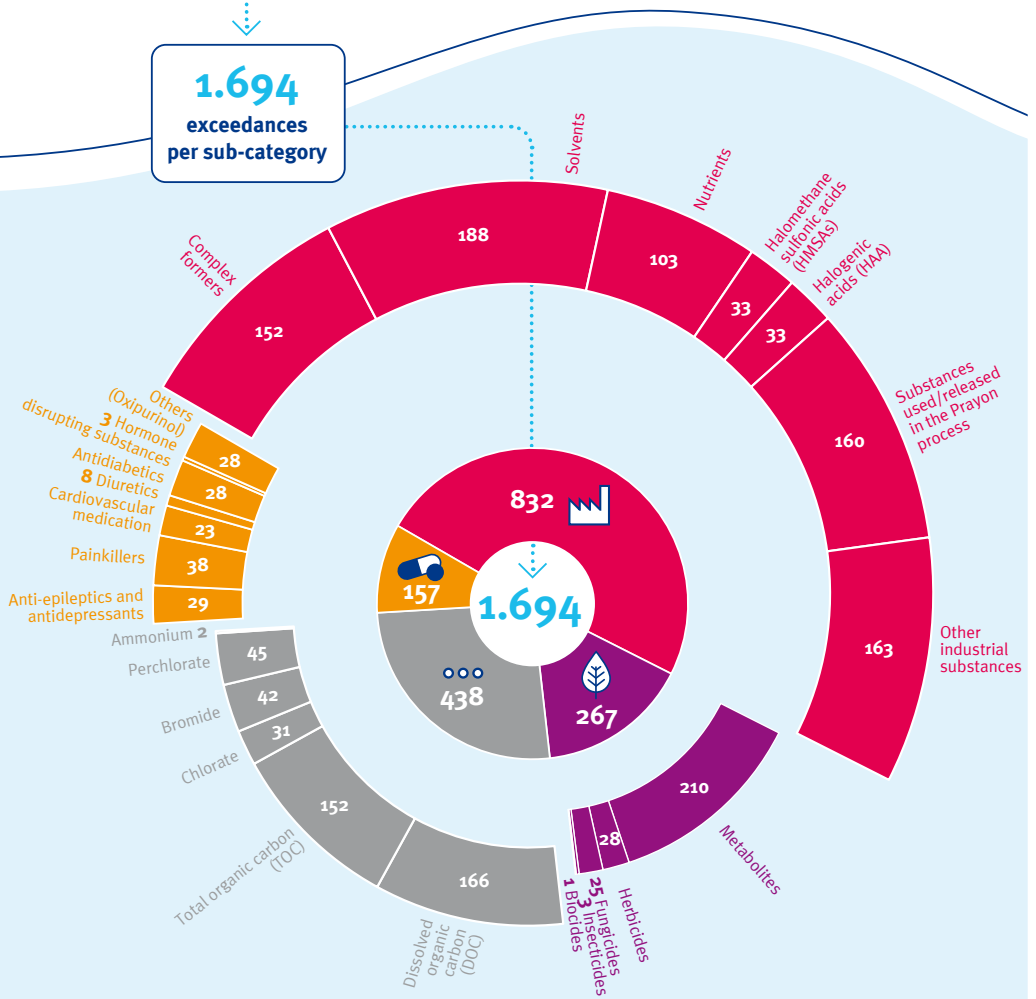


Figure 8 shows a decrease in the percentage of breaches for the residues of five commonly-used pharmaceuticals. Besides the effects of a wet year and higher water flows, the findings for 2023 and 2024 may also be the result of measures taken in the river basin. For example, the Ministry of Infrastructure and Water Management's Implementation Programme 'Chain Approach to Medicine Residues from Water'[13], which includes the expansion of wastewater treatment plants with the removal techniques for these substances.

The percentages for S-metolachlor and OA have decreased significantly. This is because European approval of the active substance S-metolachlor has not been renewed.

In Figure 9, a decrease in the percentage of breaches for glyphosate is noticeable and, to a lesser extent, also for AMPA. No clear trend can be observed for chloridazone-desphenyl. The percentages for S-metolachlor and OA have decreased significantly. This is because European approval of the active substance S-metolachlor has not been renewed and all authorisations for plant protection products containing that active substance must be withdrawn by 23 April 2024. The use-by date, being the time companies were given to use up stocks, which ended on 23 July 2024, has now passed as well.

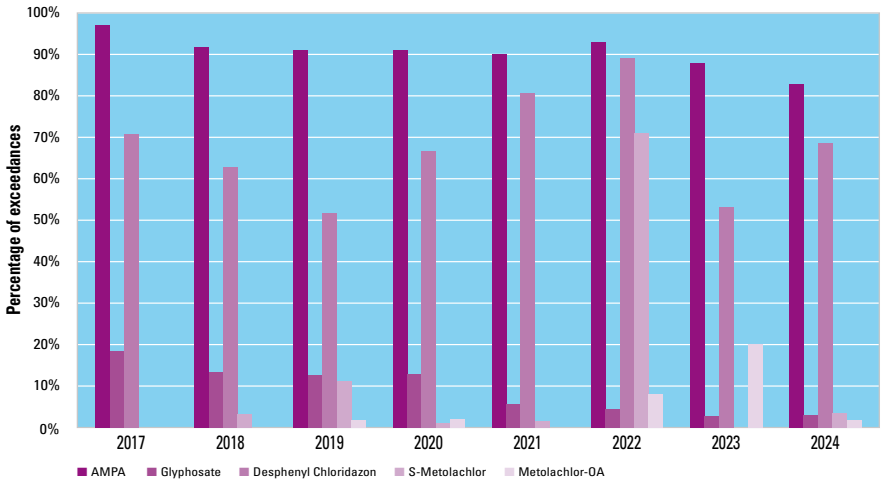
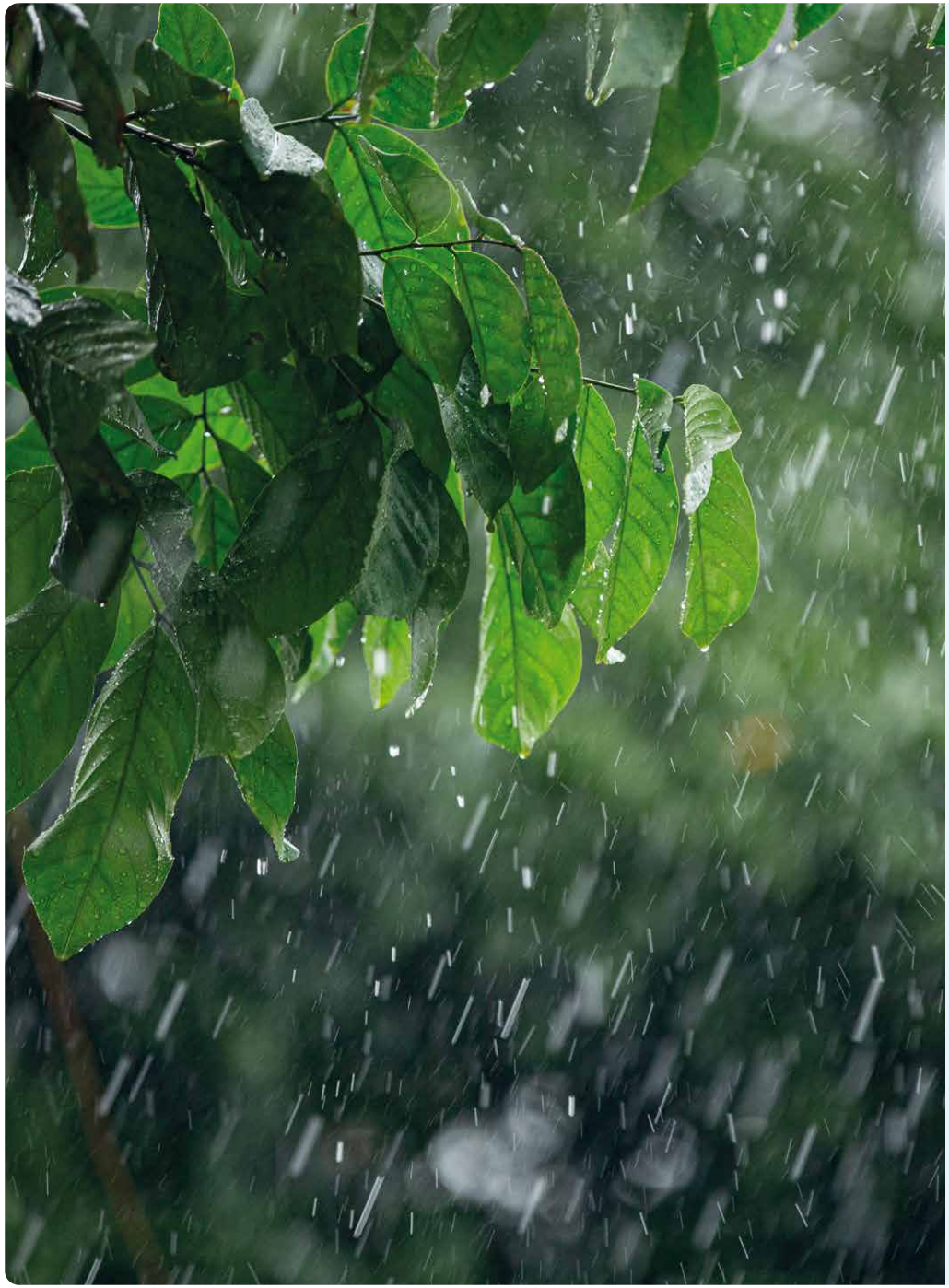


Figure 9: Percentage of ERM target value breaches for five substances from the category 'plant protection products, biocides and their metabolites', 2017-2024.

13 https://www.rijksoverheid.nl/documenten/rapporten/2023/05/08/bijlage-rapport-evaluatie-ketenaanpak-medicijnresten-uit-water-2023



A3.7 The effect of weather on water quality

Warmest year ever globally and the wettest in Belgium

The Earth is warming up and the effects of climate change are becoming more and more visible and tangible in Belgium, the Netherlands and globally. In 2024, the Earth's surface was the warmest it had been since measurements began (in 1901 in the Netherlands and 1833 in Belgium). According to Copernicus, the European climate service, the global temperature is now 1.3 °C higher than it was at the end of the nineteenth century - the temperature in Europe is an average of 2.5 °C warmer.

In every dataset, 2024 stands out as a record-breaking hot year. The temperature in 2024 was more than 0.1 °C higher than in 2023, which itself was significantly warmer than temperatures recorded previously. The last 10 years have been the 10 warmest in the measurement series. Long-term warming is caused by greenhouse gas emissions, primarily due to the large-scale combustion of fossil fuels. However, temperatures can vary considerably from one year to another due to a combination of natural and human factors.

Why the temperature has increased recently

Although we know the Earth is warming up in the long-term and understand the reasons why this is happening, it is still remarkable that the past two years have been far warmer than previous years. A number of factors have pushed up temperatures in the last year-and-a-half. For example, the El Niño weather phenomenon, which causes the surface water in the Pacific Ocean around the equator to warm up more every few years. Also, the amount of reflective aerosol (particulate matter) has decreased due to the reduction in sulphur emissions from China and global shipping in recent years. Given the diminished cooling effect of reflective sulphur, greenhouse gases are contributing to further global warming.

A recent study has also shown a decrease in cloud cover over the Atlantic Ocean, which is also resulting in a decrease in solar radiation reflection and increased warming. Researchers are still unsure what is causing this decrease in cloud cover. Is warming accelerating? Satellite observations of the radiation balance, a record of incoming solar radiation and outgoing terrestrial radiation, would seem to indicate that this is the case.

The most rain ever in Belgium

In 2024, 1170.7 mm of precipitation fell in Ukkel, Belgium (normally: 837.3 mm), which is home to the Royal Meteorological Institute of Belgium (KMI). This happened during a total of 209 days (normal: 189.8 days). This set a new all-time record for precipitation. The following years are all in the top five as well: 2001 (1088.5 mm), 2002 (1077.8 mm), 1965 (1073.9 mm) and 1966 (1055.6 mm).

It is striking that the record precipitation in Ukkel was not accompanied by a record number of days of precipitation. In fact, with 209 days of precipitation, 2024 ended far short of the record set in 1974 (when it rained for 266 days). This value is also quite close to the normal number of annual days of precipitation (189.8). The record amount of precipitation in Ukkel can mainly be explained by the large number of days (11 in 2024) with heavy rainfall (20 mm or more).

It is interesting to observe that an absolute record was also achieved for the total amount of precipitation in a 365-day period (i.e., not a calendar year). Between 12 October 2023 and 11 October 2024, a record 1299.3 mm of precipitation was recorded in Ukkel.

The high water temperatures in the Atlantic Ocean and the Mediterranean Sea could explain the high precipitation levels in 2024. They increase the amount of water vapour in the air above the sea. Certain weather conditions create moist sea air, which leads to rain or thunderstorms.

In 2024, the average temperature in Ukkel was 11.9 °C (normal: 11.0 °C). This puts the past year in fifth place for the highest average temperature in Belgium, along with 2018, just behind 2014 (12.0 °C), 2023 (12.1 °C) and the record years 2020 and 2022 (both 12.2 °C).[14]

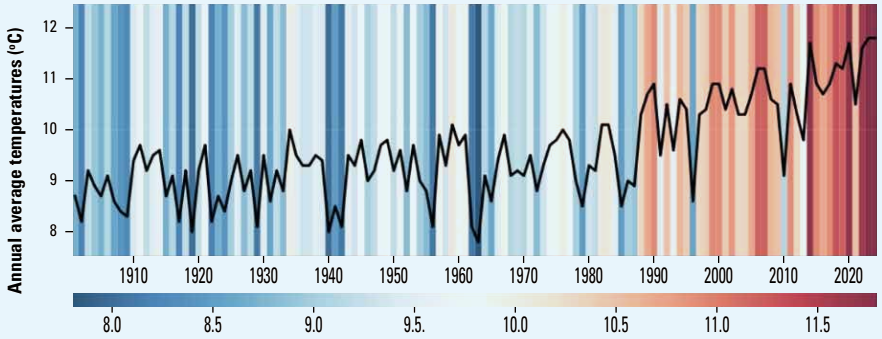


Figure 10 Climate stripes - KNMI, De Bilt

Another extremely warm and very wet year in the Netherlands

The year 2024 was the hottest year in the Netherlands since measurements began back in 1901; the same applied to the year before: 2023. With an average temperature of 11.8 °C, it was warm in the Netherlands, just as it was in 2023 (see Figure 10). Night-time temperatures in particular were warm in 2024, making the average minimum temperature this year higher than ever measured before: 7.7 °C. The highest temperature prior to this was 7.6 °C in 2023.

In recent years, the Netherlands has also had more days of heavy precipitation and fewer icy days. The year 2024 was very wet: an average of 986 mm of precipitation nationally compared to the normal 795 mm. May 2024 was the wettest May since records began. There was slightly less sunshine than usual in 2024: January, August and September were very sunny, while February and December were very cloudy.

14 *https://www.reading.ac.uk/planet/climate-resources/climate-stripes*

Also very warm and wet in North Rhine-Westphalia

The average temperature of 11.3 ˚C in North Rhine-Westphalia - a small section of the Meuse flows through this part of Germany – was in line with the temperature records for 2022 and 2023 (9.0 ˚C is the long-term average).

North Rhine-Westphalia's second-mildest winter ever in 2023-2024 was a sign of the warmth to come. It brought a February with average temperatures rivalling those of a typical April. March and the entire spring continued this trend with record-breaking warmth. The changeable summer months were followed by an autumn with warmer than average temperatures, further underscoring the unique nature of the previous record year. An average precipitation of 1,028 mm fell here in 2024 (875 mm is the long-term average). The temperature in North Rhine-Westphalia has increased by 2.4 °C since the Industrial Revolution (early 19th century).

Hottest year globally and wettest year in Western Europe

Globally, 2024 was the hottest year on record and the first year with an average temperature 1.5° C above pre-industrial levels. The last 10 years were the hottest 10 years ever measured. These facts have been sourced from the report about the European climate in 2024 (European State of the Climate, ESOTC) by the Copernicus Climate Change Service (C3S) and the World Meteorological organisation (WMO). Europe experienced the hottest year ever, with the second-highest number of heat stress days (extremely hot days during which the heat can become dangerous or unhealthy) and tropical nights on record. Western Europe experienced one of the 10 wettest years on record and Europe was confronted with the most widespread flooding since 2013.

Sources:
https://www.knmi.nl/over-het-knmi/nieuws/2024-warmste-jaar-ooit-gemeten
https://www.meteo.be/nl/info/nieuwsoverzicht/2024-een-heel-warm-en-recordnat-jaar-in-ukkel
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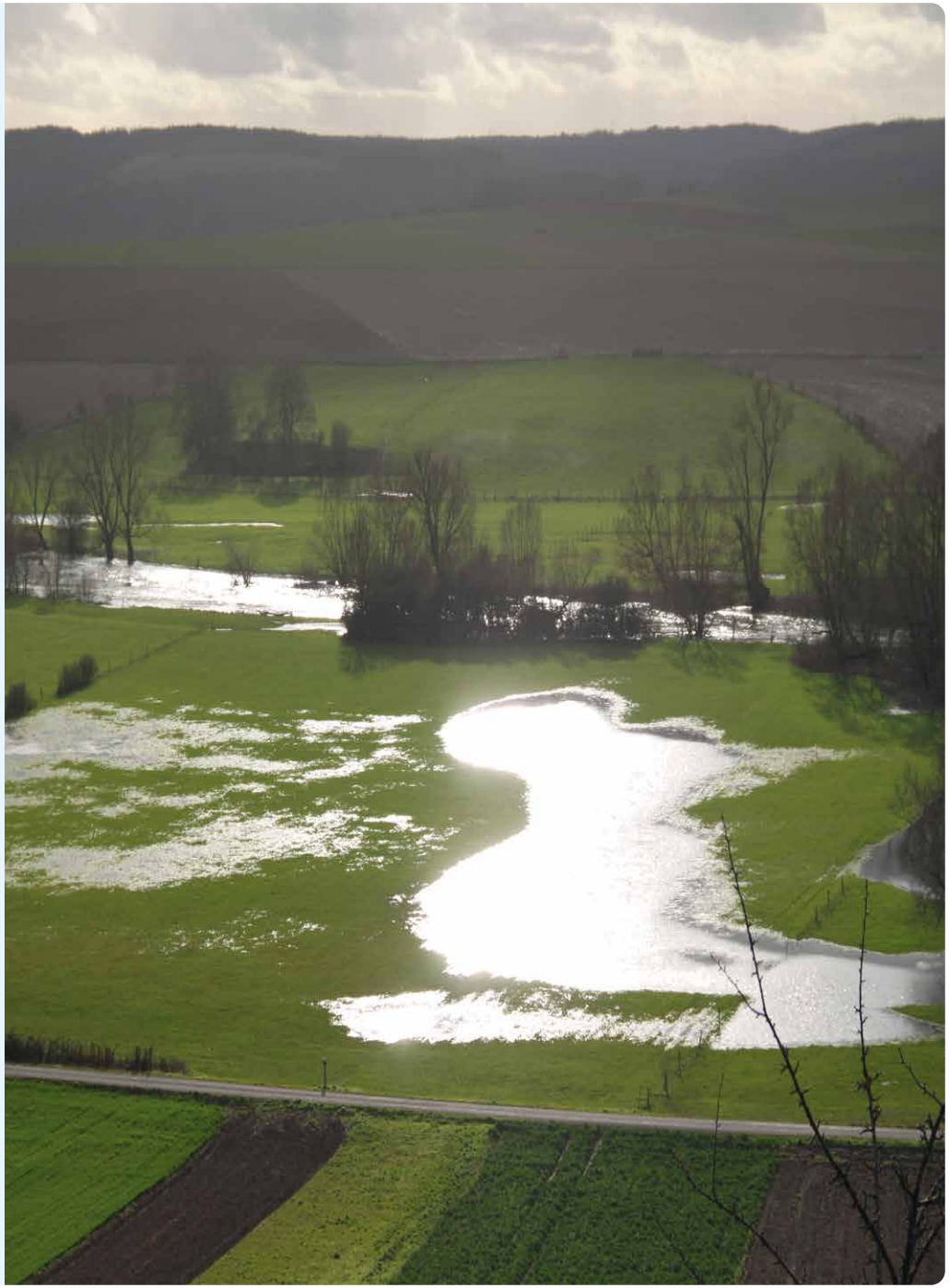


Drought resulting in poorer or improved water quality

We expect more water quality problems in dry years than in wet ones. This is because harmful substances are less diluted at low flows. However, water quality in the Meuse was surprisingly good in 2018 - a dry year - despite the low flow. At the time, RIWA-Meuse identified several possible explanations for this, including:

- The improved monitoring and awareness of industrial wastewater treatment plants has prevented major incidents;
- The general improvement in water quality in the past few decades[15] has improved the self-purifying capacity of the river;
- With the increase in mussels (particularly exotic species like the quagga and the zebra mussel), the water has become much clearer, allowing UV radiation to penetrate further, for example;
- The breakdown of substances, by bacteria for example, usually occurs faster or better at higher temperatures;
- The relatively long period of time without precipitation resulted in a decrease in sewer overflows, which meant that excess sewage, possibly mixed with rainwater, was discharged into surface water in the event of heavy rainfall or other unforeseen circumstances;
- Due to the lack of precipitation, pollutants did not flow from agricultural fields and paved surfaces into the river either;
- Given the prolonged, higher summer temperatures, wastewater treatment plants operated at a higher purification efficiency. As a result, the relatively large proportion of effluent (treated sewage) in the Meuse did not lead to a significant deterioration in water quality;
- The influx of clean water from small tributaries of the river may have had a positive effect;
- Due to the low flow rate of the river (the amount of water that flows through the river at a given point in a given time), the flow rate was lower, which resulted in the increased settlement of pollutants and a longer breakdown time.

A lot of rain and implications for water quality

A number of the explanations above could also be valid in wet years like 2024 but with the opposite effect: more sewer overflows, more surface runoff from agricultural land and paved surfaces, higher flow rates and associated turbidity can actually lead to poorer water quality. As such, dilution would appear to be ineffective in the improvement of water quality problems. However, looking at the sweetener sucralose as an indicator of the percentage of sewage in the Meuse, dilution does appear to play a role. In figure 11, we see not just an increase in concentration between 2016 and 2024 but also higher concentrations in a dry year (2022) and lower ones in a wet year (2024).

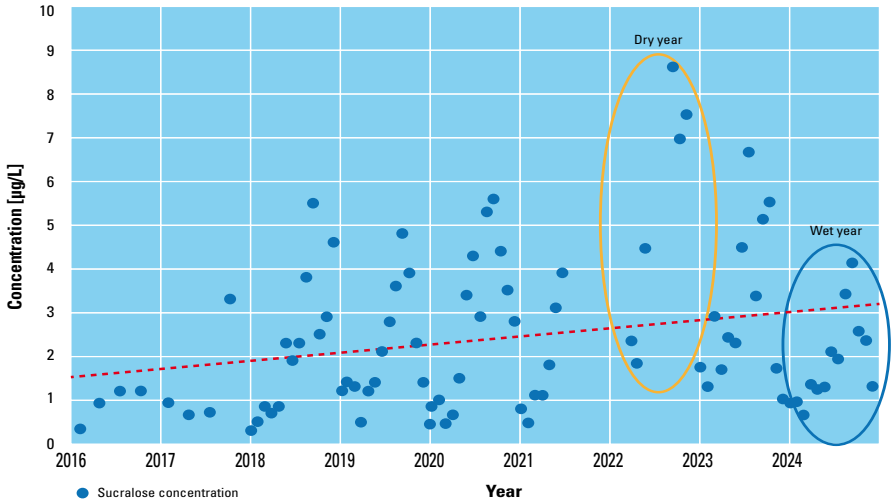


Figure 11: Development of the concentration of sucralose in the Bergsche Maas, 2016-2024.

There is a greater risk of increased pest and disease pressure in agricultural crops in warm, wet years. In the spring of 2024, the Flemish coordination centre for applied research and Extension on Organic Agriculture (CCBT)

15 *Fewer structural breaches by nutrients and heavy metals in particular*

warned of high disease pressure in potatoes. An example of this is the potato disease Phytophthora, caused by a fungus. The European Commission's Joint Research Center observed that persistent rainfall in the Benelux, western Germany and northeastern France, etc. was having a negative impact on crop growth and field work. It also observed that some winter cereals were being exposed to unfavourable, wet conditions during their sensitive flowering phase. Crops are more affected by weeds and fungi in warm, humid conditions like those in 2024. This leads to the increased use of fungicides (antifungals) and herbicides (weed killers) in conventional agriculture, which, naturally has negative consequences for water quality.

In dry years with low river flows, groundwater makes up a larger percentage of the total volume of Meuse water than in wet years. The expectation is that this will lead to an increase in the number of breaches of the ERM target value by metabolites of plant protection products in groundwater, such as chloridazon desphenyl. However, the percentage of breaches of the ERM target value due to chloridazon desphenyl in the Meuse was lower in the dry years 2018 (62.9%) and 2020 (66.7%) than in the wet years 2022 (89.3%) and 2024 (68.5%). This could indicate that drainage water plays a significant role for this substance.

Which chemicals in the Meuse are problematic for drinking water production?

A4 Drinking water-relevant substances

An estimated 350,000 chemicals are produced and sold globally[16]. It is impossible to measure all of them or to know which substances are being used in the Meuse River Bsin . Rijkswaterstaat and the members of RIWA-Meuse are currently measuring just under 1,000 chemicals in the Meuse. We refer to the most important of these chemicals as drinking water relevant: they can end up in drinking water and it is important to monitor them closely.

RIWA-Meuse has been focusing on so-called drinking water-relevant substances since 2007. These substances can find their way into drinking water after a natural purification process, which is undesirable. RIWA-Meuse's attention was drawn to these substances with the entry into force of the WFD in 2000. Article 7.3 of this European directive states: *"Member States shall ensure the necessary protection for the bodies of water identified with the aim of avoiding deterioration in their quality in order to reduce the level of purification treatment required in the production of drinking water. Member States may establish safeguard zones for those bodies of water."*

The WFD establishes European environmental quality standards for priority substances and priority hazardous substances (substances that the EU prioritises) to achieve good surface water chemical status. Additional standards can be established for each river basin for specific substances that hinder the achievement of a good chemical status and a good ecological status. However, standards have not been established for substances that hinder the production of drinking water, neither Europe-wide nor at river basin level. This has been left to the individual countries. Because rivers throughout Europe are used for the production of drinking water, approximately 170 drinking water companies from 18 countries drew up the ERM[17], which includes target values (Table 5).

16 *Toward a Global Understanding of Chemical Pollution: A First Comprehensive Analysis of National and Regional Chemical Inventories. Zhanyun Wang, Glen W. Walker, Derek C. G. Muir and Kakuko Nagatani-Yoshida. Environmental Science & Technology 2020 54 (5), 2575-2584. DOI: 10.1021/acs.est.9b06379*

17 *https://www.riwa-maas.org/publicatie/european-river-memorandum-5/*

It is possible to produce drinking water with natural purification methods from river water that meets these target values. RIWA-Meuse focuses on the substances that regularly fail ERM testing against these target values: this determines the discharges to be the subject of focus.

Table: ERM-Target values

General parameters	Target value
Oxygen content	> 8 mg/L
Electrical conductivity	70 mS/m
pH value	7 - 9
Temperature	25 °C
Chloride	100 mg/L
Sulphate	100 mg/L
Nitrate	25 mg/L
Fluoride	1.0 mg/L
Ammonium	0.3 mg/L
Composite organic parameters	**Target value**
Total organic carbon (TOC)	4 mg/L
Dissolved organic carbon (DOC)	3 mg/L
Adsorbable organic halogen compounds (AOX)	25 µg/L
Adsorbable organic sulphur compounds (AOS)	80 µg/L
Anthropogenic (non natural) substances	**Target value**
Evaluated substances **without** known effects on biological systems microbially poorly degradable substances, per individual substance	1.0 µg/L
Evaluated substances **with** known effects on biological systems, per individual substance	0.1 µg/L*
Non-evaluated substances that cannot be removed sufficiently by natural procedures, per individual substance	0.1 µg/L
Non-evaluated substances that form non-evaluated degradation/transformation products, per individual substance	0.1 µg/L

** (*except if toxicological findings require an even lower value, e.g. for genotoxic substances)*

In 2007, the KWR research institute, commissioned by RIWA-Meuse, developed additional criteria for the testing of substances, facilitating a distinction between substances based on the number, locations and extent of the target value breaches. This allows us to rank the substances: a substance that is found frequently and in many locations at levels significantly exceeding the target value is ranked higher than a substance that is found less frequently, in fewer locations, or less significantly above the target value. The criteria for this testing have been adjusted slightly over the years. For example, whether a substance can be removed from the water and purified, ranging from difficult to easy. To determine this so-called removability in a natural purification process, the vapour pressure (volatilisation), biodegradability (persistence) and octanol-water partition coefficient (mobility) are assessed. Toxicity, odour and taste thresholds and public perception of a substance are considered as well.

Regular evaluation ensures relevance and focus

In 2007, KWR, commissioned by RIWA-Meuse, launched an initial evaluation of what are now known as drinking water-relevant substances. At the time, KWR classified 16 substances as a ‘threat’ and 34 as a ‘potential threat’. In 2009, KWR conducted a second evaluation and classified 3 additional substances as a ‘threat’. In this case, some parties felt that the term ‘a threat to the drinking water function’ of the Meuse was excessive. From 2011 onwards RIWA-Meuse therefore started to refer to these substances as ‘substances relevant to the production of drinking water from the Meuse’ or ‘drinking water-relevant substances’.

In 2011, Het Waterlaboratorium (HWL), which became responsible for evaluations after KWR, classified 19 substances as drinking water relevant; this was the first time these substances were ranked by relevance. HWL also classified 23 substances as potentially drinking water relevant based on 13 measurements per year. Another 30 substances were classified as potentially drinking water-relevant based on four measurements per year.

In 2015, HWL classified 28 substances as drinking water-relevant and 34 as 'candidate drinking water-relevant', the new term for potentially drinking water-relevant. For the first time, a list was put together of 53 'substances that are no longer relevant to drinking water'. These are substances that no longer meet the criteria and no longer pose a problem to drinking water production. Since then, the individual drinking water companies have decided whether or not to continue to monitor these substances and how.

The 2021 evaluation resulted in a list of 30 drinking water-relevant substances, one of which consists of a group of 20 PFAS.

After the HWL evaluation in 2018, the list of drinking water-relevant substances consisted of 33 chemical compounds. 15 substances were candidate drinking water-relevant and the list of substances that are no longer relevant to the drinking water contained 82 chemical compounds.

The 2021 evaluation resulted in a list of 30 drinking water-relevant substances, one of which consists of a group of 20 PFAS. Therefore, technically, there are a total of 49 substances on the list. HWL identified 14 candidate drinking water-relevant substances for inclusion in the joint RIWA-Meuse monitoring programme and for monitoring via a quantitative analysis method. Added to this, 19 candidate drinking water-relevant substances were included for monitoring via (targeted) screening methods. The lists of (candidate) drinking water-relevant substances have changed over the years; see Figures 12 and 13.

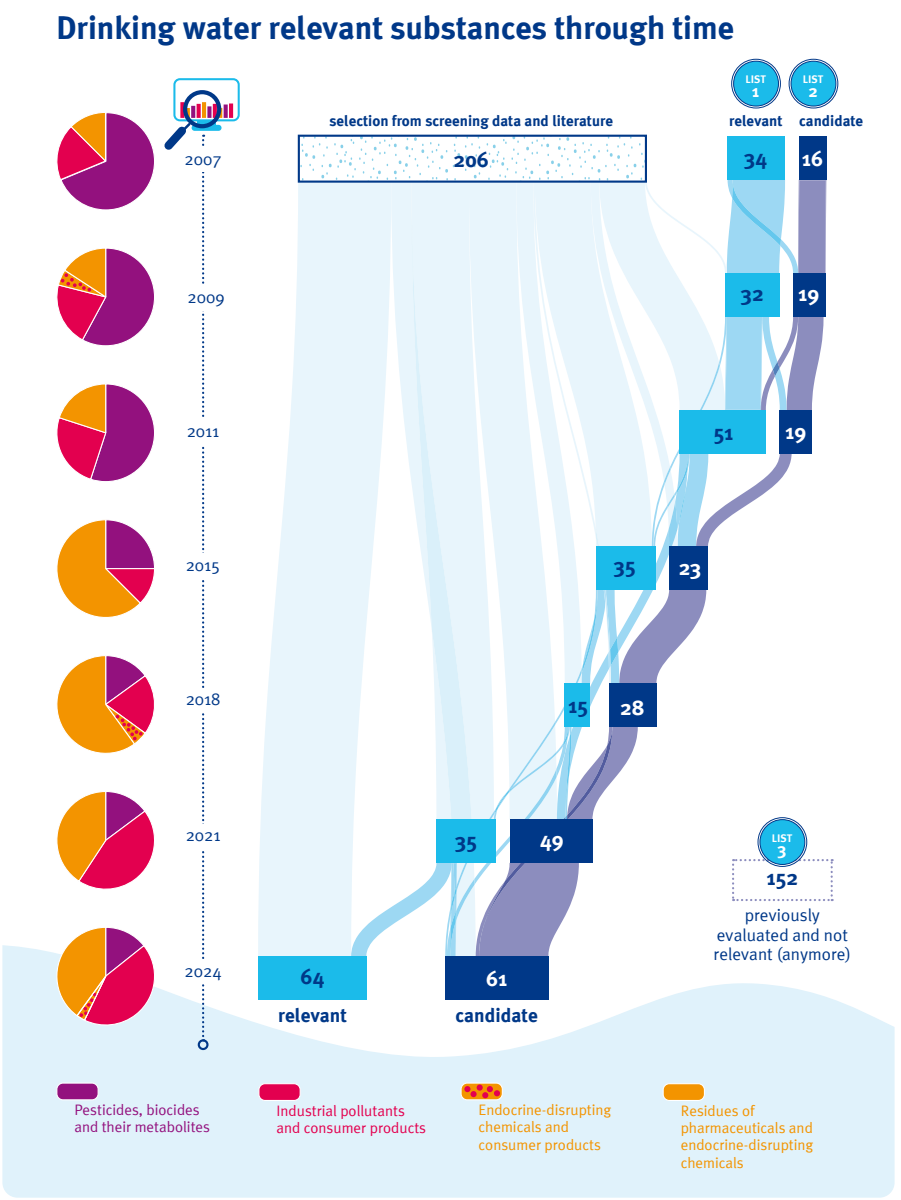


Figure 12: Changes in lists of (candidate) drinking water-relevant substances, 2007-2024 (20 PFAS individually).

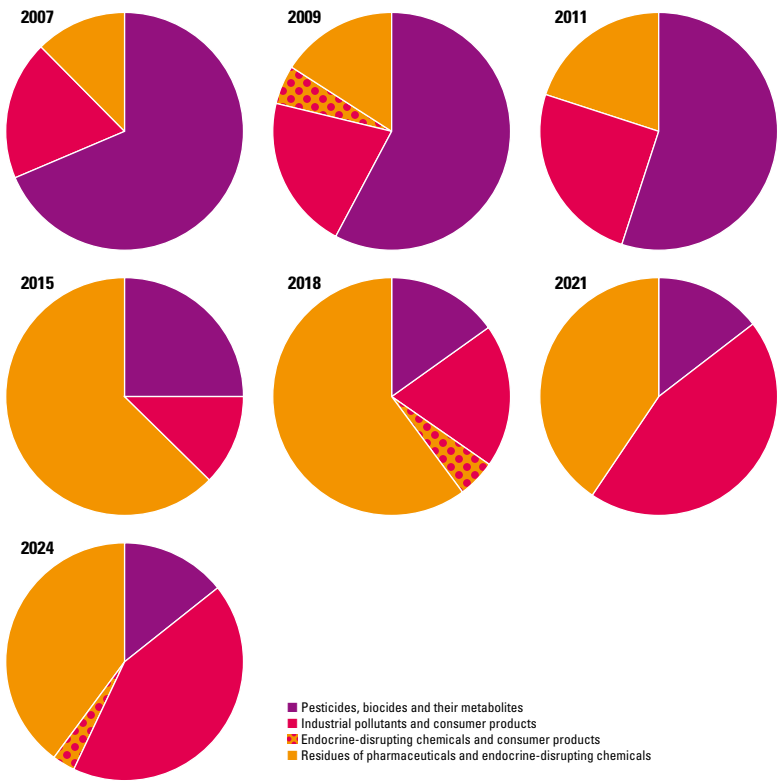


Figure 13: Drinking water-relevant substances distributed across categories, 2007-2024 (percentages, 20 PFAS = 1 substance).

Figure 13 shows that the largest category of substances on the drinking water-relevant list previously consisted of Plant protection products, biocides and their metabolites, followed by Residues of pharmaceuticals and endocrine-disrupting chemicals; the largest category today is Industrial substances and consumer products[18]. It is also striking that glyphosate is the only substance to be assessed as drinking water relevant after each evaluation, although this substance drops from first place in 2007 to 19th place in 2024.

The properties of glyphosate did not change between 2007 and 2024, but the detection frequency, namely how often the substance is detected and at which concentrations the ERM target values are breached, have steadily decreased over the years.

The same picture applies to other plant protection products. The herbicides diuron, chlorotoluron and isoproturon and the fungicide carbendazim lost their authorisations as plant protection products and are no longer relevant for drinking water. The herbicides 2,4-D, MCPA, mecoprop (MCPP) and nicosulfuron still have their authorisations, but their detection frequencies and concentrations have decreased to the point that they are no longer drinking water-relevant. The herbicide dimethenamid was previously a candidate drinking water-relevant substances on three occasions and was assessed as drinking water relevant in 2024; This therefore illustrates a countertrend.

A typical example of a substance that changes from one list to another constantly is the hormone-disrupting substance bisphenol(-A), which has now been assessed as drinking water relevant for the third time. It is also striking that pyrazole, a substance that was responsible for a major incident in 2015, was only classified as drinking water relevant in that particular year. This is due to the infrequent presence of this industrial substance above the ERM target value since the incident in question.

The impression is that the more substances measured, the more breaches of target values are found. However, a study of the purification requirement based on the ERM target values showed that this is incorrect (Pronk et al., 2020).

18 and back to Residues of pharmaceuticals and endocrine-disrupting chemicals, unless you include all 20 PFAS as individual substances

New drinking water-relevant substances found

HWL, Aqualab Zuid, water-Link and RIWA-Meuse identified new (candidate) drinking water-relevant substances in a study last year[19]. The evaluation in question was conducted based on measurement data from the monitoring stations and abstraction points along the Meuse between 2019 and 2023. The objective of the study was to evaluate and update the lists of drinking water-relevant substances (first) and candidate drinking water-relevant substances (second).

RIWA-Meuse classifies substances as relevant if they meet a defined set of criteria. These include detection frequency, concentrations that breach the ERM target values, (potential) removal efficiency during water treatment (how difficult or easy the substance is to remove), toxicity, odour or taste thresholds and public perception of a substance. Monitoring data are necessary to assess these criteria. Candidate drinking water-relevant substances are substances that are expected to be present in the Meuse but have not been monitored or measured yet. The criteria for drinking water-relevant substances have been refined over time. The current selection criteria are shown in the infographic below.

The list of candidate drinking water-relevant is broken down into:

a) a list of substances that are known to occur in the Meuse and that RIWA-Meuse recommends should be monitored via target analysis;
b) a list of substances that could potentially be monitored via library screening method (making it more practical to quickly screen for the presence of a substance).

In summary, we use the following lists at RIWA-Meuse:

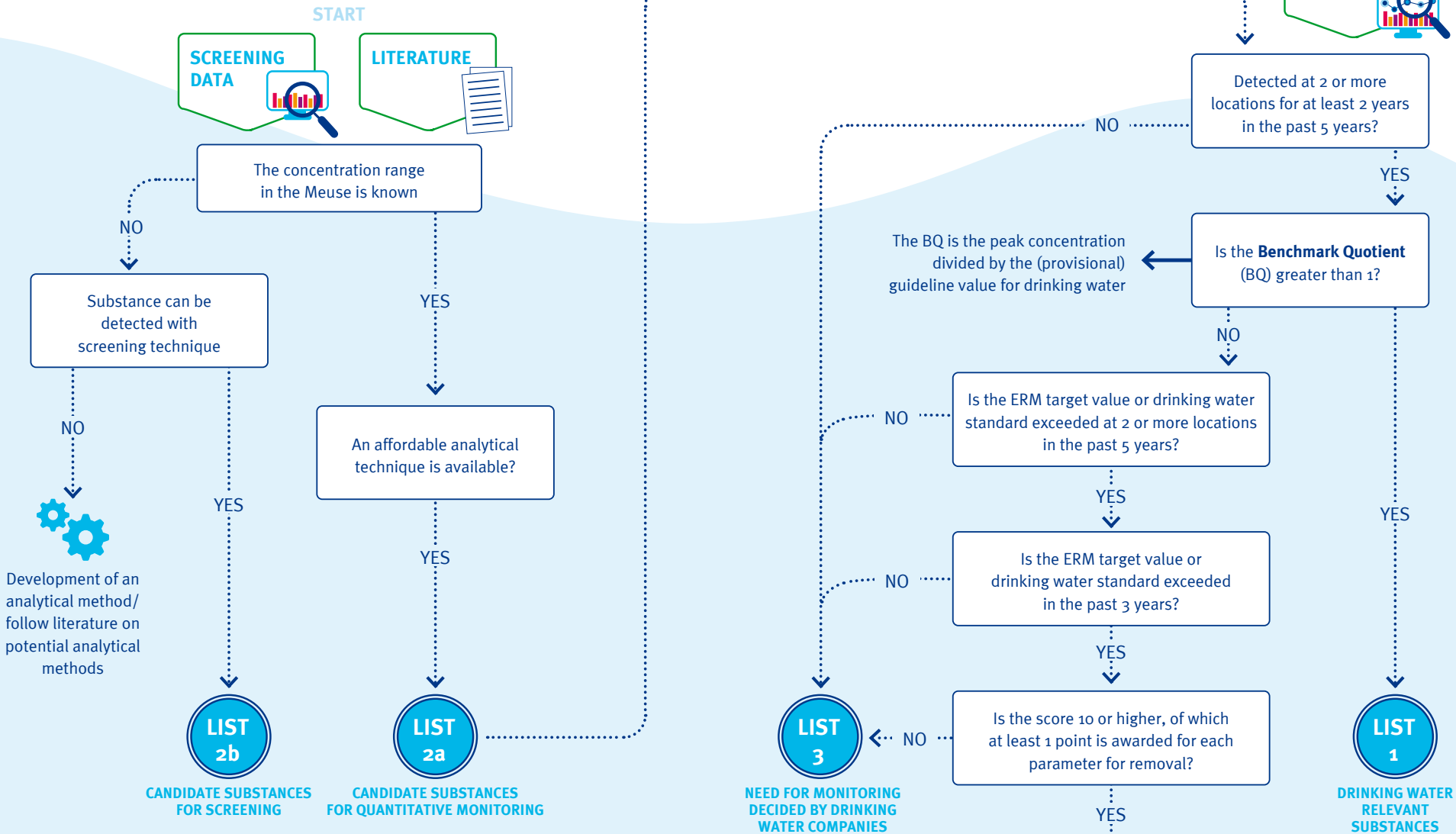
List 1: Drinking water-relevant substances
List 2: Candidate drinking water-relevant substances
List 2a: Candidate substances to be monitored via target substance analyses
List 2b: Candidate substances to be screened
List 3: Substances that no longer meet the criteria

The evaluation was conducted based on measurement data from Rijkswaterstaat and RIWA-Meuse-member monitoring stations and abstraction points along the Meuse between 2019 and 2023. The study identified new candidate drinking water-relevant substances based on a literature study and screening data. RIWA-Meuse recommends all affiliated drinking water companies to monitor the selected substances on lists 1, 2a and 2b to gain detailed insight into the water quality of the Meuse.

List 1 now includes a total of 37 drinking water-relevant substances, one of which is a substance group consisting of 20 PFAS (see infographic on pages 66 and 67). 9 of these are grouped into 4 sets because they consist of parent substances and their corresponding metabolites. RIWA-Meuse focuses its efforts on these 37 drinking water-relevant substances: This list is highlighted during consultations on the Water Framework Directive (WFD), as well as in discussions on permitting, supervision, and enforcement.

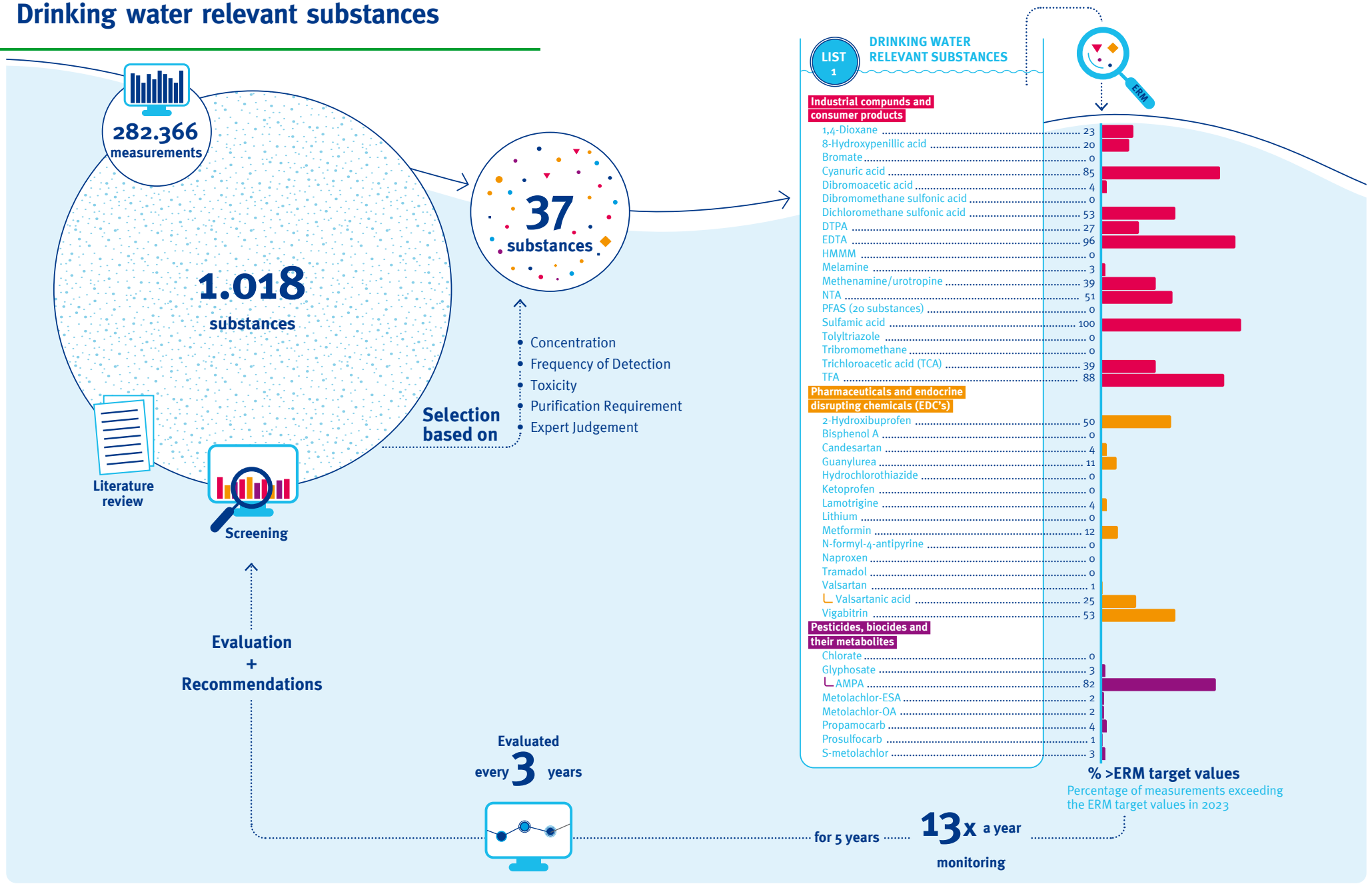
19 https://www.riwa-maas.org/en/publicatie/an-update-of-the-lists-with-substances-that-are-relevant-for-the-production-of- drinking-water-from-the-river-meuse/

Selection criteria (candidate) drinking water relevant substances



A schematic overview of the ranking scheme used to establish the list of drinking water relevant substances.

Drinking water relevant substances



List 2a contains 13 substances for which an analysis method is available. RIWA-Meuse recommends that its members include these substances in the joint monitoring programme for the Meuse and analyse them via quantitative analytical methods.

RIWA-Meuse proposes that the 50 substances on List 2b be added to the screening database of Aqualab Zuid and HWL and to initially monitor them in the Meuse via targeted screening, or to carry out a preliminary screening via non-target screening (NTS).

List 3 contains 132 substances that have been assessed in full but no longer meet the criteria for inclusion in Lists 1 or 2. This list is maintained to safeguard information about the assessment of these substances and to avoid the duplication of work in subsequent assessments (see the infographic below).

Limited overlap with WFD priority substances

In October 2022, the European Commission adopted a proposal to revise the lists of priority pollutants in the surface water and groundwater. If the Council of the European Union and the European Parliament approve the proposal, Member States will have to take measures to comply with the quality standards for the additional pollutants and to make their monitoring data available more frequently.

The proposal contains 70 substances and substance-groups. The RIWA-Meuse database contains measurement data for 57 substances in 2023 (the most recent data available at the time of the last evaluation). Of these 57 substances, 5 exceeded or were equal to the ERM target value in 2023: 1,2-dichloroethane, DEHP, glyphosate, HCB and bisphenol-A. Of these 5 substances, only glyphosate (ranked 19) and bisphenol-A (ranked 32) are included on the current List 1 of drinking water-relevant substances. In 2023, none of the measurements of these 57 substances was above the proposed maximum environmental quality standard. For 7 substances, the maximum value was at or above the annual average environmental quality standard in the proposal: these are not breaches.

The substances in question are 1,2-dichloroethane, glyphosate, diclofenac, PFOS, lead, nickel and bisphenol-A. 3 of the 7 substances are on the current list 1 of drinking water-relevant substances: PFOS (ranked 1), glyphosate (ranked 19) and bisphenol-A (ranked 32).

Sources

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The candidate drinking water-relevant substances and substances that are no longer relevant to drinking water 2024

LIST 2a CANDIDATE SUBSTANCES FOR QUANTITATIVE MONITORING

Industrial compunds and consumer products

- 1,2,4-Triazole
- 1,2-Dimethoxyethane (monoglyme)
- Methylglycindi acedic acid (α-ADA, MGDA)
- PFPrA
- PFPrS

Pharmaceuticals and endocrine disrupting chemicals (EDC's)

- Adamantan-1-amine
- Bisphenol-F
- Fexofenadine
- Flecainide
- Levocetirizine
- Oxipurinol
- Ritalinic acid

Metabolites

- Chlorothalonil R471811

LIST 2b CANDIDATE SUBSTANCES FOR SCREENING

Industrial compunds and consumer products

- ((Perfluorododecyl)methyl)oxirane
- 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-henicosafluoro-12-iodoheptadecane
- 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-henicosafluoro-12-iodooctadecane
- 1,3-Dicyclohexylurea
- 1-Phenyl-1,2-propanediol
- 2,4-Dimethylaniline
- 2-Methyl-2H-benzotriazole
- 2-Phenylquinoline
- 3-Bromo-5-chloro-2- hydroxybenzoic acid
- 6PPD-quinone
- Benzothiazole-2-sulfonic acid
- Benzylchloride
- Cotinine N-oxide
- Dicyclohexylamine
- (Methoxymethyl)melamines (mono-, di-, tri- and penta-) (MMM)
- Perfluoro-p-ethylcyclohexylsulfonic acid (PFECHS)
- Phthalic anhydride
- Tributyl citrate acetate

Pharmaceuticals and endocrine disrupting chemicals (EDC's)

- 10-Hydroxy-amitriptyline
- 4-Amino-3-hydroxybenzoic acid
- 4-Hydroxy-omeprazole
- Abacavir
- Altrenogest
- Benserazide
- Betamethasone
- Carprofen
- Chlortetracycline
- Dioxoaminopyrine
- Doxycycline
- EDDP ((2E,5R)-2-ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine)
- Emtricitabine
- Florfenicol
- Flubendazol
- Fluralaner
- Levofloxacin
- Losartan carboxylic acid
- Mesterolone
- Monensin
- Tenofovir
- Toltrazuril
- Triaprost
- Xylazine

Pesticides, biocides and their metabolites

- Acetamiprid
- Didecyldimethylammonium (DDAC)
- Fluopyram-7-hydroxy
- Haloaniline
- Lauryl guanidine
- Metamitron-desamino
- 3-Propyl-1H-1,2,4-triazole-5-amine (HYPA)
- Simetone

LIST 3 NEED FOR MONITORING DECIDED BY DRINKING WATER COMPANIES INDIVIDUALLY

- 1,2-Benzisothiazol-3(2H)-one
- 1,2-Diacetylbenzene
- 1,3-Diethyldiphenylurea
- 1,3-Diphenylguanidine
- 10,11-Dihydro-10,11-dihydroxycarbamazepine
- 1-Chloro-2,2,3,3-tetrafluorocyclobutane (C4H3ClF4)
- 1H-Benzotriazole
- 2-(Methylthio)benzothiazole
- 2,2,6,6-Tetramethyl-4-oxopiperidinonoxy
- 2,2'-Dimorpholinyldiethyl-ether
- 2,3,3,3-Tetrafluoro-2-(heptafluorpropoxy) propanoate (GenX substance)
- 2,4-D (2,4-dichlorophenoxyacetic Acid)
- 2-[4-(Diethylamino)-2-hydroxybenzoyl] benzoic acid
- 2'-Aminoacetophenone
- 2'-Methoxycinnamaldehyde/ cassiastearoptene
- 3,5,6-Trichloro-2-pyridinol (TCP)
- 4-Methylbenzotriazole
- 4-n-Nonyl phenol
- Acesulfame-K
- Acetaminophen (paracetamol)
- Acetone
- AHTN (6-acetyl-1,1,2,4,4,7-hexamethyltetraline)
- Amidotrizoic acid
- Amoxicillin
- Anti-androgenic activity (expressed in flutamide-equivalents)
- Aspirin (acetylsalicylic acid)
- Azelaic acid
- BAM (2,6-dichlorobenzamide)
- Barbital
- BBP (butylbenzylphtalate)
- Benzo(a)pyrene
- Benzothiazole
- Benzyldimethyltetradecylammonium
- Bis(2-chloroisopropyl) ether
- BPS (4,4'-sulfonyldiphenol)
- Butan-2-one O,O',O''-(methylsilanetriyl) oxime
- Caffeine
- Caprolactam
- Carbamazepine
- Carbendazim
- Cetirizine
- Chloridazon
- Chloridazone-desphenyl
- Chlorotoluron
- Ciprofloxacin
- Citalopram
- Clarithromycin
- Clindamycin
- Clopidol
- Cloxacilline
- DBP (dibutyl phthalate)
- DEP (diethyl phthalate)
- DIBP (di-(2-methyl-propyl)phthalate)
- Diclofenac
- Diethyl-2-phenylacetamide
- Diglyme (bis(2-methoxyethyl)ether)
- Diisopropyl ether (DIPE)
- Dimethenamid
- Dimethyl octadecylphosphonate
- Dimethyldisulfide
- Di-n-butyltin
- Diundecyl phthalate (DUP)
- Diuron (DMCU)
- DMSA (N,N-dimethylaminosulfanilide)
- Dodecylbenzene sulfonic acid
- Dotarem (Gd-DOTA)
- Erucamide
- Erythromycin
- Estrone
- ETBE (ethyl-tertiairy-butyl-ether)
- Ethyl sulphate
- Fenbendazol
- Fluoride
- Gabapentin
- Gadolinium (containing contrast agents)
- Gadovist (Gd-BT-DO3A)
- Galaxolide (HHCB)
- Helional
- Hexa(methoxymethyl)melamine
- Ibuprofen
- Iohexol
- Iomeprol
- Iopamidol
- Iopromide
- Ioxaglic acid
- Ioxitalamic acid
- Irbesartan
- Isoproturon
- Isosafrol
- Lincomycin
- Magnevist (Gd-DTPA),
- MCPA (4-chloro-2-methylphenoxyacetic acid)
- Mecoprop (MCPP)
- Metamizol
- Metazachlor
- Metazachlor-ethane sulfonic acid
- Metazachlor-oxanilic acid
- Methoxymethyltriphenylphosphonium
- Methyl-desfenylchloridazon
- Metofluthrin
- Metoprolol
- Monepantel
- Monobromoacetic acid
- Monochloramine
- MTBE (methyl-tert-butylether)
- Multihance (Gd-BOPTA)
- Musk (ketone)
- Musk (xylene)
- N-(2-carboxyethyl)-N-octyl-β-alanine
- N,N-Dimethyldodecylamine
- N,N-Dimethyldodecylamine n-oxide (DDAO)
- N,N-dimethylsulfamid (DMS)
- N-butylbenzenesulphonamide
- NDMA (nitrosodimethylamine)
- Nicosulfuron
- O-desmethylvenlafaxine
- Oxadiazon
- Pentobarbital
- Phenanthrene
- Phenazone
- Phenobarbital
- Pyrazole
- Sabinene
- Safrol
- Salicylic Acid
- Sebuthylazine
- Sotalol
- Sucralose
- Sulfamethoxazole
- Surfynol 104
- TBP (tributylphosphate)
- TCEP (tris(2-chloroethyl) phosphate)
- TCPP (tri-(2-chloroisopropyl) phosphate)
- Telmisartan
- Terbuthylazine
- Tetrabroombisfenol A
- Tetrachloroethene
- Tetrahydrofuran
- Thiabendazole
- Tilmicosine
- Triamcinolonehexacetonide
- Trichloroethene
- Trichloromethane
- Triethyl citrate
- Trifluoromethanesulfonic acid (F3-MSA)
- Triflusulfuron-methyl
- Triisobutyl phosphate
- Trimellitic anhydride
- Triphenylphosphine oxide (TPPO)
- Venlafaxine
- Vinylchloride

RIWA Meuse

"This tool gives us insight into the distribution of harmful substances in the river Meuse."

Thijs Blom
Data analyst at RIWA-Meuse

A5 Interview with Thijs Blom

Data analyst at RIWA-Meuse

RIWA is working with the Clean Meuse Water Chain to reduce micropollutants in the Meuse: what have we achieved so far?

Which harmful substances have been present most in the river water in the Meuse basin in recent years and where? What is the most effective way to analyse these trends in order to tackle the presence of the pollutants in question? Four trainees from the National Water Traineeship developed a tool for this purpose.

A number of substances in drinking water sources are particularly difficult for drinking water companies: substances that can be harmful to human and animal health, are difficult to clean up and are frequently detected during monitoring activities. For example, industrial pollutants, consumer products, medicines and various pesticides.

The Clean Meuse Water Chain (SMWK), a partnership between drinking water companies, water boards, Rijkswaterstaat, the Ministry of Infrastructure and Water Management and RIWA-Meuse, wants to reduce the presence of these types of micropollutants in the Meuse. Micropollutants is the umbrella term used to identify a large group of substances with various applications and varying chemical properties. The aim is to achieve a reduction of 30% by 2040 compared to 2023, the year when the SMWK's joint monitoring network was launched. To determine whether this has been achieved, the SMWK is measuring 38 substances at 30 monitoring points at least four times a year.

Four trainees from the National Water Traineeship developed a tool for this purpose. "The tool shows how far we've come with the reduction envisaged," explains Thijs Blom, the project leader. "Are we now seeing an increase in the concentration of a particular substance in the Meuse, or is it decreasing? Are we on the right track? And are we focusing on the right substances?"

Three types of substances and locations

The study examined the 38 substances collectively measured by the SMWK; they can be broken down into three categories: Firstly, Industrial pollutants and consumer products; secondly, Residues of pharmaceuticals and endocrine-disrupting chemicals and, thirdly, Plant protection products, biocides and their metabolites.

"This will enable us to specifically set out to find sources of pollution, with the aim of reducing the presence of these substances."

There are also three categories of locations. Firstly, the monitoring points in the surface water points: 19 locations in the Meuse, where the water boards, drinking water companies, Rijkswaterstaat or the Flemish Environment Agency conduct measurements. Secondly, the monitoring points at four abstraction points, where drinking water companies WML, Dunea and Evides abstract water from the Meuse for drinking water production. Thirdly, the effluent from five wastewater treatment plants, where water boards treat municipal wastewater.

Hotspots

The tool contains data from 2019 to 2023 inclusive. It was obtained from RIWA-Meuse measurements and the SMWK, which started its measurements in 2023, in the river and its tributaries.

The aim is for the tool to visualise trends: the concentrations in which substances are present in the three categories and where the hotspots are (in other words, the locations where the most breaches are measured). Blom explains: “This will enable us to specifically set out to find sources of pollution, with the aim of reducing the presence of these substances.”

Glyphosate

The study focuses on three categories of substances and three types of locations. The researchers have developed a dashboard for all 38 substances at the 29 monitoring locations.

The researchers focused on the plant protection product glyphosate, a widely used and controversial herbicide, which the EU recently authorised for another 10 years and that Blom studied during his traineeship last year (see p. 44 of the 2023 annual report). By law, drinking water companies are prohibited from producing drinking water from ground or surface water containing more than 0.1 micrograms per litre of plant protection product.

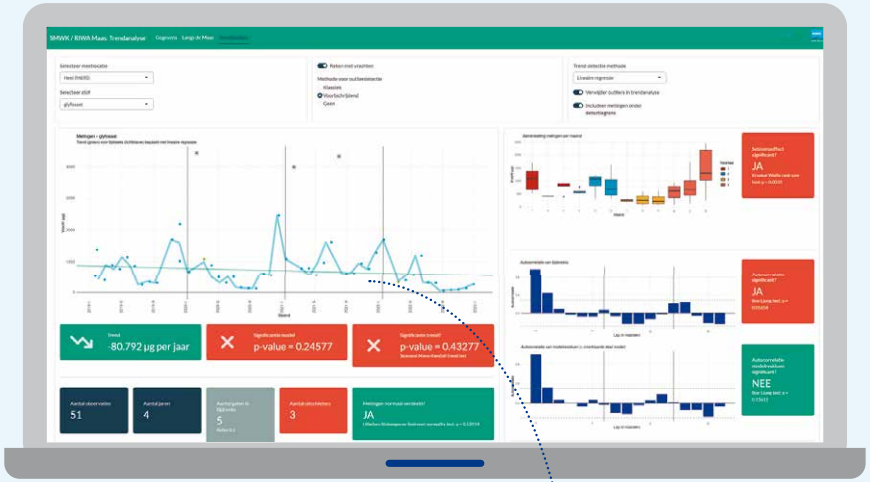
PFOA and a painkiller

The second substance that researchers studied was PFOA, a chemical substance from the group of PFAS, of which there are thousands of variants. This type is widely used in various products and has been on the European list of Substances of Very High Concern since 2013. RIVM lists numerous harmful effects on health.

The third substance is the medicine diclofenac, one of the most commonly prescribed painkillers, which also has anti-inflammatory properties. Like other medicines, its residues end up in rivers, including the Meuse, via the sewage system and wastewater treatment plants. RIVM research shows that the substance is harmful to aquatic life.

The dashboard highlights at a glance what our status is concerning the reduction goals.

Using this dashboard we are able to better uncover which substances need the most attention in the SMWK measuring program.



On the statistics tab we can monitor if trends are significant and whether seasonal effects apply to the data set.

Analysis of the data

Blom explains that you can use a dropdown menu in the tool to filter by substance, substance category and monitoring-point category. “The result is an overview of all the substances and locations that fall within the filters selected. For example, you can see the concentrations of medicines at surface water points and whether you are meeting your reduction target.” There is also a tab that shows the substances measured on a map of the Meuse River Basin.

The SMWK monitoring and interpretation working group (werkgroep Monitoring en duiding) is currently analysing the data in the dashboard. Blom: “The results will be available soon. They will show an upward or downward trend line for each substance and we will be able to clearly see how close we are to achieving our reduction targets.”

Trends in the Meuse

Results that Blom can already see: “It’s clear that glyphosate levels have been decreasing in the Bergsche Maas in recent years. The trend line for PFOA is almost horizontal. There’s a slight upward line; no real downward trend is observable yet. A high level of seasonality applies in respect of diclofenac; on average, the substance is not decreasing significantly in the Bergsche Maas. SMWK will continue its monitoring activities in the years ahead. Blom: “Trends will become even clearer once we have five years of uniform data from the SMWK monitoring network.”

B

Good rules, limited compliance

Radboud University

"We prefer to avoid difficult decisions."

Sander Meijerink
Professor of Planning at Radboud University

B1 Interview with Sander Meijerink

Professor of Planning at Radboud University.

Time for more mandatory government control, better coordination and more international cooperation

Why has it not been possible to comply with water quality regulations and make sound international agreements about the use of Meuse water? RIWA-Meuse put this question to Sander Meijerink, a Professor of Urban Planning who specialises in water governance and climate adaptation. "The urgency of this issue has not really been recognised yet."

We started by asking why good regulations are in place to protect water quality but compliance with them is often poor. For example, the WFD, a European directive that has been in force since back in 2000. Originally, the aim was to achieve its objectives by 2015. There have been two postponements and the deadline is now 2027. Why will the Netherlands not be able to meet this new deadline either?

Professor Sander Meijerink attributes this, firstly, to government control, which is too voluntary and lacking in obligation. The Council for the Environment and Infrastructure mentioned this point in an advisory report recently too. Secondly, Meijerink believes there is a lack of policy coordination between the various sectors.

Mandatory and current

As an example of aspects the government could make more mandatory, Meijerink mentions the registration of water use. Irrigation, for example: watering agricultural crops. "Currently, there is no systematic registration of water extractions, from surface water and groundwater," Meijerink says. "Despite there being periods of water scarcity. This could be made mandatory for users, like farmers, so we gain a better insight into water consumption and are able to manage water use more effectively during times of water scarcity."

He also mentions out-of-date permits for discharging substances. "Once they have been updated, it may be found that fewer discharges are permitted in some cases. It will be difficult to achieve the WFD objectives until this happens."

Meijerink stresses that the WFD objectives also include the ecological quality of waterways. For example, giving waterways more space so they are able to meander again. "This is possible in many places; in others, it is not." He notes that the government is hesitant to expropriate agricultural land. It does not show the same hesitance when building roads, for example. "This would help make it easier to achieve a number of the WFD objectives."

Limited coordination

According to Meijerink, the second reason why water quality objectives are not being met, despite the sound policy in place, is the lack of policy coordination between the various sectors. "As we know, the WFD focuses on water and water quality. But the achievability of its objectives also depends on what is happening in other policy areas. Especially agricultural policy." He mentions fertiliser regulations, pesticide use, nitrogen policy and phosphate standards.

The National Programme for Rural Areas had actually made a good start with this coordination, Meijerink adds. Provinces, water boards and other parties in the programme had worked hard for a number of years to achieve a more integrated, coordinated approach to water quality and agricultural issues. "Unfortunately, this all stopped with the inauguration of the Schoof cabinet. Very disappointing," says the Professor of Planning.

The same is happening at European level, Meijerink says. "The Common Agricultural Policy emphasises food security without always properly considering

consequences for the environment. The coordination between agriculture and drinking water quality could actually be improved across the board."

Are the right regulations in place?

But are the policies, rules, guidelines and laws that are in place to protect water quality actually the right policies, rules, guidelines and laws or could they be improved? For example, the WFD applies the one-out-all-out principle: a surface water body must meet all the requirements to be deemed in compliance with the directive. "That's a very high bar," Meijerink says. "The resulting picture is sometimes a little distorted because of this. Significant progress may have been achieved on almost every aspect, but a country is deemed to be non-compliant if its fails to meet just one aspect. That's not exactly motivating."

In the Netherlands, the WFD sets no fewer than 100,000 chemical and ecological quality objectives for our surface water and groundwater. The Netherlands is currently meeting approximately 80% of these objectives but none of the approximately 750 Dutch surface water bodies has achieved 'good' status yet," Meijerink explains. This will only be possible when all the individual ecological and chemical parameters have been assessed as 'good'.

Reputation

Water quality in the Netherlands is relatively poor compared to other EU countries. Meijerink believes this is due to the densely-populated nature of our country; agriculture here is highly intensive and there is a lot of industry. "It's difficult to achieve water quality objectives like this when you've got so many people living on such a small piece of land."

But none of the countries will meet the 2027 deadline. "I think this is particularly painful for the Netherlands," Meijerink says. "Because we have a certain reputation in the field of water management. And we always lead the way in the development of international agreements and guidelines."

Motivated by our own interests in part: the Netherlands is located downstream and dependent on what happens in neighbouring countries. "We are hoping that international policy will pave the way for improved water quality, more water or better protection against flooding. That's why the Netherlands often initiates agreements like these. But it's a different story when it comes to implementing this policy on our own soil."

Workarounds

This situation is not limited to the WFD. Meijerink also mentions fish migration in the Rhine, for which the Haringvliet had to be partially closed. Also, restoration of the ecology alongside the Western Scheldt, for which the Hedwigepolder had to be sacrificed. "It took an incredibly long time before this actually happened. Which was only when the government couldn't get out of it any more and a deadlock had been reached from a legal point of view. Initially, endless workarounds were devised to try to make it happen. They have been necessary for both nitrogen policy and the WFD."

Why this is? "We don't want to be affected by our neighbours' contamination, but it all gets much more difficult when you have to take expensive or difficult decisions and disappoint people," he says. "That's something we often prefer to avoid." He cites livestock reduction and the effective monitoring of wastewater discharges by companies as examples.

No urgency

Is water quality actually an important issue here in the Netherlands? "That's very much the question," the professor answers. "Not really. I don't think the urgency of the issue is being seen and recognised sufficiently yet."

Meijerink mentions again the poor implementation of the WFD. "People are accepting the repeated failure to meet the objectives." However, he also says: "The directive has put water quality on the agenda. If it hadn't, we might have done even less. But water safety, the risk of flooding, has been higher on the agenda for years now."

Clean water

Meijerink observes that people still think we have ‘got it right’ here in the Netherlands. Naturally, the tap water in most countries is not as clean as it is here. “The thinking is: we’ll manage to purify the harmful substances. And that has been possible to date. But it’s getting more and more difficult and expensive to do.”

However, Meijerink does say that there are some things that are going well here: “Many other European countries lack the financial resources they need to be able to achieve the water management objectives. That’s less of a problem here in the Netherlands because we have a water board system, with water boards that also charge their own levies.”

International agreements

The second subject that RIWA-Meuse presented to the professor is international cooperation in the Meuse water basin. Given the changing climate, we are experiencing more extensive, extreme periods of drought in the Netherlands, Flanders, Wallonia, Germany and France. This is resulting in a shortage of water in rivers, including the Meuse, more often and for longer periods of time. Quality then decreases because harmful and difficult-to-degrade pollutants are diluted less. The risk of tension and possible water-related conflicts water could increase too.

So, it is important for the various countries to cooperate in respect of the use of Meuse water. Good cooperation exists between Flanders and the Netherlands about water availability. But it would be good to extend this to the entire water basin: closer cooperation with Wallonia, France and Germany on this theme. “That would certainly make sense in light of current events,“ Meijerink says. “You want to retain the water in the upstream parts longer, so it can be used in periods of drought.”

Meuse Discharge Treaty

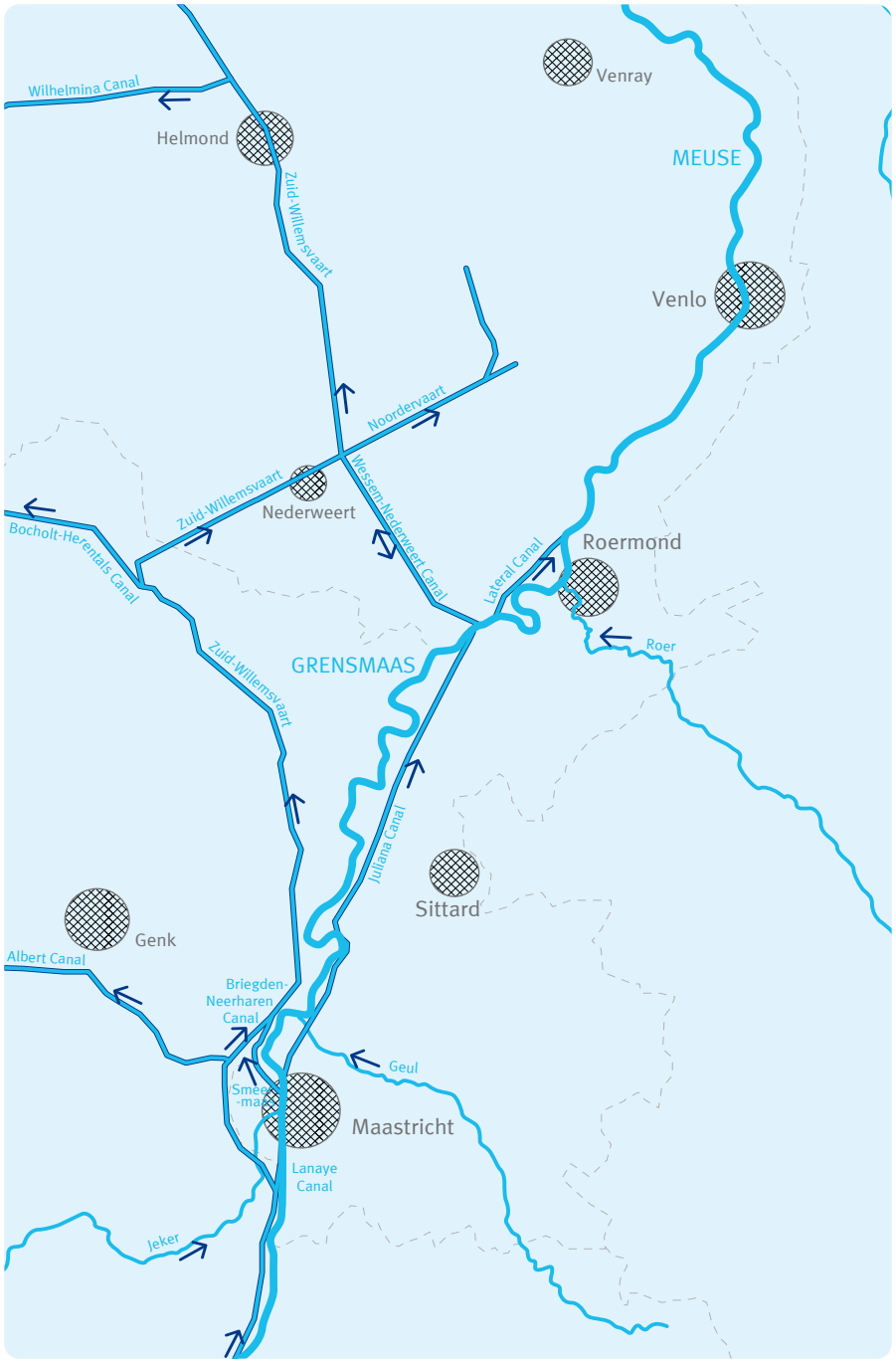
Flanders shares applications for wastewater discharge permits that could impact water quality across the border with the water manager in the Netherlands, so both can safeguard each other’s interests. The Meuse Discharge Treaty, which relates to the distribution of Meuse water between the Netherlands and Flanders, has been in force since 1996.

The treaty has been successful, Meijerink says: if an urgent situation arises, both countries discuss possible conservation measures. “Water scarcity was already on the agenda in the 1990s and agreements were made about it back then. However, decades of negotiations were needed to get to this point. Flanders was able to deepen the waterway in the Western Scheldt in return. We still don’t have a treaty like this for the Rhine.”

Upstream and downstream

But why are there no agreements with other countries, other than the treaty between Flanders and the Netherlands, about the use and distribution of Meuse water? This is due in part to the bifurcation of the river between the Netherlands and Flanders at Liège. Part of the Meuse flows via the Albert Canal to Flanders, part via the Meuse and Juliana Canal to the Netherlands and part is shared between the Netherlands and Flanders via the Meuse border. At this point, water is distributed in line with the agreements in place. This is not the case in other countries in the Meuse region; the river flows from one country to the other. This makes agreements more difficult because more water for one country can mean less for another.

The difference in interests between the upstream and downstream countries and regions also plays a role, Meijerink explains. “The Netherlands and Flanders are downstream, so it is logical for them to be very interested in agreements like this. This applies less to the upstream countries.”



Legal rankings

Besides agreements on the distribution of Meuse water between Flanders and the Netherlands, agreements are also in place about the distribution of water within these areas in the event of water scarcity. Specifically, legal rankings for the distribution between the various sectors: drinking water, shipping, industry, agriculture, recreation, nature and energy. In Flanders, this is called the assessment framework for priority water use; in the Netherlands, it is called the priority sequence.

The type of usage that is most important varies from one country to another, Meijerink explains. “A ranking for the entire Meuse or Europe as a whole is pointless because each country has different priorities for water use.” For example, in the Netherlands, dykes and drinking water are important; in Flanders, drinking water, industry and shipping; in Wallonia, shipping; and in France, the cooling of nuclear power plants, agriculture and recreational shipping.

Joint Drought Committee

Both the Netherlands and Flanders have a Drought Committee, which comes into action during periods of low river flows and (imminent) water shortages. Meijerink welcomes the idea of a joint Drought Committee for all the countries in the Meuse basin. “I think that would be very useful.” The various countries and regions in the International Meuse Committee have been keeping each other informed for several years now. Meijerink believes that greater coordination and the identification of possibilities for mutual support would be a good next step.

Meijerink believes the International Meuse Committee is best placed to foster more international agreements on the use of Meuse water. “That seems better to me than creating yet another new organisation. All the countries in the Meuse River Basin are already members and agreements of this nature align well with the goal of achieving integrated river basin management.”

The Flemish province of Antwerp

"Give downstream countries and regions an advisory role in major permit applications."

Cathy Berx
Governor of the Flemish province of Antwerp

B2 Interview with Cathy Berx

Governor of the Flemish province of Antwerp

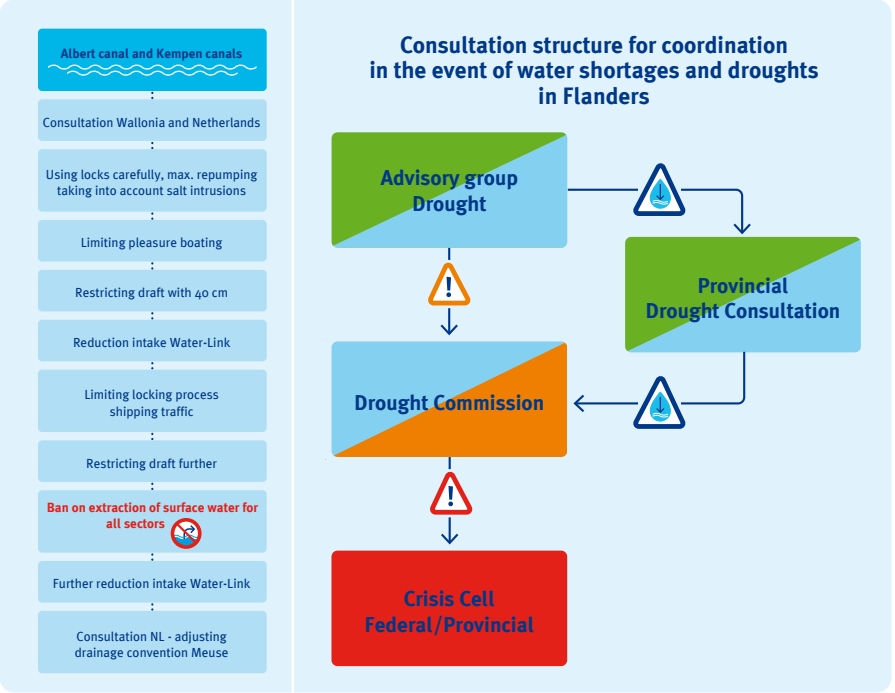
The challenges of water management during prolonged droughts in Flanders

Which challenges does Flanders come up against during prolonged droughts? This was the subject of Cathy Berx's keynote address at the 2024 National Delta Congress. RIWA-Meuse asked her about the importance of the Meuse, how Flanders is coping with prolonged droughts and what the international implications are. "It's an illusion that dilution is the solution to contamination."

In her keynote address, Cathy Berx said the following, amongst other things: "All policy and government action should start with a clear understanding of the water balance and, as such, with an objective assessment of the situation. Only then are evidence-based decisions possible. It's also crucial for governance to be organised very well: that timely warnings are given, that there is a uniform picture and that administrators consult each other. A roadmap outlines what these consultations should entail and how choices are assessed."

Could you explain how water management governance is organised in Flanders? Which choices have to be made and are they accepted by all the parties concerned? How does this work in practice?

Cathy Berx: "In Flanders, we use different management levels to coordinate droughts. Information sharing and advice are determined by the level applicable at a particular time. These agreements are set out in the road map on the coordination of water scarcity and drought (draaiboek Coördinatie waterschaarste en droogte), which is publicly available on the website of the Integrated Coordination Committee on Integrated Water Policy (CIW).

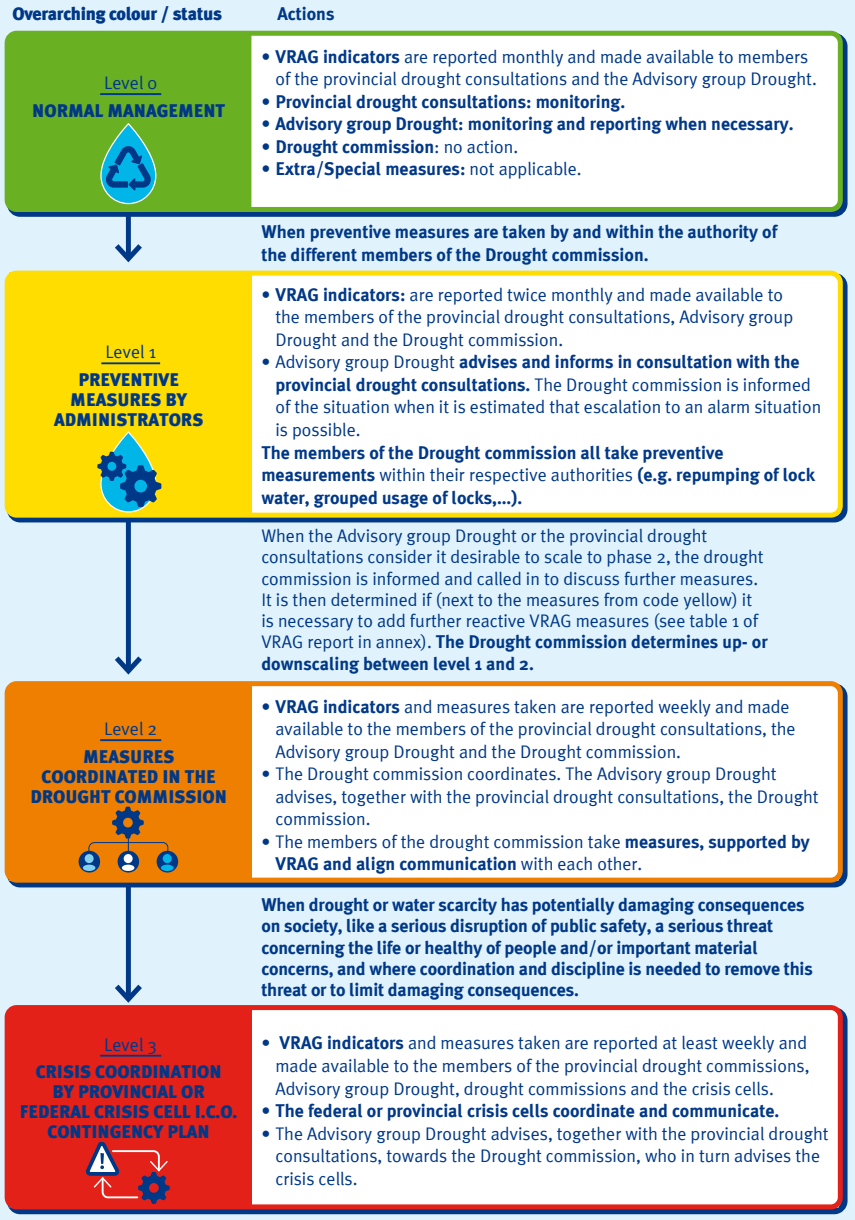


Edited source: https://www.integraalwaterbeleid.be/nl/overleg/ droogtecommissie/draaiboek/draaiboek-coordinatie-waterschaarste-en-droogte

There are four consultation forums: the Drought Advisory Group, the Provincial Drought Consultation, the Drought Committee and the Crisiscel ('Crisis Cell'). The image below uses colour codes to show which consultation forum is active at which management level. The sequence of consultations is also determined by the management level; frequency varies from monthly to weekly. It has also clearly been set out when and by which party scaling up or down is possible.

The measures to be taken are determined on the basis of the VRAG: the Flemish reactive assessment framework for priority water use (Vlaams Reactief Afwegingskader voor Prioritair Watergebruik). Generally speaking, a specific cascade of measures applies, based on a general cost-benefit analysis. It forms the basis of the VRAG. The example opposite shows the cascade established for measures on the Albert Canal.

Cascade of measures on the Albert Canal in case of drought and water shortages



Modified source: https://www.integraalwaterbeleid.be/nl/overleg/droogtecommissie/draaiboek/draaiboek-coordinatie-waterschaarste-en-droogte

As the governor of the province of Antwerp, I lead the provincial drought consultation, a role that logically aligns with my responsibilities in safety, public health and emergency planning. All these issues are also influenced by water quality and quantity. The importance of water for the foundation of our society cannot be overstated.

The supply of water via the Albert Canal serves significant socio-economic interests. Does the Flemish governance model help prevent potential water-use-related tensions and conflicts? If so, could you give an example?

"I'd like to refer again to the cascade of measures mentioned above. It is clearly stipulated that drinking water extraction must be avoided as much as possible and that measures that primarily impact shipping must always be taken first. To date, measures have never gone beyond the imposition of restrictions on recreational boating.

How is this administrative change an improvement compared to the 'old situation', before the Flemish reactive assessment framework for priority water use? Is Flanders in a better position to cope with prolonged periods of drought now? Would you also recommend this approach to other countries and regions; the Meuse River Basin , for example?

"Decisions are much more scientific and data-based now, which - of course - contributes to constructive discussions. Also, clear communication takes place about the measures expected, so they can be anticipated as much as possible in advance.

Given the changing climate, the expectation is that we will increasingly be confronted with prolonged, more intense droughts. It is also likely that water levels in rivers like the Meuse will be low more often and for longer periods of time. Flanders relies entirely on Meuse water from France and Wallonia to supply water for the Albert Canal. Approximately 90% of Dutch Meuse water comes from neighbouring countries, including Germany.

The Meuse Discharge Treaty has been regulating the distribution of Meuse water between the Netherlands and Flanders since 1995. During periods of water scarcity, this treaty serves as a guideline for the balanced distribution of available water between socio-economic use in both countries and the needs of the Meuse itself. Cooperation between Flanders and the Netherlands is based on mutual trust and respect for each other's interests.

Despite the interdependencies, no broader international agreements have been reached on the use and distribution of Meuse water in the Meuse River Basin ; for example with Wallonia, France or Germany.

"This could lead to tension and conflict, both between users and between countries within the Meuse River Basin

Would you like a treaty of this nature to be in place at a broader international level? Why haven't these agreements been made yet? Would you like to see a change in this situation?

"Of course, it would be beneficial to reach good agreements at an international level. However, as a downstream region, we don't have the strongest negotiating position. So, a more coordinating and regulatory role for Europe would help."

Persistently-low river flows are significantly increasing pressure for access to to scarce water. A careful weighing up of various interests is necessary. For example, drinking water, industry, shipping, energy production, cooling, agriculture, recreation and nature. This could lead to tension and conflict, both between users and between countries within the Meuse River Basin .

What is your view on this? Do you share these concerns? Given Flanders' dependence on other regions and countries for a sufficient supply of Meuse water, do you think it is important for an international governance model to be developed to coordinate water use and allocation internationally?

During droughts, we coordinate intensively with neighbouring regions. By doing this, we know what to expect and which efforts are needed to minimise water use with minimal impact. So, this coordination is effective at an operational level. However, given the expected climate extremes, it is crucial to strengthen this cooperation further.

Would a governance model like the one developed in Flanders work? Or would a different governance arrangement be more appropriate in an international framework?

"The principles of the VRAG could indeed form a basis for a European assessment framework."

In your keynote address at the National Delta Congress, you mentioned the Flemish Drought Commission, amongst other things. The Netherlands has a similar commission. Would you consider establishing a joint Drought Commission for all the countries in the Meuse River Basin ?

"That would be a good idea in principle, but we currently lack the mandate to develop it. For example, the International Meuse Commission does not have the authority to initiate a development of this nature."

What could be done to make sure this international commission is created? Which officials could make it happen? There does not seem to be a great deal of interest among the countries in question. Or perhaps the situation is not urgent enough yet for the need for this commission to be recognised? What do you think?

"An initiative of this nature should be discussed at a high political level. For example, at European level or in a ministerial meeting. Good agreements make good friends and, ideally, this discussion would happen before we are confronted with even bigger water crises."

You also discussed international cooperation in your keynote address. Cooperation between Flanders and the Netherlands is continuing to improve; it would be good to expand it to Wallonia, France and Germany. It is interesting, for example, that Flanders shares applications for wastewater discharge permits that could impact Dutch water quality with Rijkswaterstaat (the Dutch water manager), to safeguard Dutch interests.

It would be ideal if the relevant Walloon and French authorities could share applications for wastewater discharge permits with Flanders and the Netherlands for consultation purposes. What do you think and what would need to be done to make it happen?

Could it be an option to give downstream countries and regions an advisory role in major permit applications? This would have significant added value given the crucial role of the Meuse as a source of drinking water. We must maximise our efforts to protect it. Perhaps the time has come for a new quote: 'It's an illusion that dilution is the solution for pollution. Protection is the key to water quality.'"

Inspiring drought prevention projects from the Flemish Meuse region

- The hydroelectric power stations on the Albert Canal, which minimise lock losses and also produce green energy (fish-friendly design);
- The aquathermal energy assessment framework focuses on extracting heat from the canal without adding any additional heat to the system. This prevents any further strain on biological purification capacity during dry periods;
- The Dommel River Contract is an area-based process in which many actions are being taken to combat water shortages.
- The municipal rainwater and drought plans, which aim to find local solutions for challenges at municipal level.

University of Amsterdam

"Technology isn't the solution"

Peter van Baalen
Professor of Information Management and Digital Organisation at the University of Amsterdam

B3 Interview with Peter van Baalen

Professor of Information Management and Digital Organisation at the University of Amsterdam

Why is water-policy implementation often disappointing and how could information sharing be improved?

Why is water-quality policy fundamentally sound, but its implementation often leaves much to be desired? For example, the Netherlands is consistently failing to meet the objectives of the Water Framework Directive, harmful wastewater discharges are monitored poorly and relevant information is fragmented. Sometimes, it is good to ask people outside the water sector to take a look at these issues.

“Well, that’s a huge problem,“ Peter van Baalen thought as he read the previous RIWA-Meuse annual report. As a Professor of Information Management and Digital Organisation at the University of Amsterdam’s Faculty of Economics and Business, his field of expertise is not water but the most effective way to share knowledge and information. However, from his home in Maassluis, he can see the Nieuwe Waterweg and the water in his taps at home originates from the Meuse.

Not first and foremost

Van Baalen says that he was “a little shocked“ by the interviews in the previous report. He was surprised by the lack of transparency and cooperation between parties and countries. For example, the fact that the objectives of the WFD are consistently not being met and will not be met in 2027 either. “Especially when you consider that clean drinking water is our most basic necessity. How can we be lagging behind so much? Why are we struggling to prioritise water quality?”

Van Baalen believes that many people do not know how important the Meuse is as a source of drinking water. “We know the Meuse is used for shipping and that it floods. What’s less well-known is that seven million households depend on it for their drinking water. Once we realise that, I think we'll start looking at it differently.”

Responsibility

The previous report stated that the water quality policy is fundamentally sound — with clear guidelines and laws in place., both at European and national level and the implementing organisations are competent and usually act in good faith - but the implementation — and therefore the actual practice — often leaves much to be desired.. “A clear governance structure is absent,“ Van Baalen says, referring to the way policy is managed, implemented and monitored. “Who is overseeing the whole, the objectives and enforcement? Who is taking responsibility for solving the problem: the poor water quality?”

Van Baalen mentions the wide range of organisations involved: the drinking water companies, water boards, central and local government, environmental services, knowledge institutes and associations - and the fact that they are all responsible for different things. “That worries me. They’re the reason for many of the problems.” Because a lack of clarity also makes it difficult to improve water quality and resolve any tensions or conflicts, he explains.

From fragmented information to a platform

In short, information is very fragmented. For example, in relation to water quality, relevant aspects include the many substances that end up in the water, discharge permits, local companies, hydrological data, and information about the consequences of climate change.. All this information is held in different places, in different programs and is often either not shared or only minimally. Improving this could help improve water quality and water management.

But how can public organisations, research institutes, and private parties effectively share knowledge, data, and information of this nature? This complex

question was put to the Professor of Information Management and Digital Organisation as well. Van Baalen thinks it would be a good idea to create a central database or platform and create a third party for this purpose. “Information exchange between organisations is always very difficult,“ he says. “Uniform standards and protocols need to be developed. A key issue always is: who adapts to who? However, the willingness to exchange information is even more important.”

Water puzzle

Many companies are very reluctant to share information and will wonder how it would be shared and with whom, Van Baalen says. “Information like this is very sensitive.” He experienced this for himself, for example, when researching the development of standards and agreements on data sharing for the container industry. However, in other research, he has noticed that parties are often willing to share knowledge but are unaware of any demand for it.

Van Baalen is also aware of the risk of information overload, which can occur when organisations exchange large volumes of information. So, it is important to be clear on exactly what information is needed from which party. He summarises this as: “Knowing exactly what the water puzzle is.” In this context, he cites the fact that Meuse water is used not just for drinking water production but also by other sectors: industry, shipping, energy generation, cooling, agriculture, recreation and nature.

Not a technical issue

Van Baalen believes that information sharing is perhaps the most difficult conversation to have within a governance structure. “But once you’ve overcome these hurdles, smart, AI-based technologies can be very helpful, of course.”

However, he does not see effective information sharing as a technical issue first and foremost. “It’s mainly about getting cooperation off to a good start, the agreements you make. The role of technology is relevant but always exists in a social, economic and political context. And these contexts determine how

technology will be used." He adds to this: "Technology enables you to automate and monitor a great deal. And significant improvements can be made. But that's not the solution. The solution really does lie in the relationships within the governance structure."

Peer collaboration

As regards the hackathon the police organised to identify the biggest water polluters (see the interview on page), Van Baalen says: "A hackathon about what you can do with the information you have is a very good idea, but it's important to view all the stakeholders as rights holders. Of course, I completely agree with the detection of water contamination and the tackling of environmental crime. But I don't think you should criminalise other parties, like industry and farmers, by labelling them as polluters. They definitely won't be motivated to share knowledge and collaborate if you do."

Van Baalen believes the best governance structure or approach in this situation - a river basin - is a cooperation-based peer governance structure. "I don't think a strict enforcement policy and a heavy-handed sanctions policy is the right approach. We need industry, some farmers and other water users. If it's clear what everyone's interests are, we can take joint responsibility for them. This may sound naive, but based on my experience with governance and knowledge sharing, this works best."

Limit situation

Van Baalen explains that each cooperating party should clarify the so-called 'limit situation': in which situation is my position at threat? "What does the minimum water quality or quantity need to be? This then has to be recognised by the various parties. I understand that the drinking water companies reach their limit in the event of low water. The concentration of harmful substances is very high at times like this." In the previous annual report, Van Baalen read that the parties involved in the Danube River Basin have been successful in making good agreements. "I'm very curious how they managed to do that."

Van Baalen refers to the situation in which drinking water companies stop abstracting water from the river when excessively high concentrations of a harmful substance are measured; this is called an 'abstraction stop'. "A kind of self-regulation takes place. When industry participates in the governance structure, they all share responsibility. Now, just one party is sanctioned."

Go all out

The Meuse flows through other countries too, of course. "Yes, that makes it even more complex," Van Baalen says. "It's about making companies and organisations share responsibility for clean drinking water. That includes the people who live alongside the Meuse in France, Belgium and the Netherlands. Take me, for example - I benefit from good water quality too."

Finally, referring to the current water-quality issues, which Van Baalen read about in the previous annual report, the professor says: "It's an absolute scandal that politicians aren't prioritising the collective, societal interest. They have to solve this issue but are choosing the interests of their party and siding with businesses or farmers. It's very bad news. This is political failure and has significant consequences. The slogan 'Go all out to improve water quality' on the cover of the 2023 report is no exaggeration. This really does need to be put higher up on the agenda."

The National Police

"There are quite a few smart people doing smart things. They're just not working together yet."

Amir Niknam
Innovation advisor at the National Police

B4 Interview with Amir Niknam

innovation advisor at the National Police

Police hackathon to identify the biggest water polluters

No fewer than 100 participants from various organisations took part in the water quality hackathon last September. The object: to detect water contamination in the Netherlands and tackle environmental crime. Why the police organised this event? "Environmental safety is one of our transformation challenges."

Water quality specialists, toxicologists, researchers, data scientists, AI experts and students. They all attended the hackathon in Utrecht, organised by the National Police and the Human Environment and Transport Inspectorate (ILT), in collaboration with RIVM, as representatives of drinking water companies, universities, start-ups, water boards and knowledge institutes.

Participants worked on various objectives at 10 different tables. The overarching object was to develop a method that would facilitate the detection of water contamination and subsequent enforcement measures. "We looked at toxic pressure, an indicator that RIVM uses to determine the severity of contamination," explains Amir Niknam, innovation advisor for the police and one of the initiators of the event. "If this pressure is too high somewhere and there are substances in the water that shouldn't be there, how do you find the source of the discharge, the company responsible, and which actions you should take next, which legal entities are responsible?"

If water quality standards are breached, or a violation happens, Niknam believes that automatic notifications with an action attached to them should be sent automatically wherever possible. So that contamination is stopped and sanctions can be imposed. This instead of the current situation of random sampling and a case-by-case investigation into the source of the contamination. "We've looked at data science techniques to help us," he says. He believes it is good to know which parties are the biggest polluters. "Enforcement agencies like the police, water managers and the Human Environment and Transport Inspectorate are very busy. When choices have to be made, you want to know where to start."

Role for the police

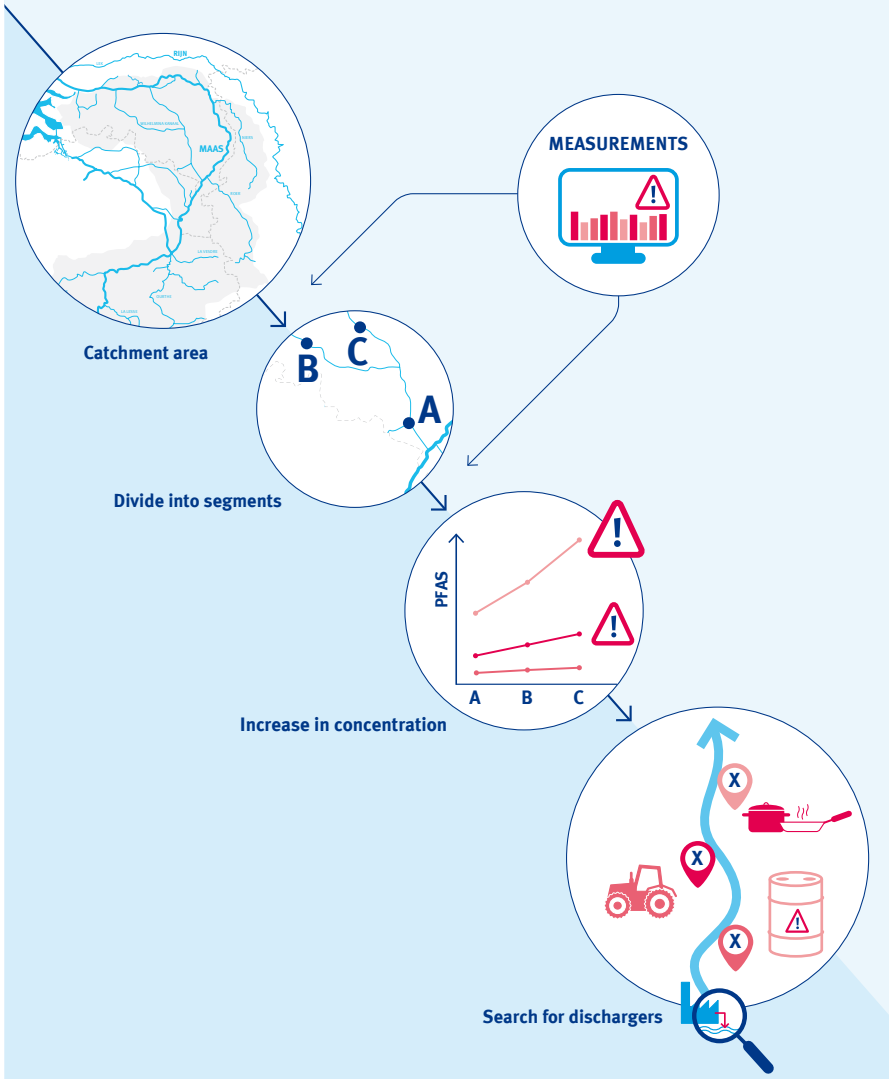
Niknam realises that most people will not immediately associate water quality with the police. "I'd like to change that." Back in 2017, he and an informal group of colleagues started to look at the subject of sustainability. "We felt that the police had a role to play here. There are countless victims of environmental crime and contamination, but they are often invisible." He became increasingly interested in this topic because of various studies. For example, according to the Lung Foundation Netherlands, air contamination kills 33 people in the Netherlands every day. "I feel a duty to right wrongs like this for future generations."

"To me, the climate crisis is the biggest security crisis of this century," says Niknam, who was also at the Extinction Rebellion demonstrations against fossil fuel subsidies on the A12 motorway. Not to arrest demonstrators but as a sympathiser. He says that, although some colleagues do not share his views, the police now consider environmental safety (as well as diversity, inclusion and digital transformation) one of today's major transformation challenges. "It's included in our policy documents. We, as the police, can protect the public with respect to this theme too. Especially if the law is being broken."

Prepare to be surprised

The police has already had positive experiences with hackathons: bringing together different parties to work together on a specific topic. Human trafficking and fugitives, for example. "It's very energising and has proved to be effective," Niknam says. "When faced with complex issues, prepare to be surprised by the results you can achieve when very smart people work together."

Approach PFAS detection



The idea this time was to do something in respect of climate or environmental safety. After discussions with all kinds of parties, including the Public Prosecution Service, the idea arose to focus on water quality. “Water quality in the Netherlands is under pressure,“ Niknam (whose role involves a wide range of subjects) learnt. “It will be a key issue in the years ahead. Because of our need to comply with legislation and also because of the contamination that’s happening.”

In the LinkedIn invitation to the hackathon, the police wrote: “We use our authority to ‘bring to book’ people and companies that are jeopardising the safe and healthy future of this country. For example, in tackling water contamination; we are targeting criminals and protecting nature. By tackling environmental crime, we are doing our bit to make society sustainable.”

Online platform

Niknam reflects on the success of the hackathon. “Because of the amazing ideas that emerged and the contacts we made we even found even some evidence of criminal offences.” The participants worked incredibly hard all day, he adds. “I think very few people were there because they had to be.” No one had time to take a break — even though a ping-pong table, a racing game, and other activities had been set up for them.

4 participants were from the company Future Facts Conclusion. After the event, they added their findings to an online platform: this was done in the form of a map of the Netherlands showing the toxic pressure per location. This proved challenging because of the sheer quantity of data, some of which was missing, had not been systematically collected or stored or was inconsistent. Niknam hopes this platform will be developed further and be made available to the public. “Making it easy for us to see what the current status is, where harmful discharges might be coming from and what needs to be done. I don’t think that’s too much to ask.”

Take over the baton

Many parties in the water world felt that the hackathon had come just at the right time. Especially because of the authority that the police brought to the subject. Niknam and his colleagues, about 10 people, organised the hackathon in their spare time and the police have no plans for a follow up to the event.

However, Niknam does hope that another party, a government agency, will take over the baton and continue to address the water-quality issue. “Someone that will take the lead - in collaboration with other organisations and companies, of course. There’s certainly a need for it.” He does not think time and money are the problem. “Definitely not. This will save time and money in the long run. Vision is more important.”

Cooperation tools

So what does Niknam feel needs to happen? “Just as with many other issues, I see a lot of people working hard on this issue,“ he says. “But also that it’s difficult to make significant progress. And that’s because certain basic pre-conditions aren’t being met.” He gives the example of the absence of one central place with up-to-date information about the discharge permits issued. “I'm glad steps are now being taken to create this.”

Niknam also mentions the many organisations involved in water: central government, provinces, municipalities, water boards, environmental services, drinking water companies, knowledge institutes, etc. “The landscape is very fragmented. I would like to see the introduction of cooperation tools, so we can exchange data and communicate better.” He would also like to see a common architecture and agreed standards, making it possible to coordinate data from different parties (about permits, for example). In this way, each organisation could continue to use its own systems without the need to enter data twice.

Modernising the polder model

Niknam does not believe the current organisational structure is optimal either: “Sometimes, it even hinders us: many people have packed schedules, inboxes are full, multiple meetings are planned and there is an information overload. That puts the brakes on creativity.”

But what can we do to change this situation? “I think it’s time to modernise our polder model; something that we’re really good at,” he responds. “Go back to the drawing board and rethink what cooperation should involve. What can we do to strengthen each other?” He suggests dedicating one day a week to working on this. And to set up a joint platform on water quality that people can contact with the questions they have, even if they work for different organisations and are in different parts of the Netherlands.

Niknam thinks the hackathon was a good start. “I was a bit taken aback by the talent there. “There are quite a few smart people doing smart things. Just not together yet; so that’s something we need to invest in.”

C

Discharge permits, supervision and enforcement

Rijkswaterstaat South Netherlands

"Who knows if the discharge information that companies provide is actually correct?"

Roel Kwanten
Coordinator of emerging substances and water quality at Rijkswaterstaat South Netherlands

C1 Interview with Roel Kwanten

Coordinator of emerging substances and water quality at Rijkswaterstaat South Netherlands

Why are the majority of discharges into the sewage system so poorly mapped?

To improve water quality, the Netherlands needs a better understanding of the origins of wastewater discharges. Indirect discharges, via the sewage system, in particular are poorly documented. Roel Kwanten: "It would be good to be able to take samples at large companies on a monthly basis."

The majority of the hundreds of thousands of companies in the Netherlands discharge their wastewater into municipal sewers. These are called indirect discharges. A small number of companies discharge straight into rivers, canals, ditches, streams and other surface waters: these are direct discharges. Roel Kwanten, coordinator of emerging substances and water quality, who has worked at Rijkswaterstaat since 1990, estimates that there are approximately 2,000 of such companies.

Indirect discharges ultimately end up in surface water too, via wastewater treatment plants. This sounds and is better than discharges that go straight into the river, which was the case until about 50 years ago, Kwanten says. "However, the treatment plants are often unable to remove all the harmful substances from the wastewater. Indirect discharges aren't monitored as frequently either." Kwanten is also an ambassador for indirect discharges. In this role, he tries to connect people from different organisations, to raise awareness for this issue.

Direct and indirect discharges

Companies that discharge substances must apply for a permit, although a notification is sometimes sufficient, depending on the business category. Roel Kwanten tries to explain how this works in the Netherlands - it's not simple: "Rijkswaterstaat and the water boards are responsible for direct discharges. Rijkswaterstaat issues permits for discharges into national waters - the sea, rivers like the Meuse and major canals - and the water boards for regional waters, such as small rivers, ditches and streams."

The municipalities and provinces are responsible for indirect discharges. Kwanten: "The municipalities issue permits for smaller companies, while the provinces do the same for large and complex companies. But because they usually lack the expertise they need in-house, they have delegated the responsibility to the environmental services."

There are 28 regional environmental services (government agencies that are responsible for regional permitting, supervision and enforcement in respect of the environment and the physical living environment). "In many cases, the environmental services know more about emissions via the air or soil, or about noise emissions, than about water," Kwanten explains. "That's why companies usually approach the water board in the purification zone applicable to them."

What is the actual situation?

When applying for a permit, companies must clearly state what they discharge into the sewage system. Kwanten: "If a company says: we don't discharge PFAS or other problematic substances, the assumption is that it doesn't. But how do we know for sure? Especially when companies themselves sometimes don't. Measurements don't lie and also enable you to discover things sometimes."

For example, a few years ago, the House of Representatives asked the Minister of Infrastructure and Water Management whether any companies were discharging PFAS into national waters. Rijkwaterstaat's permits showed that no companies at all were discharging PFAS. "Rijkswaterstaat then started carrying out

measurements at companies we suspected were discharging PFAS," Kwanten says. "And we found 5 that were. Without the measurements, we wouldn't have known. The same applies to indirect discharges."

No budget

Kwanten says that just a fraction of the hundreds of thousands of companies that discharge into the sewage system - the indirect discharges - are subject to occasional inspections currently. He does not know exactly how often these inspections happen. "But I do understand from environmental agencies that they generally only carry out inspections if they suspect an illegal discharge."

Kwanten says that the inspection frequency depends on the type of wastewater. "There's no need to inspect a local bakery. But I think samples should be taken from large companies at least once a month."

Kwanten, as a representative of the SMWK, a partnership of drinking water companies, water boards, Rijkswaterstaat and the Ministry of Infrastructure and Water Management, has been in discussions with environmental agencies in recent years. "They are aware that they play a role in the huge puzzle of where substances come from," he says. "However, their mandate is to consult with companies that want to obtain permits. They don't have the budget or capacity for inspections."

Forgotten inspections

This approach - provinces and municipalities consult environmental agencies, who in turn consult the water boards - has been in place since 2009. This is when the Dutch Water Act came into effect; this was preceded by the Dutch Pollution of Surface Waters Act. Before this, the water boards were the competent authority responsible for issuing permits to medium and large companies. "The idea was for the water boards to manage wastewater treatment plants too; they wanted to monitor what kind of wastewater was being discharged into them," Kwanten explains.

Back then, the water boards regularly visited companies to inspect compliance with the permit conditions, the Rijkswaterstaat employee says. The water boards used to have their own laboratories, but this is no longer the case. "It was forgotten to include inspections in the Dutch Environment Act," Kwanten says. "Well, I say 'forgotten'. They weren't included in the remit." He feels this is "not a good thing." How this was possible? "Well, companies were allowed to arrange many things themselves back then. A lot of trust was put in them."

"It's like looking for a needle in a haystack because measurements aren't being taken at the companies at the locations where the substances are being discharged."

Emerging substances

Samples from organisations like the SMWK show that the water in our rivers, canals and streams regularly, or even consistently, exceeds various surface water and drinking water standards. "We often don't know where these substances come from," Kwanten says. "It's like looking for a needle in a haystack because measurements aren't being taken at the companies at the locations where the substances are being discharged." More and more of them are so-called emerging substances. These substances are not subject to any legal standards yet; there are a lot of them and it is often unclear how harmful they are.

Neighbouring countries

The permitting process in neighbouring countries is less complex than it is here in the Netherlands, says Kwanten, who is Flemish and lives in Flanders. "In neighbouring countries, just one competent authority usually issues

environmental permits: the municipality or province. Various government agencies advise the competent authority, each based on their particular areas of expertise. An environmental inspectorate usually carries out discharge inspections."

In Flanders, the Flemish Environment Agency advises municipalities and provinces on issuing environmental permits. "Wastewater monitoring inspections are regularly carried out here. So, there's more control over indirect discharges than in the Netherlands; the same applies in Wallonia, France and Germany."

Discharges on the internet

Unlike the Netherlands, the results of inspections in Flanders have been published online for a few years now. So, citizens are able to see exactly what companies have discharged. "The idea is that citizens have the right to see these figures because they pay the government to inspect companies."

So, would it be a good idea to look at how neighbouring countries are doing this? Kwanten: "It's not rocket science; it just needs to be organised. It's about freeing up capacity and budget to inspect indirect discharges more."

Political will

Does the fact that neighbouring countries are increasing their inspections mean that fewer harmful substances are entering the Meuse via indirect discharges from the south? Unfortunately, Kwanten's answer is: "Not necessarily." It depends very much on the conditions in the permit, he explains. "Sometimes, more permits are issued than we would like, or conditions aren't strict enough. There are times when we know a company is discharging certain substances, but they haven't been included in the permit."

Kwanten also observes that the available capacity, the number of people freed up for inspections and laboratory analysis, varies from one region to another. "There's sufficient will among colleagues in the various services in neighbouring countries, but the same often can't be said at political level."

Extra purification too

To summarise: Kwanten emphasises that we need to do more inspections if we truly want to map indirect discharges in the Netherlands and also improve water quality and get closer to achieving the objectives of the WFD. To do this, we need more budget to be able to hire people to do the measurements and analyses.

In addition to more measurements, Kwanten also highlights the potential for enhanced purification at wastewater treatment plants. "Via additional purification steps - with activated carbon or peroxide, for example - although these are very expensive techniques and not very sustainable."

He thinks both are necessary: "Start by trying to stop as many harmful substances as possible at the source. At the same time, take steps to make the discharged wastewater cleaner."

C2 Normative flow, an important water quality assessment for discharge permits: how does it develop over time and is it protecting the Meuse sufficiently?

Every discharge into surface water requires a permit from the water manager and the successful completion of an immission assessment. The object of the water quality assessment is to determine whether a discharge is in line with water quality objectives and whether it is responsible for any unacceptable environmental impact, on water quality in particular. The assessment establishes the relationship between the discharge and the receiving surface water. It is important that low river flows are taken into account when determining the maximum discharge limit for a substance. This is because harmful and difficult-to-degrade substances in particular are diluted less when river flows are low. So, this must be taken into account when authorising discharges into the river. The immission assessment compares the maximum daily discharge load of the discharge with the mean low flow that is undershot 90% of the time (the so-called P90 value). In other words, the maximum amount of a certain substance that may be discharged in a 24-hour period is determined based on a low river flow that occurs just 10% of the time.

The immission assessment handbook[1] states the following: *"The immission assessment is carried out based on a worst-case approach, which guarantees that the environmental quality requirements (EQRs) are met in at least 90% of cases. This is because the immission assessment proceeds on the basis of a situation with a low flow that is only undershot 10% of the time. The immission assessment specifically assumes the mean 90th percentile value for the low flow rate, based on the flow data most recently available from the past 10 years. If the immission assessment can be completed successfully in these flow situations, the water quality objectives can definitely be met in other situations with higher flow."*

A current and representative P90 value is crucial to ensure that water quality is safeguarded for the remaining 90% of the time. Outdated or incorrect P90 values can lead to excessively high concentrations of (harmful) substances being discharged for much longer than the specified 10% of the time, which will have negative consequences for drinking water production from surface water and for the achievement of the WFD objectives.

Until 2020, the P90 value was based on flow data from 2002-2011. Since then, a 10-year series has been used each year, because of which the P90 value varies over time. However, there is no overview of how this value is developing or of the impact that climate change is having. What does this mean?

RIWA-Meuse commissioned HKV lijn in water to study the robustness, transparency and climate sensitivity of the P90 value[2]. It seems that this low flow value for the Meuse is sensitive to annual flow variations; it is also uncertain exactly how this flow value is calculated. The main conclusions of this study follow below:

- In practice, the P90 value has been undershot for 5, prolonged consecutive weeks on various occasions in the past 10 years. In 2018, the permit value was almost continuously undershot between July and November (88% of the time in a 5-month period).
  › *Permits do not sufficiently protect water quality and fail to do so for much longer than anticipated.*
- The P90 value can vary considerably from year to year, by approximately 20% between consecutive years, depending on whether the years are wet or dry in the 10-year series.
  › *The maximum permitted daily discharge load can vary considerably depending on the year in which a permit application is submitted.*
- The method used to calculate the P90 value is not clearly set out in the immission assessment handbook.
  › *This can lead to ambiguity and calculation differences; choices with respect to annual classification or aggregation level affect the level of the P90 value.*

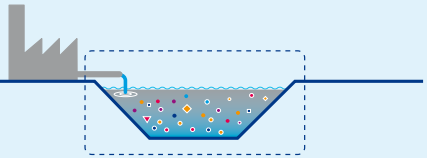
1 https://iplo.nl/thema/water/applicaties-modellen/vergunningverlening-toetsing-handhaving/immissietoets/

2 https://www.riwa-maas.org/publicatie/verkenning-stabiliteit-afvoerwaarde-lozingsvergunningen/

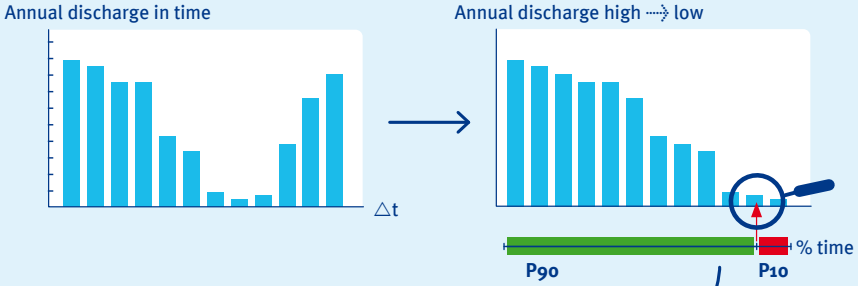
Do discharge permits protect the Meuse sufficiently during low river discharges?

WATER QUALITY TEST

P90-normative flow

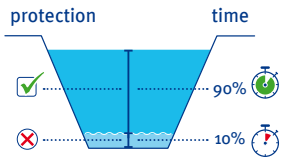


The test determines the hazard of discharges in permits on the 'receiving' water. It is essential to take into account low river flows.

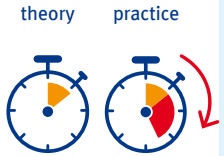


P90-value: must ensure that granted permits will not exceed environmental quality requirements **90%** of the time.

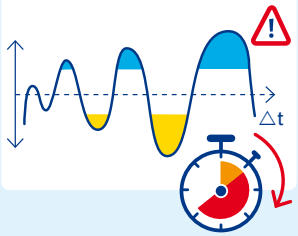
QUALITY TEST



EXCEEDING OF QUALITY NORMS



CLIMATE ROBUST?



The water quality test is done when granting permits to protect sources of drinking water during periods of low river flows against waste water discharges.

LONGER BREACHES

The P90-value is commonly exceeded for extended periods.

NOT PROTECTING

In dry years the P90-method is not protecting enough for the Meuse.

NOT TRANSPARENT

It is not unambiguously determined how the testing value is calculated, different outcomes are possible.

VARIABILITY

The P90-value can fluctuate +-20% per consecutive year, causing the daily freights of substances that can be discharged to fluctuate strongly each year.

REGULAR REVISIONS

To sufficiently protect with the changing climate, P90-values in permits must be regularly revised.

- In time, climate change will lead to lower P90 values. Technically, the method is climate-proof: the period of time during which the P90 value is undershot remains unchanged as the P90 evolves. A current P90 value protects the water 90% of the time.
  › *To be climate-proof, permits and the associated P90 value must be reviewed regularly, otherwise water quality will not be protected sufficiently.*

These findings underscore the need for a more robust and transparent substantiation of the P90 value. It is also recommended that permit values be periodically reviewed against the current P90 value. This will provide an insight into the risks for abstraction points in the event of prolonged low flows. However, this does prompt the question of whether a review of the current system is necessary and how other countries in the Meuse River Basin safeguard water quality in the event of prolonged low flows.

Usefulness and necessity of flow-dependent discharge permits

At the time of writing this article, we are experiencing the driest spring in decades. The highest precipitation deficit for this time of year has been recorded since measurements began. This is the third consecutive year of extreme drought. These were the sentences with which Peter de Putter, a water and environmental lawyer and Director of Sterk Consulting, and Jasper van Kempen, Professor by Special Appointment of Transdisciplinary Water Law at Utrecht University, started an article in the legal journal Milieu en Recht[3] in 2020. The article was based on research for which Sterk Consulting had been commissioned by the Ministry of Infrastructure and Water Management, into the possibility and necessity of making industrial discharges flow-dependent[4]. Is it necessary and possible to include flow-dependent discharge requirements in discharge permits, or permit regulations that become more stringent as flow rates in surface water bodies, such as major rivers, decrease?

In 2025, the Netherlands experienced its driest March since records began in 1906. This raises the question of whether the findings from Sterk Consulting's research are still relevant. And also the extent to which the research conclusions and recommendations have found their way to the appropriate authorities and led to the necessary changes?

Several passages, conclusions and recommendations from the research report follow below:

- The overarching conclusion is that current instruments - the abstraction ban in particular - give the water manager sufficient opportunity to protect water quality and dependent functions as much as possible when flows are low.
- Extreme drought can lead to lower water levels and flow deficits. Discharges happening at these times can cause surface water quality to deteriorate.
- It had already been guaranteed that the standards intended to protect the ecology and drinking water production would be met at least 90% of the time. A recent change means that the immission assessment now looks at data from the past 10 years (not the previous fixed period of 2002-2011). This ensures that the latest drought trends are always taken into account as well.
- In early 2019, a motion of the House of Representatives proposed switching to a system of flow-dependent discharge requirements in permits, replacing the current system in which one ongoing discharge requirement applies per substance (with the exception of cooling water discharges and several salt discharges). A system of this nature would have advantages and disadvantages, with the disadvantages outlined predominating for the time being. Currently, the conclusion is that there is no need to expand the existing permitting procedure to include a system of flow-dependent discharge requirements; it would be wiser to continue to utilise existing tools. However, to date it has been noted that little experience has been gained with the priority sequence .
- Given the limited experience in the use of drought instruments, the Minister of Infrastructure and Water Management is recommended to develop guidelines to help facilitate the rapid implementation of the measures available in times of extreme drought. The guidelines could also specify as to how to implement supervision and enforcement of the new specific duty of care set

3 *https://www.stowa.nl/sites/default/files/2024-03/juridisch%20instrumentarium%20voor%20het%20beperken%20van%20lozingen%20bij%20extreme%20droogte%2C%20MenR%20sept.%202020%20-van%20Kempen%20en%20de%20Putter.pdf*
4 *https://zoek.officielebekendmakingen.nl/blg-940948.pdf*

out in the Environmental Activities Decree (Bal). Knowledge of the possibilities that this duty of care offers is relevant for permit providers as well.

- Bearing in mind the relatively new nature of drought issues, it is also recommended that governments, drinking water companies and wastewater discharging companies organise regular (regional) contact moments, not least of all during the permitting process.
- The Minister of Infrastructure and Water Management has been advised to reassess the situation in five years, to see whether there might then be reason to consider low flow rates during the permitting process, as proposed in the motion described above.

How does the P90 value vary based on historical flow data?

5 years after the advice above, HKV "lijn in water" visualised how the P90 value of the Meuse at Eijsden and Megen develops if calculated as defined in the immission assessment handbook. Figure 1 shows how the P90 value would have developed in the past: no clear trend is visible but a strong year-on-year variation is. Notable year-on-year changes follow below:

- In Megen, the P90 decreases from 66.1 to 58.0 m^3/s between 2003 and 2004 (-12.3%) because the dry year 2003 is added to the time series.
- In Eijsden, the P90 increases from 43.5 to 52.2 m^3/s between 2020 and 2021 (+20%) because the dry year 2009 is removed from the time series.

How is the P90 value changing under the influence of climate change?

Figure 2 shows how P90 values are expected to develop in the future, based on the KNMI'23 climate scenarios.

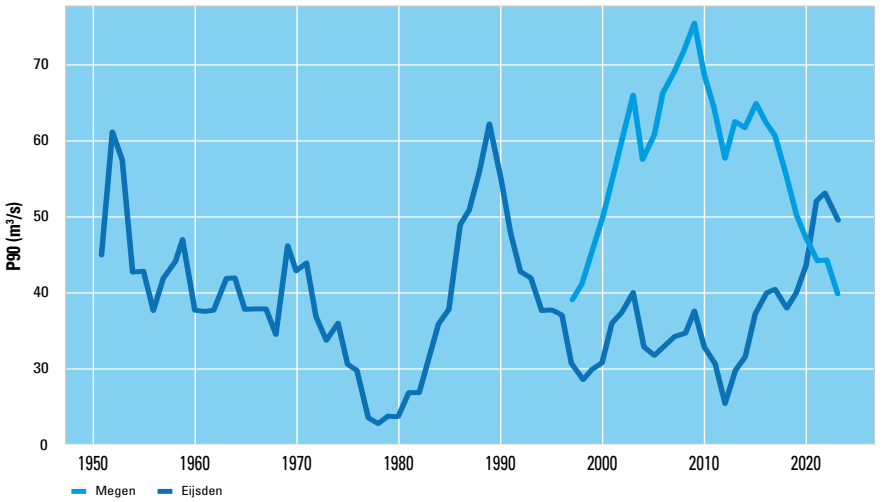


Figure 1: The P90 value for Megen and Eijsden. The P90 value is calculated based on the 10th percentile of the preceding 10 years.

Main trends

- For wet scenarios, we initially see a slight increase in P90 compared to the current climate (2033), followed by a decrease in the years leading up to 2150.
- For dry scenarios, the P90 value remains similar to the value today until 2050 and then decreases slightly.
- In every scenario, the spread (uncertainty) of the P90 increases the further we move in time.

The results show that the P90 value is climate-sensitive and will probably decrease over time. This makes it necessary to update the P90 values periodically to ensure they remain consistent with flow conditions in the prevailing climate.

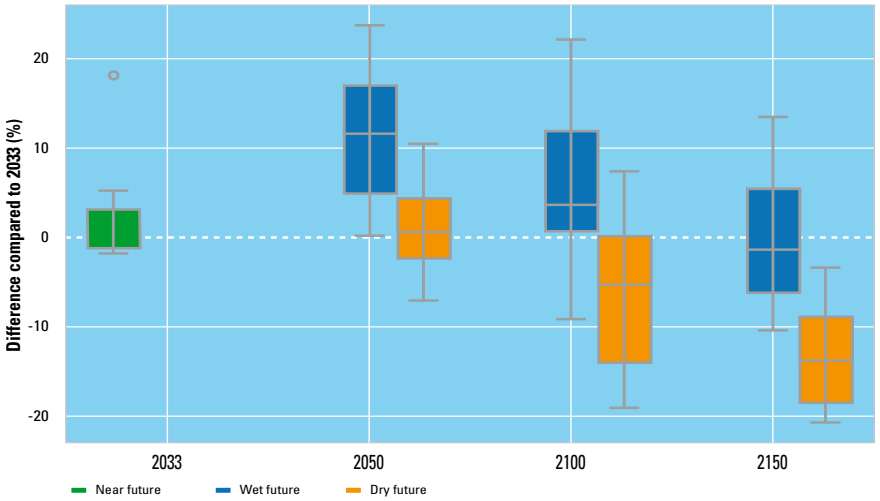


Figure 2: The P90 values for each climate scenario, based on 240 years. The coloured box represents the middle 50% of the data, the interquartile range (Q1 to Q3), with the median as the central line. The whiskers represent the data within 1.5 times of the interquartile range. Values outside this range (outliers) are indicated with a dot. A wet (blue) and dry (orange) forecast are shown. The variations in the box plots are due to the high, medium and low scenarios.

How does the period of time during which the P90 value is undershot vary over time?

Figure 3 shows the number of days per year in which the flow is below the permit value:

- In dry years, the number of days in which the permit value is undershot may be significantly higher. For example, the permit value was undershot almost consecutively for 135 days between July and November 2018 (36% of the year).
- In other dry years, e.g. 2019, 2020 and 2022, the number of days in which the permit value was breached were also significantly more than the expected 36.5 days, with the values being 94[5], 69[6] and 73[7] respectively.

5 *Compared to P90 of 58.1 m3/sec*
6 *Compared to P90 of 47.3 m3/sec*
7 *compared to P90 of 44.5 m3/sec*

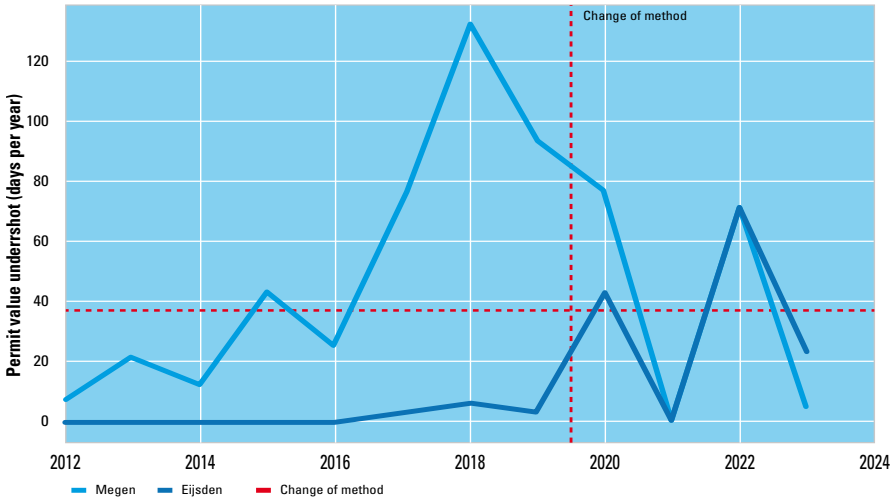


Figure 3: The number of days per year in which the permit value is undershot.

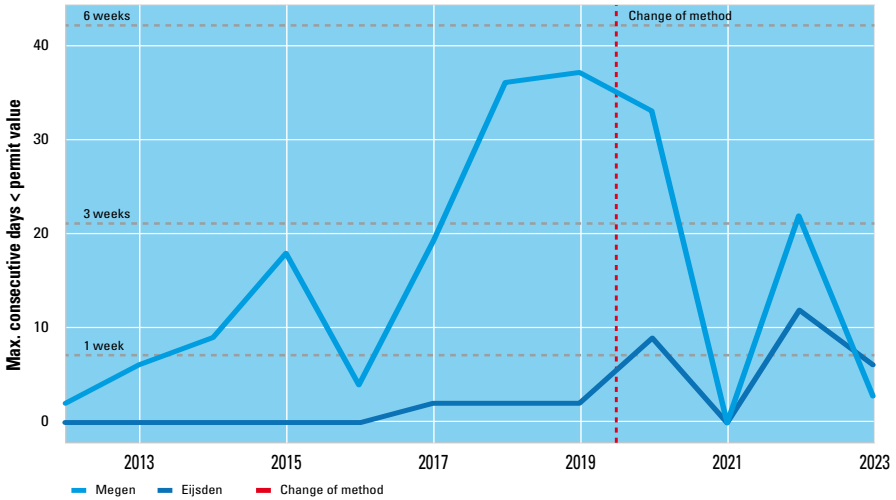


Figure 4: The maximum number of consecutive days per year on which the flow falls below the permit value.

Both the number of days and the longest consecutive period of time in which the permit value is undershot are particularly important for applications like drinking water abstraction. Figure 4 shows the maximum annual period of time during which the permit value is undershot. Key observations:

- In Megen, the permit value was undershot for ≥1 week in 58% of the years (2012-2023), compared to 17% in Eijsden.
- In Megen, the permit value was undershot for a consecutive period of ≥3 weeks in 33% of the years, with outliers of up to 5 weeks in 2019. The permit value was undershot for almost 5 weeks in 2018 and 2020 as well.
- In Eijsden, the maximum consecutive period of time during which the permit value was undershot remained consistently below 3 weeks.

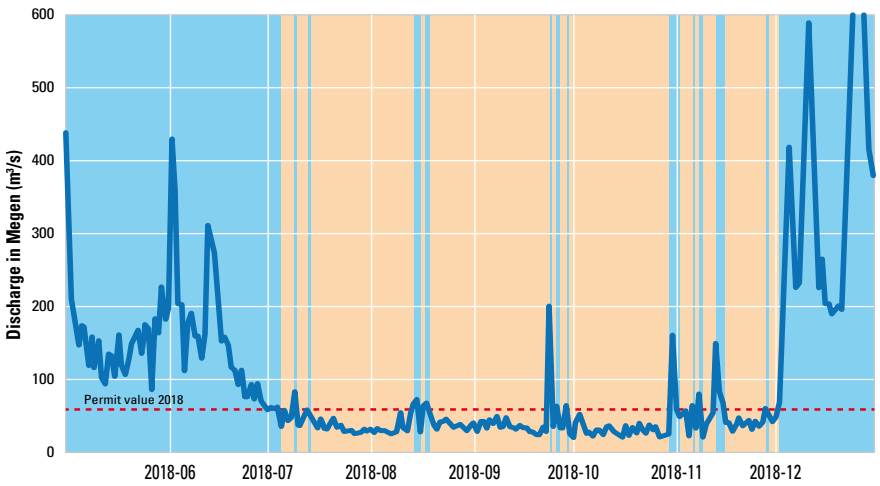


Figure 5: The periods during which the permit value was undershot in Megen in 2018. The events are clearly clustered between July and November.

In 2018, the longest consecutive period of time during which the permit value was undershot was 37 days. The permit value was not met for a total of 132 days. Almost all of these days were in summer and autumn periods (Figure 5). The 132 days during which the permit value was undershot all happened within a 150-day period - i.e. 88% of the time, within 5 months.

"It is proving difficult for the competent authorities to regularly review permits in practice."

As set out later in this report, the HKV study shows that if permits are not reviewed regularly the current procedure insufficiently protects the Meuse as a source of drinking water during prolonged periods of low river flows. It is proving difficult for the competent authorities to regularly review permits in practice: the question is whether the current system should now be reviewed to ensure the Meuse is adequately protected when river flows are low (which is already a more frequent occurrence)? This situation also raises the question of what other countries in the Meuse River Basin are doing to protect river water during prolonged periods of low river flows?

Evides and RIWA-Meuse

"We could do with being a little more activist in our approach."

Annette Ottolini
General Manager of Evides Water Company and board member of RIWA-Meuse

C3 Interview with Annette Ottolini

General Manager of Evides Water Company and board member of RIWA-Meuse

Permanent measurements, dynamic permits, agreements with companies and a ban on harmful substances

Which challenges has Annette Ottolini come up against in recent years and how does she view the future? Before stepping down from both of the roles above, we asked her to reflect on her past and future. "The time has come to bang the drum harder. We can't be patient for much longer."

In recent years, Annette Ottolini has been confronted with numerous challenges in her role as the Managing Director of Evides Water Company and board member of RIWA-Meuse. She has been in both roles since 2014 and is stepping down this year. The challenges in question related primarily to water quality in the Meuse. 86 percent of the drinking water that Evides Water Company produces for 2.5 million consumers and businesses in the south-west of South Holland, the south-west of North Brabant and in Zeeland is produced from Meuse water, 4% from the Haringvliet and 10% from groundwater.

Abstraction stop

The biggest challenge happened 10 years ago, Ottolini explains: when a measurement revealed the presence of pyrazole in the Meuse. This chemical is used to manufacture medicines, dyes and pesticides. After the mussel monitor sounded an alarm and numerous unidentified substances were found, the water companies stopped their abstraction of Meuse water. "We had a quite lengthy abstraction stop," Ottolini says.

Evides Water Company was unable to abstract water from the Meuse for drinking water production for 25 days. This was the first such prolonged abstraction stop since 1995. "As a result, we eventually found ourselves with just a week's supply of water for the whole of the south-west Netherlands; it was a crisis and an immediate wake-up call."

To prevent a situation like this happening again, Evides Water Company decided to build a new abstraction pump station, to facilitate the faster abstraction of more water from the river to replenish the reservoir's water supply after an abstraction stop. The abstraction pump station in question (Bergsche Maas) was opened in 2021.

Mussels

When the water level in the reservoirs was dropping in 2015, it also became apparent that there were many mussels on the edges of the reservoirs, Ottolini says. If they dried out, they would rot and the water quality would deteriorate to the point that it was no longer suitable for drinking water production. So, the shape of the reservoirs was modified to stop so many mussels attaching themselves to them; another benefit was that more space was created in the reservoirs.

Although the water company is now better prepared for a crisis like this, Ottolini says: "Water quality in the Meuse isn't improving. That really worries me. Yes, we can implement abstraction stops and adjust purification methods. But the European Water Framework Directive states that water companies must be able to produce drinking water based on simple purification principles. This is far from the case at the moment."

Mapping discharges

To change this situation, the SMWK, a partnership of drinking water companies - including Evides Water Company, RIWA-Meuse, water boards and central government - that was launched in 2015, developed sound measurement methods. "This allows us to accurately track the exact origin of these discharges,"

Ottolini explains. “We then mapped the above in the Atlas for a Clean Meuse.” This document contains all companies’ direct discharges into rivers, ditches, streams and canals. The partnership is now also trying to gain a better understanding of indirect discharges, which enter the river via the sewer and wastewater treatment plants.

In 2015, it was found that the substance pyrazole had originated from Sitech, now Circle Infra Partners, which purifies wastewater from the factories on the Chemelot industrial estate in Limburg. In the years after the pyrazole crisis, discussions took place about the company’s new discharge permit: at the initiative of the Limburg water board, various parties - Evides Water Company, Dunea, WML, the province of Limburg and Rijkswaterstaat - worked with Circle Infra Partners to agree on a permit that was workable for everyone.

Ottolini explains this so-called Mutual Gains Approach. “Discussions culminated in what was a very good permit. It contains all the substances that this company discharges and the relevant maximum quantities. The aquatic hazard of the substances - their negative impact on water quality for people, animals and plants - is also measured continuously. The permit includes various calibration and adjustment times, giving it a dynamic character.”

Sample permit

Circle Infra Partners was issued with its new discharge permit in 2020. “We had expected to see the wide adoption of this type of permit,“ Ottolini says. “Especially because the Association of the Dutch Chemical Industry (VNC) was very impressed by it. Everyone was enthusiastic. Unfortunately, no other companies and competent authorities have followed suit to date.”

Ottolini believes that the authorities responsible for issuing permits ought to be the initiators of a Mutual Gains Approach like this. “I would like to urge the Ministry of Infrastructure and Water Management to develop a policy that requires competent authorities to issue this type of permit.” Rijkswaterstaat and the water boards would issue permits for direct discharges, while the 29 regional environmental services would issue permits for indirect discharges. In many cases, some of the substances that companies discharge are not currently included in their discharge permits, Ottolini explains. There is a huge backlog in the updating of permits, and permits in the Netherlands are often outdated because they were issued for an indefinite period of time, which means they do not include the current discharge requirements for substances. “In the meantime, a company could have made changes to its production process and now be discharging substances that aren’t included in the permit.”

Always up to date and clear requirements

So, Ottolini says: “We are advocating for permanent wastewater measurements. The beauty of dynamic permits like these is that they are always up to date.” But what about the backlog in permits to be updated? “Some of the competent authorities say they don't have enough staff,“ she says. “But if the permit is designed based on a system with permanent measurements, there are no backlogs and often fewer people are needed.” Are continuous measurements possible? Ottolini believes they are: “The new technologies make it easy.”

The SMWK is currently working on the improved mapping of indirect discharges, which is no easy task. Ottolini also believes that water boards should impose stricter requirements on the wastewater they receive. “And make agreements about this with the companies that discharge via them. The water boards are hard at work on this, but there’s always room for improvement.”

Less diluted

Climate change has been a challenge for Evides Water Company in recent years too and will certainly continue to be a challenge in the future. “We commissioned Deltares to conduct a study to determine whether the Meuse will still be an important and reliable source for us in 2100,“ Ottolini says. The study shows that the quantity, the availability of fresh water, won't be a problem, but quality will. “We're concerned about that. Especially given the new climate scenarios from the Royal Netherlands Meteorological Institute (KNMI), which show a dramatic acceleration in climate change.”

Ottolini mentions the fact that contamination is now increasing: medicine residues, pesticides, plastics, PFAS and other harmful substances and

emphasises: “Droughts exacerbate this problem. Because these substances are present in higher concentrations when flow is low and there’s not much water flowing through the river.”

Better source protection

That is why Ottolini believes a ban on the discharge of SVHCs, a list compiled by RIVM that contains more than 3,000 substances, should be implemented as soon as possible. She adds: “I think it’s wonderful to see rivers here and there around the world becoming legal entities; this makes it possible to protect them.” The first such river was the Whanganui River in New Zealand in 2017.

Ottolini also mentions the precautionary principle: substances must first be thoroughly tested for their aquatic hazard - their harm to humans, the environment and drinking water - before they can be discharged. “It’s a bit crazy, of course, that companies can discharge them freely, leaving us to pick up the pieces afterwards.” Thanks to all the technologies at our disposal, drinking water companies can also turn polluted water into good-quality drinking water, but that costs a lot of money, raw materials, energy and water. “It makes a huge difference if you do it upfront, in advance.”

Leading the way

An assessment of this nature is a smart move for the companies that discharge these substances too, she explains. “If a company knows that discharges are not harmful, it will be future-proof. Then, it’s guaranteed a license to operate.” This proposal means preparing for the upcoming legislation from Brussels and seeking more environmentally-friendly alternatives. “It’s a win-win-win situation for everyone: the companies, the competent authorities and all the parties that use the fresh water.”

Ottolini also mentions the SMWK’s efforts to engage with businesses about the impact of discharges. “This is very important. But if we’re not successful, we will need to take a more proactive approach - we can't wait too long.”

Higher on the agenda

Which role does Ottolini see for RIWA-Meuse in the protection of the Meuse as a source of drinking water in the future? She returns to the WFD. “It’s remarkable, of course, that it’s been in place since 2000 and that we’ve known what to do for 25 years now. So many things have been postponed time and time again. I think that we, RIWA-Meuse, both alone and with our members, need to become a little more activistic.”

By this, she means: “Put it even higher on the agenda, beat the drum more forcefully and legally enshrine the responsibility of permit providers: make a Mutual Gains Approach mandatory and also the permanent monitoring of wastewater at companies. Ensure an actual ban is in place on the discharge of SVHCs and really make sure the precautionary principle is applied. Make clear agreements and improve adherence to them.”

Ottolini believes that, since 2014, when Ottolini started in the roles she is about to step down from, RIWA-Meuse has definitely put the various issues on the map. She concludes: “I'm pleased with how the association has developed in recent years: it is seeking publicity much more. Having said that, there’s still so much more to be achieved.”

D

Annexes

Annex 1

Substances that exceeded the ERM target value in 2024.

Many environmentally-foreign substances (pollutants) are found in Meuse water. In 2024, 66 substances exceeded the target value in the European River Memorandum (ERM target value) in target substance analyses. This happened 1,847 times in 8,521 measurements that were conducted for these 66 substances - in 27.7% of the cases. It is possible to produce drinking water in a sustainable way with natural purification methods from river water that meets the ERM target values.

To gain an impression of the types of substance that drinking water companies had to deal with in 2024, a 'mugbook' for substances in the Meuse that exceeded the ERM target value in this year is presented below. RIVM's PMT screening tool was used to look up the PMT scores of these substances, insofar as they are available.

This concerned the following substance groups:

- Industrial pollutants and consumer products
- Residues of pharmaceuticals and endocrine-disrupting chemicals
- Plant protection products, biocides and their metabolites

Legend

Substance groups

Industrial pollutants and consumer products

Residues of pharmaceuticals and endocrine-disrupting chemicals

Pesticides, biocides and their metabolites

Drinking water-relevant

CASRN The CAS-number is the unique identification number for chemical and biological substances. CAS stands for Chemical Abstracts Service. RN stands for registration number.

PMT

PMT stands for Persistent (not or hardly degradable in the environment), Mobile (well soluble in water and therefore easily transported through the environment) and Toxic (toxic to humans and/or ecosystem).

PMT-score: low to average ‹ 0,33

PMT-score: high 0,33-0,5

PMT-score: very high › 0,5

CLP

In the EU the required Classification, Labelling and Packaging (CLP) of around 8000 substances is legislated. One label can include one or more danger pictograms:

Health danger/ danger to ozone

Acute toxicity

Flammable

Serious health hazard

Corrosive

Hazardous to the environment

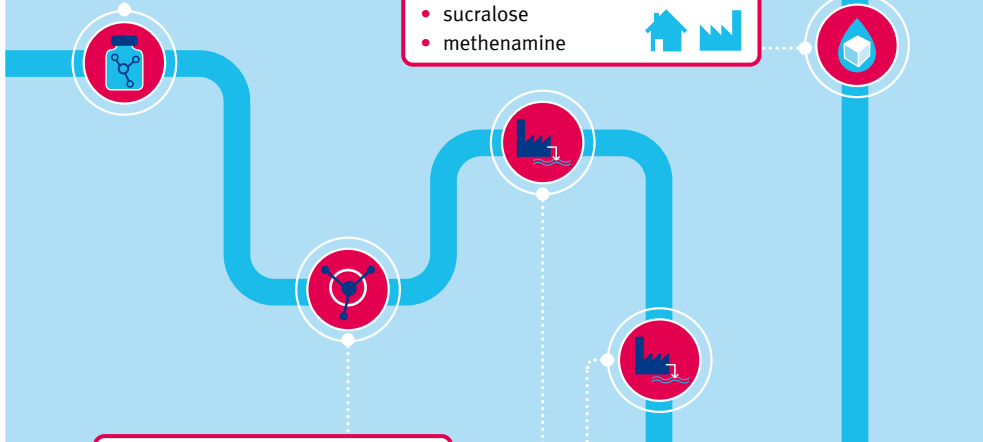
Which industrial pollutants and consumer products end up in the Meuse?

Solvents
- Trifluoroacetic acid
- 1,4-Dioxane
- Tetrahydrofuran

Halomethane sulfonic acids
- Dichloromethanesulfonic acid

Halogenated acetic acids
- Trichloroacetic acid
- Dibromoacetic acid
- Bromochloroacetic acid
- Monobromoacetic acid
- Dichloroacetic acid

Food additives
- sucralose
- methenamine



Complex formers
- EDTA
- NTA
- DTPA

Substances that are used/released in the Prayon process
- Di-isopropyl ether
- Dimethyl ketone

Other industrial substances and consumer products
- Sulfametic acid
- Melamine
- Cyanuric acid
- 8-hydroxypenillic acid
- Aniline
- Dicyclopentadione
- Ethyl hydrogen sulfate

How often are these substances measured above the ERM-target values in 2024? See table 5 below.

Industrial pollutants and consumer products

Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
Industrial pollutants and consumer products																832	3031	27,4%
sulfamic acid	5329-14-6	0,1	µg/l					12		20		19		32	47	62	62	100%
ethylenediaminetetraacetic acid (EDTA)	60-00-4	1	µg/l		5,4	7,7	4,8	8		6,1		18		23	11	86	90	95,5%
trifluoroacetic acid	76-05-1	1	µg/l				1,55	1,4		1,6		1,5	1,64	1,6	1,5	74	84	88,1%
cyanuric acid	108-80-5	0,1	µg/l				2,53	2,1		5,7		1,2	2,09	2,1	1,7	75	88	85,2%
sucralose	56038-13-2	1	µg/l				1,35	1,4		2	3,9	3,5	4,13	4,9	2,4	56	92	60,8%
dichloro-methanesulfonic acid	53638-45-2	0,1	µg/l					0,4		0,3		0,16		0,29	0,26	33	62	53,2%
nitriloacetic acid (NTA)	139-13-9	1	µg/l				8	1		7,8		1,4		1,1	14	42	82	51,2%
trichloroacetic acid	76-03-9	0,1	µg/l								0,37	0,14		0,2	0,19	27	70	38,5%
methenamine	100-97-0	1	µg/l		3,79	17,6	2,65	4,4		11		1,4	1,58	2,2	1,7	47	122	38,5%
diisopropyl ether	108-20-3	1	µg/l			5,56	4,7	11	3,2	6,2	1,2	0,02	0,88	1,1	0,21	116	417	27,8%
diethylenetriaminepentaace-tic acid (DTPA)	67-43-6	1	µg/l									8,8		5,4	1,4	24	90	26,6%
1,4-dioxane	123-91-1	0,1	µg/l					0,97		5,7		0,15		0,19	0,37	79	337	23,4%
dimethyl ketone (acetone)	67-64-1	1	µg/l					6,6		7,1						44	224	19,6%
8-Hydroxypenillic acid	3053-85-8	0,1	µg/l											0,66	0,12	8	41	19,5%
tetrahydrofuran	109-99-9	0,1	µg/l					0,26		0,87				0,77	0,24	35	311	11,2%
aniline	62-53-3	0,1	µg/l					0,07		0,05		0,06		0,09	0,16	5	49	10,2%
dibromoacetic acid	631-64-1	0,1	µg/l									0,12		0,31		3	70	4,2%
dicyclopentadiene	77-73-6	0,1	µg/l				0,21			0,01		0,1			0,01	2	64	3,1%
melamine	108-78-1	1	µg/l		0,32	0,30	0,36	1,4		1	1,1	2,6	1,17	1,5	1,3	10	387	2,5%
bromochloracetic acid	5589-96-8	0,1	µg/l											0,24		1	58	1,7%
ethyl hydrogen sulphate	540-82-9	0,1	µg/l												0,13	1	62	1,6%
dichloroacetic acid	79-43-6	0,1	µg/l								0,06	0,05		0,3	0,05	1	75	1,3%
monobromoacetic acid	79-08-3	0,1	µg/l								0,07	0,08		0,14		1	94	1,0%

ERM-tv = ERM target value, TAI = Tailfer, NAM = Namêche, LUI = Liège, EYS = Eijsden, ROO = Roosteren, STV = Stevensweert, HEE = Heel, BRA = Brakel, HEU = Heusden, KEI = Keizersveer, BSM = Bergsche Maas, HAR = Haringvliet.
In the table, the highest-measured value is presented if the parameter exceeded the ERM target value, where n is the number of breaches and N is the number of measurements.

Industrial pollutants and consumer products

In 2024, 67 parameters exceeded the ERM target values one or more times. Industrial pollutants were the culprit in 34.3% of cases (23). Of the 3,031 measurements that were done for these 23 substances, 832 (27.4%) breached the ERM target value (see Tabel 6).

Table 6 on page 153: Industrial pollutants and consumer products that exceeded the ERM target value in 2024 (maximum concentrations, in order of percentage of breaching measurements).

Complex formers

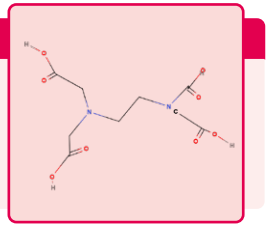
Complex formers (chelates) are chemical substances that form complex, soluble molecules with certain metal ions, thanks to which these metal ions are inactivated such that they cannot react in a normal way with other elements or ions in order to form a precipitate or deposit. They are used as ingredients in cleaning agents such as limescale removers and strippers and as stabilisers in bleaches and soap products.

EDTA (CASRN 60-00-4)

PMT-score 0,23 (P=0,02 | M=0,95 | T=0,68)

Drinking water-relevant

CLP



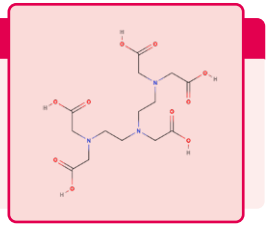
Application: EDTA (ethylenediaminetetraacetic acid) is a complex former that is used in detergents and in medicine to trap and remove calcium and other metals, including heavy metals such as arsenic, copper and mercury.

Origin: this substance mainly ends up in surface water via waste-water treatment plants.

Distribution of contamination: EDTA was found to be well above the ERM target value of 1 µg/L at all monitoring points where it was measured. The indicative drinking water target value for EDTA is 600 µg/L.

Notable: since 1990, this substance has been detected at concentrations between 0 and 30 µg/L in drinking and surface water. EDTA is a compound only slightly toxic to humans, but it has the property of releasing heavy metals from silt and keeping them dissolved in water.

DTPA (CASRN 67-43-6)



PMT **PMT-score 0,26 (P=0,03 | M= 0,96 | T=0,68)**

DWR **Drinking water-relevant**

CLP

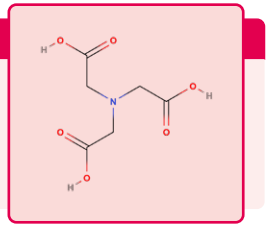
Application: from the 1960s onwards, DTPA (pentetic acid or diethylenetriaminepentaacetic acid) has been used to combat internal contamination with radioactive material. DTPA and its derivatives are used to form complexes with gadolinium, which in their turn are used as contrast agents in MRI scans. DTPA is also used in the extraction of soil samples.

Origin: this substance mainly ends up in surface water via waste-water treatment plants.

Distribution of contamination: DTPA was detected at above the ERM target value at Namêche, Liège, Roosteren, Heel, Brakel, Bergsche Maas and Haringvliet. Since July 2022, DTPA has been on the Netherlands' list of Substances of Very High Concern [source: RIVM). The indicative drinking water target value for DTPA is 700 µg/L.

Notable: In the past (2018), Dunea and Evides had an exemption to allow them to continue to use surface water with DTPA at Brakel and Keizersveer (Gat van de Kerksloot) for the production of drinking water. Similarly to EDTA, DTPA forms stable complexes with many metals.

NTA (CASRN 139-13-9)



PMT **PMT-score 0,13 (P=0,01 | M=0,94 | T=0,18)**

DWR **Drinking water-relevant**

CLP

Application: NTA (nitrilotriacetic acid) is suitable for softening water and for preventing or removing limescale deposits. It is therefore frequently added to water in boilers. NTA was used increasingly from the late 1960s as a replacement for phosphates in detergents.

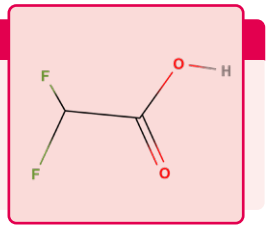
Origin: This substance mainly ends up in surface water via cooling water discharges and waste-water treatment plants.

Distribution of contamination: NTA was detected at above the ERM target value in measurements at Eijsden, Brakel and Bergsche Maas. The indicative drinking water target value for NTA is 400 µg/L.

Notable: NTA is effectively biologically degradable, better than the similar EDTA. It is mainly the water-soluble trisodium salt of NTA that is used in soaps and detergents. The IARC WHO (the International Agency for Research on Cancer), part of the WHO (United Nations World Health Organization) considers NTA a possible human carcinogen (IARC class 2B).

Solvents

Trifluoroacetic acid (TFA, CASRN 76-05-1)



PMT **PMT-score 0,34 (P=0,16 | M=0,75 | T=0,34)**

DWR **Drinking water-relevant**

CLP

Application: trifluoroacetic acid (TFA) is used in the production of trifluoroacetic fluoride and 2,2,2-trifluoroethanol. The acid is added to some HPLC analyses in the mobile phase to reduce the occurrence of 'tailing'. The acid is also frequently used as a building block in the synthesis of pharmaceutical substances and agricultural chemicals and as a catalyst in polymerisations and condensation reactions. On the boundary between organic chemistry and biochemistry, trifluoroacetic acid is used during in vitro peptide synthesis to remove the protective tert-butoxycarbonyl group from amino groups. TFA is used in the form of its salts (trifluoroacetates) in the production of ceramic materials. TFA is a much-used solvent in NMR spectroscopy, and it is used in mass spectrometry to calibrate the equipment (source: Wikipedia). TFA is also a breakdown product of hydrofluorocarbons (HFCs) that are used in applications including air conditioners, foam blowing agents and propellant gases in aerosols[1]. TFA can also be a metabolite of, amongst other things, plant protection products7, medicines10 or of the substance 4:2 fluorotelomer sulphonate.

1 *https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-05-06_texte_73-2021_persistent_degradation_ products.pdf*

Origin: This substance mainly ends up in surface water via industrial waste-water treatment plants. TFA has also been detected in groundwater and rain-water. An article in Environment International states that the use of plant protection products with a C-CF3 group in agriculture results in the formation and emission of a substantial amount of TFA6.

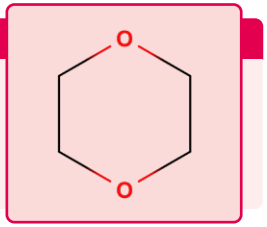
Distribution of contamination: TFA was detected above the ERM target value at Eijsden, Roosteren, Heel, Brakel, Keizersveer, Bergsche Maas and Haringvliet. OSPAR[2] added TFA to the list of Substances of Very High Concern on 15 November 2024 because TFA falls under the SVHC substance group of Per- and poly-fluoroalkyl substances[3]. TFA has an advised indicative drinking water guidance value of 2.2 µg/l[4] if no other PFAS are present, which is not very likely given the ubiquity of several PFAS.

1,4-Dioxane (CASRN 123-91-1)

PMT **PMT-score 0,38 (P=0,09 | M=0,73 | T=0,84)**

DWR **Drinking water-relevant**

CLP



Application: 1,4-Dioxane is an ether that is mainly used as a solvent in the paper, cotton and textile industry, in vehicle coolants, as an initial substance for the synthesis of other substances, as a foaming agent in the polymer industry, and in the production of cosmetics and shampoos. On 12 July 2021, 1,4-dioxane was added to REACH Annex XIV (Substance of Very High Concern, SVHC). In the Netherlands, the substance was added to the SVHC list on the same date[5]. 1,4-Dioxane may be formed in the production and processing of ethylene oxide, a major raw material in the chemicals industry. Two cases are known in which the production of ethylene oxide led to emissions of 1,4-dioxane: at INEOS in Dormagen (Rhine) and at KLK Kolb Specialties in Delden (Twente Canal). Ethylene oxide is used, among other things, as an intermediate product in processes including the production of ethylene glycols.It is also used as a disinfecting agent for heat-sensitive materials in hospitals.

Origin: it emerges from the REACH dossier that at least one ethylene oxide factory is situated on the Meuse (source: ECHA). There are also at least two manufacturers on the Albert Canal.

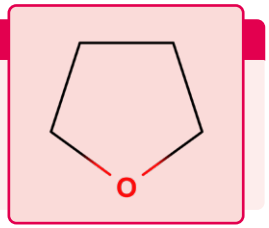
Distribution of contamination: 1,4-Dioxane was detected above the ERM target value at Roosteren, Heel, Brakel, Bergsche Maas and Haringvliet. The indicative drinking water target value for 1,4-dioxane is 3 µg/l19.

Notable: the IARC WHO states that this ether could potentially be carcinogenic to humans (IARC class 2B).

Tetrahydrofuran (THF, CASRN 109-99-9)

PMT **PMT-score 0,35 (P=0,08 | M=0,65 | T=0,80)**

CLP



Application: Tetrahydrofuran (THF) is a solvent that is used in the chemicals industry. It can be polymerised by strong acids or electrophiles (such as trityl tetrafluoroborate) into a linear polymer, poly(tetramethylene ether) glycol or PTMEG (also known as polytetramethylene oxide). This glycol is mainly used for the production of elastomer polyurethanes, in particular polyurethane fibres such as elastane (Spandex, Lycra).

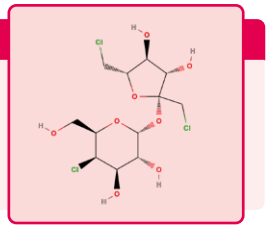
Origin: this substance mainly ends up in surface water via waste-water treatment plants.

Distribution of contamination: THF was detected above the ERM target value at Roosteren, Heel, Brakel, Bergsche Maas and Haringvliet.

2 *Convention for the Protection of the Marine Environment of the North-East Atlantic of the Oslo and Paris Commissions (the 'OSPAR Convention')*
3 *https://rvszoeksysteem.rivm.nl/stof/detail/3481*
4 *https://www.rivm.nl/documenten/bijlage-bij-rivm-brief-aan-ilt-indicatieve-drinkwaterrichtwaarde-trifluorazijnzuur-tfa*
5 *https://rvszoeksysteem.rivm.nl/stof/detail/2598*

Food additives

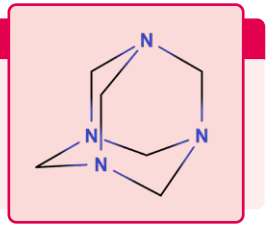
Sucralose (E955) (CASRN 56038-13-2)



PMT **PMT-score 0,62 (P=0,45 | M=0,87 | T=0,61)**

Application: sucralose (E955) is an artificial sweetener that is used as a sugar replacement in various foodstuff products and soft drinks.
Origin: this substance mainly ends up in surface water via waste-water treatment plants.
Distribution of contamination: sucralose was detected at concentrations above the ERM target value at Eijsden, Heusden, Brakel, Keizersveer, Bergsche Maas and Haringvliet. It is stable and is not broken down or absorbed in the body. This property means that it is also not (well) broken down in the environment, a waste-water treatment plant or a simple drinking water purification plant. The indicative drinking water target value for sucralose is 5,000 µg/L.
Notable: sucralose is in Annex III of the REACH Regulation due to the suspicion of carcinogenicity, hazard to the aquatic living environment, mutagenicity and persistence (source: ECHA).

Methenamine [E239] (CASRN 100-97-0)



PMT **PMT-score 0,63 (P=0,81 | M=0,93 | T=0,34)**

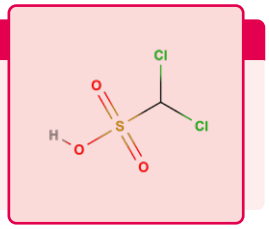
DWR **Drinking water-relevant**

CLP 

Application: methenamine (urotropine, hexamine) is one of the trivial names for a compound that is much used in phenol resin and many other industrial applications, and also as a preservative against mould (E239 in products including caviar, rollmop herring, tinned fish and pickled herring). Methenamine is also the main constituent of solid fuel tablets, known by the name Esbit, much used for example in stoves for campers, mountain climbers and the military, and in miniature steam engines. Methenamine may also be used as a corrosion inhibitor and antibiotic.
Origin: this substance mainly ends up in surface water via waste-water treatment plants.
Distribution of contamination: methenamine was detected above the ERM target value at Namêche, Liège, Eijsden, Roosteren, Heel, Keizersveer, Bergsche Maas and Haringvliet. The indicative drinking water target value for methenamine is 500 µg/L.
Notable: since 2010, methenamine has been monitored in the water abstracted at Brakel and it is detected regularly at over the ERM target value. Since 2012 this substance has also been detected systematically at Keizersveer and Haringvliet at above the ERM target value.

Halomethane sulfonic acids (HMSAs) and halogenated acetic acids (HAZ, HAAs)

Dichloro-methanesulfonic acid (CASRN 53638-45-2)



PMT **PMT-score 0,46 (P=0,22 | M=0,72 | T=0,61)**

DWR **Drinking water-relevant**

Application: Halomethanesulfonic acids (HMSAs) are recently discovered polar disinfectant byproducts.
Origin: HMSAs arise frequently and at high levels in drinking water and could potentially be very persistent and very mobile (vPvM).[6]
Distribution of contamination: just as in 2023, dichloromethanesulfonic acid was detected above the ERM target value at Roosteren, Heel, Brakel, Bergsche Maas and Haringvliet.

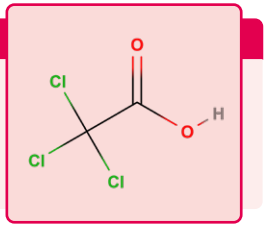
6 *https://www.ufz.de/promote/index.php?en=33621*

Trichloroacetic acid (TCA, CASRN 76-03-9)

PMT-score 0,54 (P=0,36 | M=0,68 | T=0,62)

Drinking water-relevant

CLP

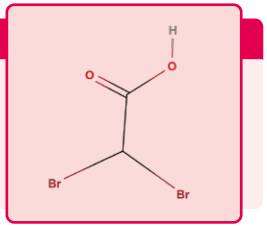


Dibromoacetic acid (DBA, CASRN 631-64-1)

PMT-score 0,33 (P=0,06 | M=0,73 | T=0,81)

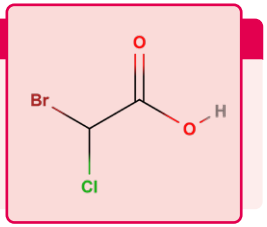
Drinking water-relevant

CLP



Bromochloroacetic acid, (BCA, CASRN 5589-96-8)

CLP



Monobromoacetic acid (MBA, CASRN 79-08-3)

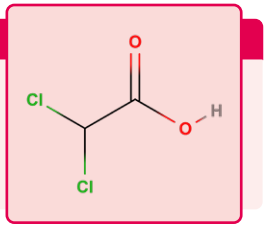
PMT-score 0,28 (P=0,04 | M=0,75 | T=0,82)

CLP

Dichloroacetic acid (CASRN 79-43-6)

PMT-score 0,40 (P=0,11 | M=0,72 | T=0,82)

CLP



Application: halogenated acetic acids (HAZ, HAAs) are known byproducts that arise from the chlorination of water. However, TCA also has many applications, including as a solvent in the plastics industry, production of sodium trichloroacetic acid (a herbicide), an etchant in metal processing, an additive in mineral lubricant oils and a catalyst for polymerisation reactions (source: Wikipedia). In biochemistry, TCA is used to precipitate out proteins and other macromolecules. Other applications are to be found in the medical (treatment of skin conditions and removal of warts) and cosmetic spheres (chemical peeling). TCA has been detected in the Meuse since 1986[7].

Origin: chlorination of water in industrial processes is probably the source of HAA in the Meuse.

Distribution of contamination: TCA was detected above the ERM target value at Heusden, Brakel, Bergsche Maas and Haringvliet, DBA at Brakel and Bergsche Maas, BCA, MBA and DCA at Bergsche Maas.

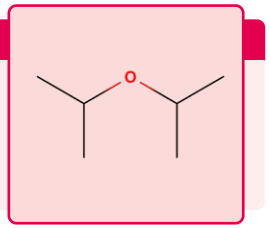
Notable: TCA has been detected above the reporting limit for years in Meuse water at Heusden and Brakel.

Substances that are used/released in the Prayon process

Di-isopropyl ether (DIPE, CASRN 108-20-3)

PMT-score 0,35 (P=0,10 | M=0,56 | T=0,75)

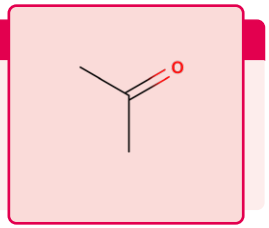
CLP



Dimethyl ketone (acetone, CASRN 67-64-1)

PMT-score 0,11 (P=0,08 | M=0,67 | T=0,02)

CLP



Application: There is a known industrial discharge in the Wallonian part of the river basin that for decades has been responsible for the presence of the substances fluoride, DIPE and tributyl phosphate in the Meuse. The company Société de Prayon developed and patented an extraction process that uses the solvents di-isopropyl ether (DIPE, 85-95%) and tributyl phosphate (5-15%) with

7 *H2O article by Versteegh, J.F.M, Peters, R.J.B. & De Leer, E.W.B. (1990), https://edepot.wur.nl/376185*

which technical grade phosphoric acid can be upgraded to phosphoric acid of food quality (source: Gilmour, 2013). Since 1983, this process has been used in the factory at Engis and there is presently a plant with which 120,000 tonnes per year (expressed as P2O5) can be processed with the Prayon process as it is known. In the first step of the pre-treatment in the Prayon process, the impurities sulfate and fluoride in industrial grade phosphoric acid are reduced to 0.3% and 0.1% respectively. Part of the fluoride is recovered from the process and sold in the form of hexafluorosilicic acid (H2SiF6). Research has shown that dimethyl ketone (acetone) can be formed from DIPE via 2-propanol (isopropyl alcohol, IPA). From a chemical reaction in the production process, DIPE can be converted to 2-propanol, which can then be converted to acetone by biodegradation during or after discharge into the Meuse. This conversion takes place at different times of the year and depends mainly on flow and temperature. Incidentally, it is known that 2-propanol may be discharged into the Meuse by a plant at the Chemelot chemical park in Sittard/Geleen.

Origin: waste-water discharges by the company Société de Prayon in Engis.

Distribution of contamination: acetone was detected above the ERM target value at the Roosteren and Heel monitoring points. DIPE was detected above the ERM target value at Liège, Eijsden, Roosteren, Stevensweert, Heel, Heusden and Bergsche Maas. The indicative drinking water target value for DIPE is 1,400 µg/L.

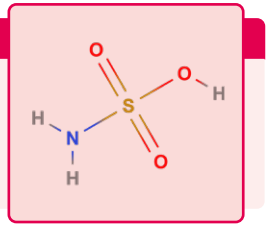
Notable: Société de Prayon further optimised the fluoride recovery process in their factory at Engis by installing a vapour separator and air scrubber in October 2014. This ought to deliver an extra yield of around 250 tonnes of fluoride per year, which would no longer be discharged. In recent years, a single breach of fluoride arose; the last time fluoride regularly exceeded the ERM target value was in 2011: then, this applied to 34% of the measurements at Liège. The drinking water companies are delighted that the contaminations have been reduced, partly through reuse of the substances. They hope that this positive trend continues and that all emissions finally come below the ERM target value. Société de Prayon has made known that, in the future, it plans to reduce the discharges of DIPE and TBP by means of an additional purification step.

Other industrial substances and consumer products

Sulfamic acid (CASRN 5329-14-6)

DWR **Drinking water-relevant**

CLP



Application: sulfamic acid, an inorganic substance, is an ingredient of many acidic cleaning agents for the removal of deposits: limescale deposit in coffee machines and on chrome or stainless steel in places such as milking sheds and breweries, in steam boilers, cement residue on tiles and urine scale on sanitary ware. Sulfamic acid is also used in the synthesis of artificial sweeteners (cyclamic acid and sodium cyclamate).

Origin: the use of cleaning agents in both industry and households probably leads to the concentrations observed.

Distribution of contamination: sulfamic acid was detected far above the ERM target value in all measurements at Roosteren, Heel, Brakel, Bergsche Maas and Haringvliet. The indicative drinking water target value for sulfamic acid is 1,400 µg/L[8].

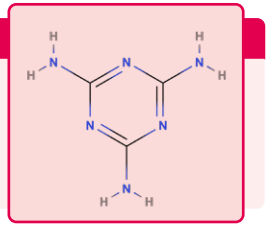
8 *https://rvs.rivm.nl/sites/default/files/2022-06/Advies_14951A00_drw_rw_sulfaminezuur.pdf*

Melamine (CASRN 108-78-1)

PMT **PMT-score 0,64 (P=0,53 | M=0,80 | T=0,61)**

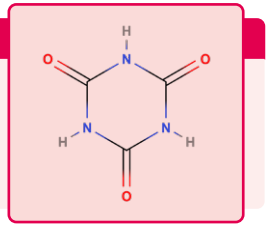
DWR **Drinking water-relevant**

CLP



Cyanuric acid (CASRN 108-80-5)

DWR **Drinking water-relevant**



Application: melamine is a synthetic substance mainly used in the production of plastics. Under high pressure (>7 MPa) and a temperature over 370°C, isocyanic acid is formed, yielding cyanuric acid via an exothermic reaction. The cyanuric acid condenses with ammonia into melamine and water. Finally, the liquid melamine cools into the intended end product: a white crystalline powder. Melamine is formed from urea, with ammonia and carbon dioxide as byproducts[9]. Melamine plastics are strong, hard, light and resistant to strong acids among other things. Consumer products into which melamine is processed include plastic plates, cups, dishes and cutlery, and also miracle sponges as they are known. The Netherlands Food and Consumer Product Safety Authority (NVWA) recommends no longer using crockery made from bamboo with melamine plastic, such as coffee cups and bowls[10].

Cyanuric acid is primarily used as a chemical intermediate (raw material) for the production of the following three chlorinated derivatives: dichloroisocyanuric acid (CASRN 2782-57-2), trichloroisocyanuric acid (CASRN 87-90-1) and sodium dichloroisocyanurate (CASRN 2893-78-9). Cyanuric acid, as a product or end product, is frequently used as a stabiliser in the swimming pool industry. Cyanuric acid forms a weak bond with the free chlorine (N-Cl) in pool water, which protects it against the ultraviolet rays that would otherwise break it down.

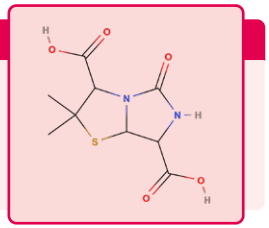
Origin: In 1964, DSM built the first melamine factory on the site that is now known as Chemelot, a large industrial complex for the chemicals industry between Stein and Geleen, in the Netherlands province of Limburg. OCI Nitrogen has a melamine factory on the Chemelot premises. It is the only production location of melamine in the Netherlands and it makes products such as MelaminebyOCI™ and Melafine®. OCI Nitrogen is by far the largest production site for melamine in the world.

Distribution of contamination: melamine was detected above the ERM target value at Roosteren, Heel, Heusden, Brakel, Keizersveer, Bergsche Maas and Haringvliet. Cyanuric acid breached the ERM target value at Eijsden, Roosteren, Heel, Brakel, Keizersveer, Bergsche Maas and Haringvliet. Melamine has an indicative drinking water target value of 0.28 µM. This value applies to the sum of melamine, melem and melam. This value takes account of the simultaneous presence of cyanuric acid. If it has been demonstrated that the concentration of cyanuric acid is below 10 µg/L (0.08 µM), a drinking water target value of 2.0 µM applies for the sum of melamine, melem and melam. The values stated only apply if the concentration of cyanuric acid is lower than the sum of melamine, melem and melam.

8-Hydroxypenillic acid (CASRN 3053-85-8)

PMT **PMT-score 0,23 (P=0,06 | M=0,64 | T=0,33)**

DWR **Drinking water-relevant**



Application/Origin: RIVM classifies 8-hydroxypenillic acid under (animal) medicines[11]. In the past, this substance was used as an additive in the purification process of the IAZI of Sitech Services BV (now Circle Infra Partners) in Sittard/Geleen[12]. As the substance is not found at the Heel abstraction point, this is not the origin of the breaches now observed.

Distribution of contamination: 8-Hydroxypenillic acid was detected above the ERM target value at Bergsche Maas and Haringvliet. The indicative drinking water target value for this substance is 10 µg/L.

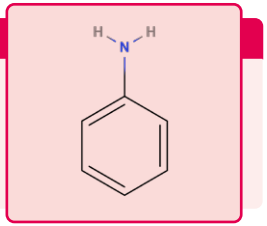
9 https://www.helpdeskwater.nl/publish/pages/158977/studie_bedrijfslozingen_melamine_en_cyanuurzuur_in_nederland.pdf
10 https://nos.nl/artikel/2368846-nvwa-stop-met-gebruik-bekers-en-kommen-van-melamine-en-bamboe

11 https://rvszoeksysteem.rivm.nl/stof/detail/5206
12 https://rvs.rivm.nl/sites/default/files/2019-03/2.%20drw%208-hydroxypenillic%20acid.pdf

Aniline (CASRN 62-53-3)

PMT-score 0,39 (P=0,13 | M=0,60 | T=0,80)

CLP



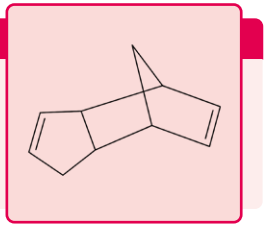
Application/Origin: aniline is a basic raw material for the chemical industry. It is particularly used in the production of dyes and methylene diphenyl diisocyanate (MDI); this, in turn, is a component of polyurethanes. Since 1987, the Badische Anilin- und Soda Fabrik (BASF) has been using aniline for the synthetic production of indigo, a dye that could previously only be obtained from plant-based raw materials (Heumann synthesis).

Distribution of contamination: aniline was detected at a concentration above the ERM target value at Haringvliet. This indicates a source in the Rhine River Basin.

Dicyclopentadiene (1,3-CPD, CASRN 77-73-6)

PMT-score 0,25 (P=0,12 | M=0,38 | T=0,34)

CLP



Application: dicyclopentadiene (1,3-CPD) is used as a monomer or comonomer in synthetic resins - particularly, unsaturated polyesters and synthetic rubbers like EPDM. Poly-DCPD, with just dicyclopentadiene as the monomer, is a thermosetting synthetic resin that is used as an engineering plastic in technical applications. During production, it is important to ensure that the residual monomer content is low enough to prevent the resin having an unpleasant odour. Dicyclopentadiene is used in flame retardants too. In the past, dicyclopentadiene was also used as a plant growth regulator and repellent (due to its odour) in agriculture. This application is no longer permitted in the European Union.

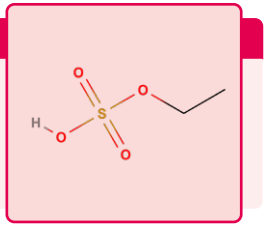
Origin: unknown.

Distribution of contamination: 1,3-CPD was detected above the ERM target value at the Eijsden border monitoring station.

Ethyl hydrogen sulfate (CASRN 540-82-9)

PMT-score 0,40 (P=0,11 | M=0,83 | T=0,70)

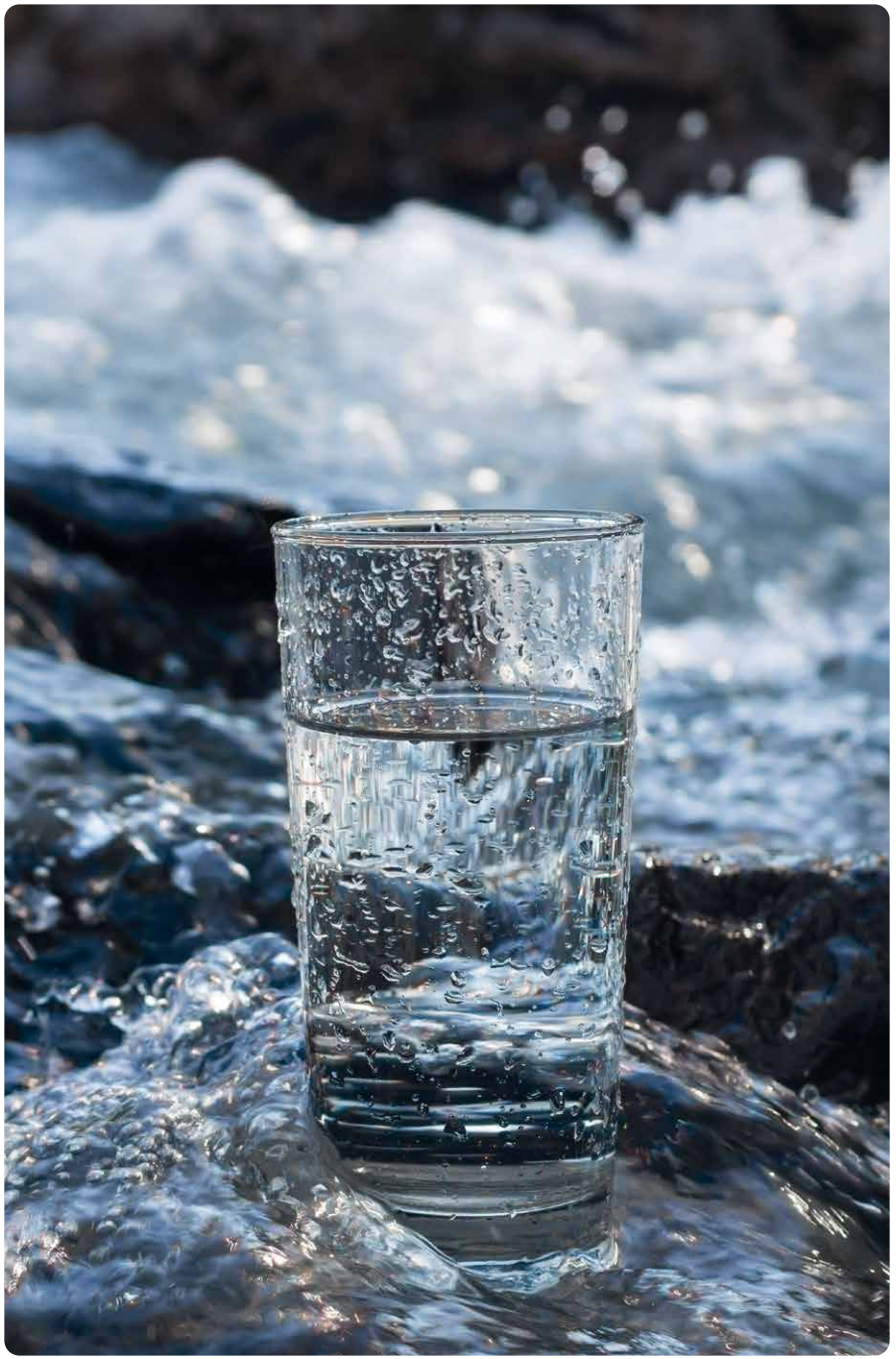
CLP



Application: ethyl hydrogen sulfate, also known as sulfovinic acid and ethyl sulfate, is an organic chemical compound that is used as an intermediate product in the production of ethanol from ethylene. It is the ethyl ester of sulfuric acid. Propane nitrile can be made by distillation of ethyl sulphate in the presence of potassium cyanide. The nickel(II) salt of ethyl sulfate (CASRN 71720-48-4) is a Substance of Very High Concern (source: RIVM and ECHA).

Origin: unknown.

Distribution of contamination: ethyl hydrogen sulphate was detected at a concentration above the ERM target value at Haringvliet. This indicates a source in the Rhine River Basin.



Substances with a drinking water standard

There are a number of substances that have drinking water standards in addition to an ERM target value. In the past, we did not report on these substances, because the ERM target value is intended for substances without a drinking water standard. An exception is the category of plant protection products, biocides and their metabolites. These substances are tested against the ERM target value, which is equal to the standard for drinking water, and in the Netherlands also equal to the standard for surface water from which drinking water is made. From 2021 onwards, all substances will be tested against their ERM target value, even if they have a drinking water standard.

In 2024, breaches of the ERM target values took place for:

- chlorinated hydrocarbons: 1,2-dichloroethane (Namêche, Eijsden, Roosteren, Heel, Heusden, Keizersveer and Bergsche Maas),
- trihalomethanes: dichloromethane (Roosteren), sum of tetra- and trichloroethylene (Roosteren), sum of trihalomethanes (Liège, Roosteren, Heel and Haringvliet),
- PAH: benzo(b)fluoranthene and benzo(j)fluoranthene (Eijsden and Heel), fluoranthene (Eijsden and Heel , pyrene (Heel), phenanthrene (Heel), benzo(a)pyrene (Heel), benzo(a)anthracene (Heel), chrysene (Heel), naphthalene (Namêche), sum 16 EPA (Namêche and Liège) and sum 10 PAH (Roosteren and Heel).

Which residues of pharmaceuticals and endocrine-disrupting chemicals end up in the Meuse?

Painkillers
- 2-hydroxibuprofen
- N-formyl-4-aminoantipyrine (FAA)
- N-acetyl-4-aminoantipyrine (AAA)
- Ibuprofen
- Paracetamol

Anti-diabetics
- Metformine
- Guanylureum

Medications for epilepsy and depression
- Vigabatrin
- Lamotrigine
- Levetiracetam

Other substances
- Oxypurinol

Cardiovascular medication
- Valsartanic acid
- Candesartan
- Valsartan

Diuretics (water pills)
- Theobromine

Endocrine-disrupting chemicals
- Bis(2-ethylhexyl) phthalate
- ER-CALUX

How often are these substances measured above the ERM-target values? See table 6 below.

Residues of pharmaceuticals and endocrine-disrupting chemicals

Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
Residues of pharmaceuticals and endocrine-disrupting chemicals																157	1257	12,5%
oxypurinol	2465-59-0	0,1	µg/l								0,78	0,72				28	30	93,3%
vigabatrin	60643-86-9	0,1	µg/l					0,83		0,96				0,84	0,55	24	45	53,3%
2-hydroxibuprofen	51146-55-5	0,1	µg/l				0,15						0,1			13	26	50%
valsartanic acid	164265-78-5	0,1	µg/l					0,07		0,11	0,18	0,16		0,28	0,25	19	75	25,3%
theobromine	83-67-0	0,1	µg/l					0,12		0,18				0,13	0,09	8	45	17,7%
N-formyl-4-aminoantipyrine	1672-58-8	0,1	µg/l					0,01		0,01	0,09	0,06		0,09	0,18	13	75	17,3%
metformin	657-24-9	1	µg/l		1,17	1,26	1,23	1,9		1,1	0,8	0,4	0,72	0,92	0,59	16	136	11,7%
guanylurea	141-83-3	1	µg/l				0,61	0,92		0,92	0,75	0,29	0,84	1,3	1,7	12	109	11%
N-Acetylaminoantipyrine	83-15-8	0,1	µg/l					0,01		0,02	0,05			0,05	0,12	6	75	8%
di(2-ethylhexyl)phthalate (DEHP)	117-81-7	0,1	µg/l									0,41				1	17	5,8%
paracetamol	103-90-2	0,1	µg/l	0,14				0,13		0,07	0,07			0,08	0,04	5	101	4,9%
ER-CALUX		0,25	ng E2-eq/l		0,09	0,12		0,15		0,17				0,61	0,61	2	49	4%
lamotrigine	84057-84-1	0,1	µg/l		0,08	0,08		0,07		0,07	0,1	0,07		0,11	0,1	4	101	3,9%
candesartan	139481-59-7	0,1	µg/l					0,01		0,01	0,08	0,05	0,05	0,08	0,12	3	77	3,9%
levetiracetam	102767-28-2	0,1	µg/l					0,1		0,05				0,04	0,02	1	44	2,2%
ibuprofen	15687-27-1	0,1	µg/l		0,04	0,20					0,03					1	125	0,8%
valsartan	137862-53-4	0,1	µg/l		0,06	0,07		0,04		0,07	0,08			0,08	0,11	1	127	0,7%

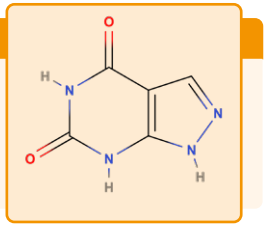
ERM-tv = ERM target value, TAI = Tailfer, NAM = Namêche, LUI = Liège, EYS = Eijsden, ROO = Roosteren, STV = Stevensweert, HEE = Heel, BRA = Brakel, HEU = Heusden, KEI = Keizersveer, BSM = Bergsche Maas, HAR = Haringvliet.
In the table, the highest-measured value is presented if the parameter exceeded the ERM target value, where n is the number of breaches and N is the number of measurements.

Residues of pharmaceuticals and endocrine-disrupting chemicals

In 2024, 67 parameters exceeded the ERM target values one or more times. In 24.4% of these cases, the issue was residues of pharmaceuticals and endocrine-disrupting chemicals (17). Of the 1,257 measurements that were done for these 17 substances, 157 (12.5%) breached the ERM target value (see Tabel 7).

Table 7 on page 173: Residues of pharmaceuticals and endocrine-disrupting chemicals that breached the ERM target value in 2024 (maximum concentrations, in order of percentage of breaching measurements).

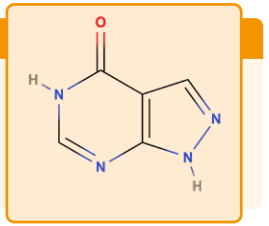
Oxypurinol (CASRN 2465-59-0)



PMT-score 0,26 (P=0,10 | M=0,52 | T=0,33)

CLP

Allopurinol (CASRN 315-30-0)



Application: oxypurinol is a metabolite of allopurinol, which inhibits the formation of uric acid by inhibiting the enzyme xanthine oxidase. Allopurinol prevents the body converting purine into uric acid. Purine arises in certain foodstuffs, and the body produces it as well. In this way, allopurinol reduces the amount of uric acid in the blood. Doctors prescribe allopurinol for gout, kidney stones, kidney diseases and cancer. It is also used for certain metabolic conditions in which too much uric acid is produced. Allopurinol (Zyloric®), with 26,947,700 DDD[13], was at position 70 in the top 100 of the most-prescribed medications in the Netherlands in 2023 (source: gipdatabank.nl).

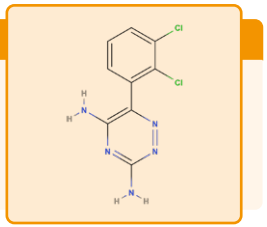
Origin: Allopurinol is converted rapidly (in two hours) into its active metabolite oxypurinol. The half life of this substance is 18 to 30 hours, which means that the effectiveness of allopurinol largely arises via its conversion product. Oxypurinol is excreted by the body and ends up in the surface water via sewerage systems.

Distribution of contamination: oxipurinol breached the ERM target value measurements at Heusden and Brakel. Oxypurinol has an indicative drinking water target value of 8 µg/L.

13 *Defined Daily Dose*

Medications for epilepsy and depression

Lamotrigine (CASRN 84057-84-1)



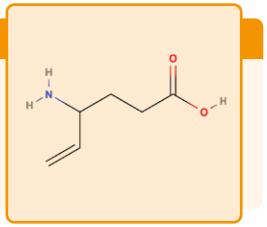
PMT **PMT-score 0,64 (P=0,77 | M=0,47 | T=0,74)**

DWR **Drinking water-relevant**

CLP

Application: lamotrigine is a substance that brings overstimulated nerves in the brain to rest in epilepsy and manic depression (bipolar disorder). Sometimes also in neuralgia, in post-traumatic stress disorder (PTSD), in complex regional pain syndrome (CPRS, also called post-traumatic dystrophy), singultus (hiccups), muscle cramps and in the treatment of breast cancer to combat hot flushes. In 2023, lamotrigine was at position 183 in the top 500 of the most prescribed medications in the Netherlands with 6,992,400 DDD (Lamictal®).
Origin: after being administered, this substance is excreted by the body and ends up in the surface water via sewerage systems.
Distribution of contamination: lamotrigine was detected at the ERM target value at Roosteren, Heel, Bergsche Maas and Haringvliet.

Vigabatrin (CASRN 60643-86-9)



PMT **PMT-score 0,18 (P=0,03 | M=0,89 | T=0,18)**

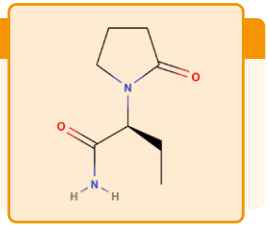
DWR **Drinkwaterrelevant**

CLP

Application: vigabatrin is a substance that brings overstimulated nerves in the brain to rest in epilepsy. It is one of the last therapeutic options, because it is less safe and is less well tolerated than other antiepileptic drugs (source: Farmacotherapeutisch Kompas). In 2023, vigabatrin - with 90.930 DDD (Sabril®) - was not in the top 500 most-prescribed drugs.

Origin: after being administered, this substance is excreted by the body and ends up in the surface water via sewerage systems.
Distribution of contamination: vigabatrin was detected at the ERM target value at Roosteren, Heel, Bergsche Maas and Haringvliet.

Levetiracetam (CASRN 102767-28-2)

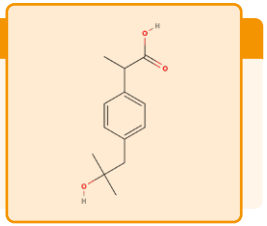


CLP

Application: levetiracetam affects the transmission of information through nerves in the brain. Doctors prescribe it for epilepsy.
Origin: after being administered, this substance is excreted by the body and ends up in the surface water via sewerage systems.
Distribution of contamination: levetiracetam was detected at the ERM target value at Roosteren.

Analgesics (painkillers)

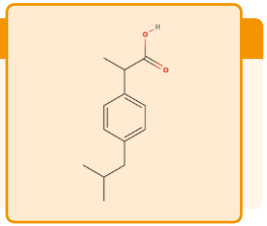
2-Hydroxyibuprofen (CASRN 51146-55-5)



DWR **Drinking water-relevant**

CLP

Ibuprofen (CASRN 15687-27-1)

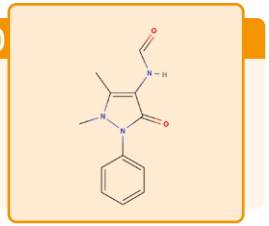


PMT **PMT-score 0,27 (P=0,10 | M=0,44 | T=0,17)**

CLP

Application: ibuprofen (chemical name: iso-butyl-propanoic-phenylic acid) is an analgetic that belongs to the group of non-steroidal anti-inflammatory drugs (NSAIDs). It acts as an inflammation inhibitor, analgetic and fever reducer; the action is similar to that of acetylsalicylic acid. The medicine was developed by the research department of the pharmaceutical firm Boots in the United Kingdom and was approved in 1969. It is sold under different brand names including Advil, Brufen, Dolofin, Ibruphar, Motrin, Nuprin and Nurofen, as well as the generic name ibuprofen. The patent on the medicine has lapsed in the meantime. In 2023, ibuprofen was at position 156 in the top 500 of the most prescribed medications in the Netherlands with 9,258,200 DDD (Brufen®).
2-Hydroxyibuprofen is a metabolite of ibuprofen.
Origin: after being administered, this substance is excreted by the body and ends up in the surface water via sewerage systems.
Distribution of contamination: ibuprofen breached the ERM target value at Liège, while 2-hydroxyibuprofen breached this value at Eijsden and Keizersveer.

N-Formyl-4-aminoantipyrine (FAA, CASRN 1672-58-8)

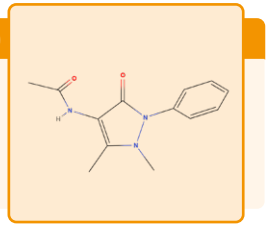


PMT **PMT-score 0,46 (P=0,24 | M=0,68 | T=0,61)**

DWR **Drinking water-relevant**

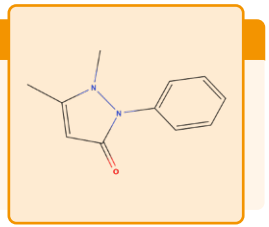
CLP

N-Acetyl-4-aminoantipyrine (AAA, CASRN 83-15-8)



PMT **PMT-score 0,48 (P=0,26 | M=0,70 | T=0,61)**

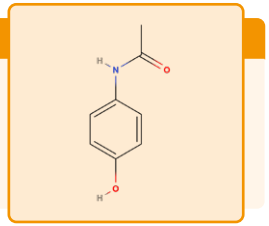
Antipyrine (phenazone, CASRN 60-80-0)



PMT **PMT-score 0,40 (P=0,16 | M=0,66 | T=0,61)**

Application: N-Formyl-4-aminoantipyrine (FAA) and N-acetyl-4-aminoantipyrine (AAA) are metabolites of antipyrene, a medication with analgesic and anti-pyretic effects, also known as phenazone. Phenazone was synthesised for the first time by Ludwig Knorr in 1887 and used as an analgesic and fever-reducing medication. Phenazone is now only seldom used for the treatment of pain and fever. It is however frequently used in the testing of the effects of other medications or illnesses in the medication-degrading enzymes in the liver.
Origin: after being administered, this substance is excreted by the body and ends up in the surface water via sewerage systems.
Distribution of contamination: FAA equalled the ERM target value in measurements at Brakel and breached it at Bergsche Maas and Haringvliet, while AAA was only detected in breach at Haringvliet. AAA has an indicative drinking water target value of 10 µg/L.

Paracetamol (CASRN 103-90-2)



PMT **PMT-score 0,36 (P=0,13 | M=0,62 | T=0,57)**

CLP

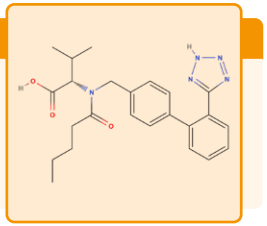
Application: Paracetamol is an over-the-counter analgesic and fever-reducing drug. The name paracetamol is derived from the chemical name para-acetylaminophenol.

Origin: after being administered, this substance is excreted by the body and ends up in the surface water via sewerage systems.

Distribution of contamination: paracetamol breached the ERM target value in measurements at Tailfer and Roosteren.

Medications for cardiovascular diseases (AIIRAs and beta blockers)

Valsartan (CASRN 137862-53-4)

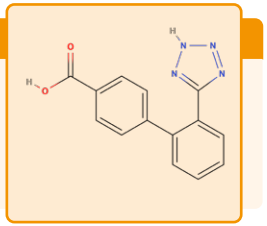


PMT **PMT-score 0,33 (P=0,14 | M=0,47 | T=0,56)**

DWR **Drinking water-relevant**

CLP

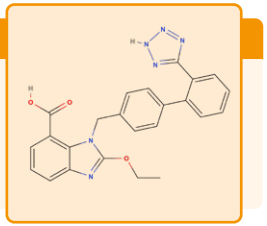
Valsartanic acid (CASRN 164265-78-5)



PMT **PMT-score 0,35 (P=0,21 | M=0,63 | T=0,33)**

DWR **Drinking water-relevant**

Candesartan (CASRN 139481-59-7)



PMT **PMT-score 0,40 (P=0,54 | M=0,28 | T=0,42)**

DWR **Drinking water-relevant**

CLP

Application: valsartan and candesartan are medications in the category angiotensin II receptor antagonists (AIIRAs). They inhibit the action of a hormone in the blood that contracts the blood vessels and raises the blood pressure. They are prescribed for high blood pressure, heart failure and after a cardiac infarct. Valsartanic acid is a breakdown product of valsartan. In 2023, valsartan was in positions 57 (Diovan®, 34,888,200 DDD), 105 (Entresto® with sacubitril, 15,253,900 DDD), 201 (Codiovan® with diuretics, 5,875,800 DDD), 275 (Exforge® with amlodipine, 2,905,100 DDD) and 284 (Exforge HCT® with amlodipine and hydrochlorothiazide, 2,489,400 DDD) in the top 500 of the most-prescribed medications in the Netherlands [source: gipdatabank.nl). In 2023, candesartan appeared twice in the top 500 of the most-prescribed medications in the

Netherlands: at number 26 with 74,221,600 (Atacand®) and at number 230 with 4,426,700 DDD (Atacand plus® with diuretics).

Application: after being administered, these substances are excreted by the body and end up in the surface water via sewerage systems.

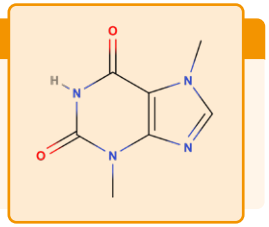
Distribution of contamination: the breakdown product of valsartan, valsartan acid, breached the ERM target value in measurements at Heel, Heusden, Brakel, Bergsche Maas and Haringvliet. Valsartan and candesartan breached the ERM target value in measurements at Haringvliet.

Notable: valsartan was in the news in 2017 and 2018 thanks to large-scale recalls of medication by pharmacists worldwide. Blood pressure-lowering drugs in the sartans group contained elevated concentrations of carcinogenic nitrosamines, including N-nitrosodimethylamine (NDMA) and N-nitrosodiethylamine (NDEA). After this discovery, a study was initiated immediately to investigate the cause of the presence of this contaminant. This study led to the recommendation to permit no measurable quantity of nitrosamines in sartans.

Diuretics (water pills)

Theobromine (CASRN 8367-0)

CLP



Application: theobromine is used as a diuretic (it promotes the excretion of urine), a vasodilator and a product that relaxes the cardiac muscle. It has a stimulating effect on the nervous system and heart muscle; it causes relaxation of the smooth muscles, it dilates blood vessels. It is also the substance that gives dark chocolate its bitter taste. Theobromine is also a metabolite of caffeine. Theobromine is taken up very rapidly in the oral cavity and stomach and has a very rapid effect on the body. The liver breaks the substance down, and it then travels to the kidneys via the blood where is excreted as waste.

Origin: after being administered as a diuretic, or after consuming chocolate or coffee, this substance is excreted by the body and ends up in the surface water via sewerage systems.

Distribution of contamination: theobromine was detected at levels above or at the ERM target value at Roosteren, Heel, Bergsche Maas and Haringvliet.

Note: theobromine is found in cocoa and chocolate. The amount of theobromine in chocolate is safe for humans, even at high levels, but can be fatal for animals like dogs, cats, horses and ferrets because they break down theobromine more slowly. The amount of theobromine in a 200-g bar of dark chocolate is enough to kill a Labrador.

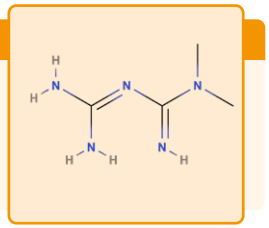
Antidiabetic drugs

Metformin (CASRN 657-24-9)

PMT **PMT-score 0,33 (P=0,12 | M=0,96 | T=0,34)**

DWR **Drinking water-relevant**

CLP



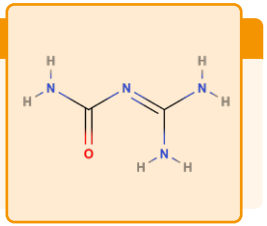
Application: metformin is an antidiabetic drug, a medication to lower the blood sugar. It belongs to the most-produced drugs in the world as regards production volume[14]. Doctors prescribe metformin not only for diabetes mellitus but sometimes also for reduced fertility caused by a deformity of the ovaries (Polycystic Ovary Syndrome, PCOS). In Belgium, 38 medications with this active substance are authorised (source: https://fagg.be). In 2023, metformin, with a total of 162,236,700 DDD (Glucient®), stood in the 10th place of most-prescribed medications in the Netherlands (source: gipdatabank.nl). Metformin is also present at position 356 (Janumet® with sitagliptin, 1,336,300 DDD) and 380 (Eucreas® with vildagliptin, 862,580 DDD). Metformin is not available over the counter.

14 *https://pubs.rsc.org/en/content/articlelanding/2009/em/b909311g/unauth*

Application: after being administered, these substances are excreted by the body and end up in the surface water via sewerage systems.
Distribution of contamination: metformin was detected above the ERM target value in 2024 at the measurement points Namêche, Liège, Roosteren, Heel and Bergsche Maas. The indicative drinking water target value for metformin is 196 µg/L.

Guanylurea (CASRN 141-83-3)

PMT **PMT-score 0,29 (P=0,10 | M=0,78 | T=0,33)**
DWR **Drinking water-relevant**
CLP

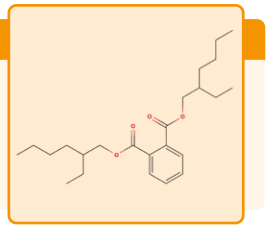


Application: guanylureum is the primary breakdown product of metformin, which is not broken down further by bacteria or under the influence of light in aerobic conditions (source: [Trautwein and Kümmerer, 2011 in Derksen and Ter Laak, 2013).
Origin: metformin introduced into surface water breaks down into guanylurea, after which no further breakdown happens. Guanylurea is indeed well broken down by passage through soil.
Distribution of contamination: guanylurea was detected above the ERM target value in 2024 at the monitoring points Bergsche Maas and Haringvliet. Guanylurea has an indicative drinking water target value of 22.5 µg/L.
Notable: the breakdown product guanylurea has a lower indicative drinking water target value than the parent substance metformin.

Endocrine-disrupting chemicals

Bis(2-ethylhexyl) phthalate (DEHP, CASRN 117-81-7)

PMT **PMT-score 0,15 (P=0,05 | M=0,11 | T=0,71)**



Application: bis(2-ethylhexyl) phthalate (DEHP) is used as a plasticiser in PVC production, as a hydraulic fluid, as a dielectric in capacitors and as a solvent in organic chemistry. Plastics contain about 1% to 40% DEHP on average.
Origin: use of plasticisers in plastic, glue, ink, hydraulic fluid, etc.
Distribution of contamination: DEHP breached the ERM target value in measurements at Brakel. DEHP was also found above the ERM target value at Brakel in 2023, 2017 and in 2011 to 2014.
Notable: DEHP is a priority hazardous substance in the European water policy (Directive 2013/39/EU). DEHP was classified as an endocrine-disrupting chemical (EDC) by the European Commission in July 2017 and identified as Substance of Very High Concern (SVHC) under Article 57(f) of REACH. On 17 December 2018, the European Commission decided to end the use and trade of products containing DEHP, dibutyl phthalate (DBP), benzyl butyl phthalate (BBP) and DIBP in the European Union (EU Regulation No. 2018/2005).

ER-CALUX®

Application: none (effect measurement).
Origin: CALUX® assays form a family of bioassays that make use of human or mammalian cells. They are genetically modified such that they produce light as a reaction to exposure to substances that induce a specific effect. A reporter gene (luciferase) is then transcribed into the cell nucleus and translated into an enzyme that produces light after administration of its substrate, luciferin. The amount of light produced is proportional to the activity of the substances to which the cells have been exposed and it is quantified in a luminometer. The

"ER" in ER-CALUX® stands for estrogen responsive: this bioassay specifically signals the activation of estrogen receptors, which play a direct role in maintaining the hormone balance.

Distribution of contamination: In 2024, ER-CALUX® breached the ERM target value in measurements at Bergsche Maas and Haringvliet. In 2021, the ERM target value was breached in measurements at Namêche, Liège, Heel, Keizersveer and Bergsche Maas.

Notable: The ERM target value for ER-CALUX® is very low because the reference substance estradiol (E2) is hormonally disruptive in the body even at very low concentrations.

Which pesticides, biocides and their metabolites end up in the Meuse?

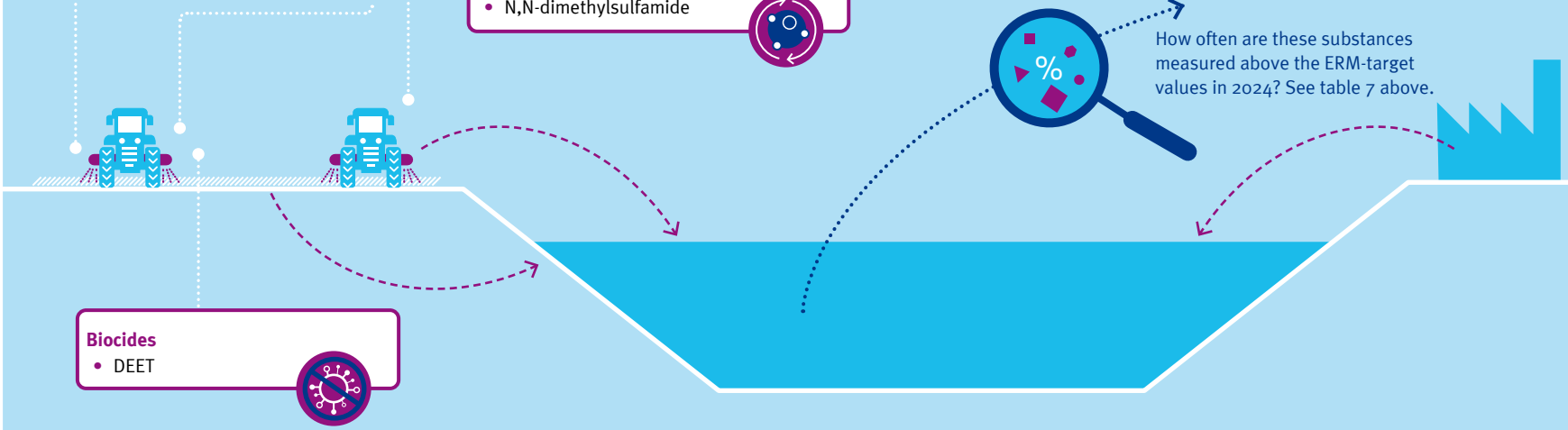
Fungicides
- Fluopyram
- Propamocarb
- Dimethomorph
- Thiabendazole

Herbicides
- Dimethenamid(-p)
- (s-)Metolachloor
- Glyphosate
- MCPA
- Prosulfocarb
- Chlorotoluron
- dicamba
- propyzamide
- flufenacet

Insecticides
- Flonicamid

Metabolites
- AMPA
- Chloridazon desphenyl
- Metazachlor-OA
- Metazachlor-ESA
- Metolachlor-OA
- N,N-dimethylsulfamide

Biocides
- DEET



How often are these substances measured above the ERM-target values in 2024? See table 7 above.

Plant protection products, biocides and their metabolites

Parameter	CASRN	ERM-	tv	TAI	NAM	LUI	EYS	ROO	STV	HEE	BRA	HEU	KEI	BSM	HAR	n/	N	%
Plant protection products, biocides and their metabolites																267	2818	9,5%
aminomethylphosphonic acid (AMPA)	1066-51-9	0,1	µg/l	0,2	0,24	0,16	0,56	0,75	0,93	0,82	0,93	0,732	0,80	0,69	0,44	116	142	81,6%
chloridazone-desphenyl	6339-19-1	0,1	µg/l	0,07	0,19	0,19		0,24		0,25	0,29	0,23		0,29	0,19	87	127	68,5%
fluopyram	658066-35-4	0,1	µg/l								0,02	0,22				5	30	16,6%
flonicamid	158062-67-0	0,1	µg/l									0,23				3	30	10%
propamocarb	24579-73-5	0,1	µg/l					0,4		0,33	0,09			0,13		16	382	4,1%
dimethenamide(-p)	163515-14-8	0,1	µg/l	0,12	0,11	0,14	0,08	0,07		0,07	0,26	0,06	0,21	0,24	0,04	7	183	3,8%
(S)-metolachlor	87392-12-9	0,1	µg/l		0,07			0,04		0,03	0,18	0,12		0,04	0,02	7	201	3,4%
propyzamide	23950-58-5	0,1	µg/l								0,22					1	32	3,1%
glyphosate	1071-83-6	0,1	µg/l		0,04	0,05	0	0,13	0,48	0,09	0,11	0,05		0,08	0,04	4	142	2,8%
flufenacet	142459-58-3	0,1	µg/l		0,08	0,20										1	38	2,6%
dimethomorph	110488-70-5	0,1	µg/l								0,08	0,05		0,24		3	118	2,5%
metazachlor OXA	1231244-60-2	0,1	µg/l		0,17	0,12					0,06			0,06	0,07	2	97	2%
metazachlor ESA	172960-62-2	0,1	µg/l		0,13	0,1				0,07	0,09	0,06		0,08	0,09	2	97	2%
thiabendazole	148-79-8	0,1	µg/l		0,14											1	54	1,8%
metolachlor-OA	152019-73-3	0,1	µg/l		0,04						0,13	0,08		0,14	0,06	2	123	1,6%
N,N-Dimethylsulfamide	3984-14-3	0,1	µg/l								0,05	0,10				1	81	1,2%
chlorotoluron	15545-48-9	0,1	µg/l	0,11	0,05	0,10				0,05	0,08		0,06	0,07	0,05	2	178	1,1%
prosulfocarb	52888-80-9	0,1	µg/l	0,12				0,11		0,1	0,1			0,09	0,08	4	379	1%
dicamba	1918-00-9	0,1	µg/l		0,05			0,34			0,02					1	111	0,9%
diethyltoluamide (DEET)	134-62-3	0,1	µg/l		0,02			0,04		0,05	0,07			0,13	0,03	1	113	0,8%
MCPA	94-74-6	0,1	µg/l							0,02	0,04	0,12	0,05	0,04		1	160	0,6%

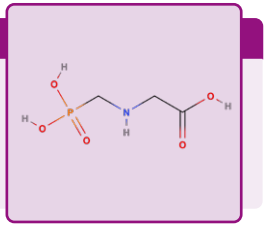
ERM-tv = ERM target value, TAI = Tailfer, NAM = Namêche, LUI = Liège, EYS = Eijsden, ROO = Roosteren, STV = Stevensweert, HEE = Heel, BRA = Brakel, HEU = Heusden, KEI = Keizersveer, BSM = Bergsche Maas, HAR = Haringvliet.
In the table, the highest-measured value is presented if the parameter exceeded the ERM target value, where n is the number of breaches and N is the number of measurements.

Plant protection products, biocides and their metabolites

In 2024, 67 parameters exceeded the ERM target values one or more times. In 31.3% of cases (21 times), this concerned Plant protection products, biocides and metabolites. Of the 2,818 measurements that were done for these 21 substances, 267 (9.5%) exceeded the ERM target value (see Tabel 8).

Table 8 on page 189: Plant protection products, biocides and their metabolites that breached the ERM target value in 2024 (maximum concentrations, in order of percentage of breaching measurements).

Glyphosate (CASRN 1071-83-6)



PMT **PMT-score 0,25 (P=0,05 | M=0,96 | T=0,34)**

DWR **Drinking water-relevant**

CLP

Application: glyphosate is a herbicide (weedkiller).

Origin: although the majority of the quantities sold are applied in agriculture, we know from practical investigations and monitoring programmes in the past that emissions of glyphosate into the Meuse mainly originate from sources outside agriculture, such as site management and, in particular, application to surfacing. This was confirmed by calculations of burdens of emissions that were conducted in 2010 for the Netherlands part of the Meuse River Basin: 1.5% of the burden comes from agricultural use and 98.5% via rainwater drains, overflows and effluents from wastewater treatment plants. The Board for the Authorisation of Plant Protection Products and Biocides (CTGB) have imposed increasing restrictions on the use of plant protection products containing glyphosate over the years, such as:

When applied on temporarily uncultivated land, ditch banks should not be sprayed.

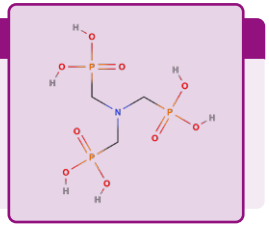
To protect drinking water sources, the application of this pesticide is not allowed on closed and semi-open hard surfaces in the Meuse River Basin. This concerns the following areas in the Netherlands: the provinces of Limburg and North Brabant (except the municipalities of Woensdrecht and Bergen op Zoom) and the municipalities of Maasdriel, West Maas en Waal, Druten, Wijchen, Beuningen, Heumen and Nijmegen, west of the Meuse-Waal canal.

Distribution of contamination: glyphosate breached the ERM target value at the Roosteren, Stevensweert and Heusden monitoring points.

Notable: in 1994, the drinking water companies demonstrated the presence of the glyphosate in the Netherlands part of the Meuse for the first time and, from 1996, the ERM target value was exceeded every year. Particularly in the period 2002-2005, the average concentration of glyphosate in the Meuse rose to above 0.1 µg/L. The ERM target value has no longer been exceeded at Tailfer for years, which means that very little glyphosate from France ends up in the Meuse.

In 2018, an exemption was granted to WML and Evides to allow them to continue to use surface water containing glyphosate at Heel and Keizersveer (Gat van de Kerksloot) for the production of drinking water.

Aminomethylphosphonic acid (AMPA, CASRN 1066-51-9)



PMT **PMT-score 0,30 (P=0,10 | M=0,84 | T=0,33)**

DWR **Drinking water-relevant**

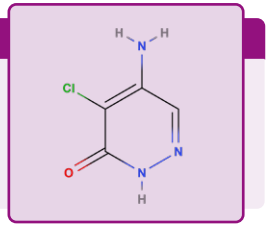
Application: aminomethylphosphonic acid (AMPA) is a metabolite of glyphosate or ATMP.

Origin: the majority of the AMPA burden increase between Eijsden and Keizersveer was explained in a 2010 monitoring programme by the use of glyphosate as a herbicide, and mainly outside agriculture. In that monitoring programme in 2010, a major source of AMPA was also discovered that did not have its source in the use of glyphosate. High concentrations of AMPA were measured in the Ur tributary, which flows into the Grensmaas (Border Meuse) at Stein. The AMPA in the water of the Ur tributary is a breakdown product of ATMP (aminotrismethylenephosphonic acid) which is added to cooling water on the nearby Chemelot chemistry industrial estate. It was calculated that 34% of the AMPA burden increase between Eijsden and Keizersveer in 2010 was caused by this. These emissions have since been significantly reduced.

Distribution of contamination: AMPA was detected at above the ERM target value at all monitoring points where it was measured.

Notable: the Dutch government considers AMPA a metabolite of a plant protection product that is toxicologically irrelevant to humans. Since 2011, the Dutch government has applied a standard for metabolites toxicologically irrelevant to humans of 1 µg/L for the raw material for the production of drinking water (Dutch Drinking Water Regulation 2011). Since 2020, a list of metabolites of plant protection products toxicologically irrelevant to humans and their standards has been available[15]. The standard of 1 µg/L was not breached anywhere in 2024. This is the first time this standard has not been breached since measurements began.

Chloridazon desphenyl (CASRN 6339-19-1)



PMT **PMT-score 0,46 (P=0,20 | M=0,80 | T=0,61)**

Application: chloridazon desphenyl is a metabolite of chloridazon, a herbicide . Authorisations of plant protection products based on the active substance chloridazon have recently been withdrawn in Belgium and the Netherlands. The last authorisations in the Netherlands expired on 31 December 2018, with a use-by date of 30 June 2020. This was done based on the expiry date of the active substance chloridazon set in Implementing Regulation 2008/41/EC. Chloridazon was present in plant protection products with the names: Agrichem Chloridazon 65% Sp.P. (NL), Agrichem Chloridazon F.W. (NL), Alicep N (NL), Alliproc (NL), Better Df (NL), Better Sc (BE, NL), Better Wp (NL), Bietazol 520 (BE), Booster 520 (BE), Chlordex Sc (BE), Chloridazon Df (NL), Chloridazon Flow 3 (NL), Chloridaz-W.G. (NL), Fiesta (NL), Fiesta New (BE), Imex-Chloridazon Flow 2 (NL), Luxan Chloridazon Df (NL), Luxan Chloridazon Flow (NL), Luxan Chloridazon Spuitkorrel (NL), Pyramin DF (NL), Pyramin FL (NL), Pyramin Sc 520 (BE) and Pyroquin Tdi Sc (BE) (source: CTGB and Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

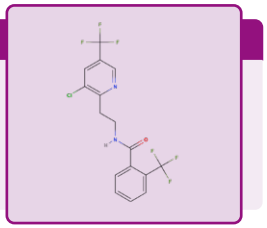
Distribution of contamination: the metabolite chloridazon desphenyl was detected above the ERM target value at Namêche, Liège, Roosteren, Heel, Bergsche Maas and Haringvliet. The Netherlands government considers chloridazon desphenyl to be a metabolite of a crop protection agent toxicologically irrelevant to humans. Since 2011, the Dutch government has applied a standard for metabolites toxicologically irrelevant to humans of 1 µg/L for the raw material for the production of drinking water (Dutch Drinking Water Regulation 2011). Since 2020, a list of metabolites of plant protection products toxicologically

15 https://rvszoeksysteem.rivm.nl/Stoffen

irrelevant to humans and their standards has been available22. The standard of 1 µg/L was not exceeded in 2024. In Flanders, chloridazon desphenyl[16] is tested against a precautionary value of 4.5 µg/L.

Notable: chloridazon desphenyl is detected in groundwater in many North European countries.

Fluopyram (CASRN 658066-35-4)



PMT **PMT-score 0,44 (P=0,99 | M=0,26 | T=0,33)**

CLP

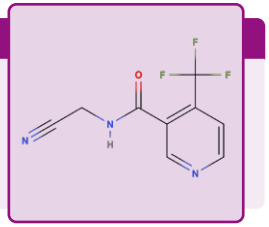
Application: fluopyram is approved in the Netherlands and Belgium in several plant protection products as a fungicide (to combat mould) and a nematicide (to combat roundworms including eelworms) in all kinds of arable crops, vegetables, fruit crops and floriculture crops (source: HWL factsheet). These plant protection products are sold in Belgium and the Netherlands under the brand names Ascra Xpro (BE, NL), Bixazor Extra (BE), Caligula (BE), Exteris Stressgard (BE, NL), Inter Blast (BE), Inter Lunar (BE), Keynote Xpro (BE), Luna Care (BE, NL), Luna Experience (BE, NL), Luna Privilege (BE, NL), Luna Sensation (BE, NL), Luna Smart (BE), Moona Duo (BE), Propulse (BE, NL), Propyram 250 Se (BE), Recital (BE), Silvron Xpro (BE, NL), Veldig Xpro (BE), Velum Prime (BE, NL), Verango (NL), VSM Care (BE), Vsm Fluostrobine (BE) and Yearling (BE) (source: CTGB and Phytoweb).

Origin: it emerges from the monitoring data that fluopyram was mainly detected at high concentrations in the polder water at Brakel Pumping Station. Direct application in agriculture, fruit growing and floriculture is probably the main source of fluopyram in the polder water and indirectly the surface water (source: HWL factsheet).

Distribution of contamination: as in 2022 and 2023, fluopyram was only found above the ERM target value at Brakel. This indicates a local source.

Notable: since 15 November 2024, RIVM has classified fluopyram as a Substance of Very High Concern because it belongs to the PFAS group. Trifluoroacetic acid is one of the metabolites of fluopyram.

Flonicamid (CASRN 158062-67-0)



PMT **PMT-score 0,54 (P=0,83 | M=0,58 | T=0,33)**

CLP

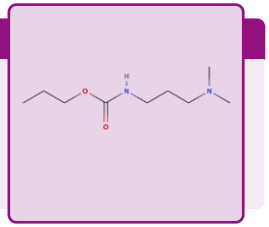
Application: flonicamid is authorised in the Netherlands for use as an insecticide and belongs to the pyridine carboxamides. It is permitted in the cultivation of various vegetables, fruits and flower bulbs. Flonicamid is or was the active substance in the plant protection products Afinto (BE, NL), Alakazam 500 Wg (BE), Apn Flonicamid 500 (NL), Flonicastar (BE), Flonigold 500 (BE), Hinode (BE, NL), Inter Peki (NL), Inter Peki Wg (NL), Shoori (NL), Teppeki (BE, NL), Teppeki WG (NL) and VSM Flonicamid 50 Wg (NL) (source: CTGB and Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: flonicamid was detected above the ERM target value at Brakel. This indicates a local source.

Notable: since 15 November 2024, RIVM has classified flonicamid as a Substance of Very High Concern because it belongs to the PFAS group. Trifluoroacetic acid is one of its metabolites.

Propamocarb (CASRN 24579-73-5)



PMT **PMT-score 0,54 (P=0,36 | M=0,61 | T=0,74)**

DWR **Drinking water-relevant**

CLP

Application: propamocarb is a fungicide that is used in agriculture in the cultivation of various vegetables, types of lettuce, tomatoes, potatoes and house plants, to combat false mildew, phytophthora and pythium. In Belgium and the Netherlands, plant protection products based on the active substance propamocarb are and were authorised with names such as Budget Propamocarb-Fosetyl (NL), Matix (NL), Previcur Energy (BE, NL), Profo Energy (BE) and Wopro Energy (NL). There are or were also plant protection products authorised on the

16 *https://www.vmm.be/wetgeving/relevante_en_niet-relevante_metabolieten_tw.pdf*

basis of propamocarb hydrochloride (CASRN 25606-41-1) with names such as Agrichem Propamocarb (NL), Alonso (BE), Axidor (BE, NL), Boreso Flex (BE), Budget Propamocarb 722 (NL), Consento (NL), Curomil 450 Sc (BE), Diprospero (BE, NL), Edipro (BE, NL), Phytocur N (NL), Imex Propamocarb (NL), Infinito (BE, NL), Matix (BE), Obscur (BE), Omix (BE), Omix Duo (BE), Omix Duo Sc (BE), Parimco PROPAMOCARB (NL), Potagold 687.5 Sc (BE), Previcur N (NL), Promess (NL), Proplant (BE, NL), Proxanil (BE, NL), Proxanil Garden (BE), Proxidor (NL), Raport (BE, NL), Rival (BE, NL), Rival Duo (BE), Simpro (BE), Sporax (BE, NL), Tattoo C (NL) and VSM Finito (BE) (source: CTGB and Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

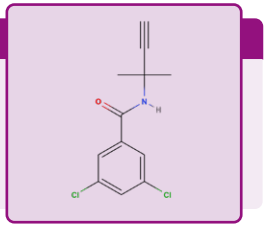
Distribution of contamination: propamocarb exceeded the ERM target value at Roosteren.

Notable: see the section 'Example of incident with successful tracing' on page 3537 of the Annual Report on the Meuse 2021[17].

Propyzamide (CASRN 23950-58-5)

PMT **PMT-score 0,55 (P=0,76| M=0,40| T=0,56)**

CLP



Application: propyzamide is the active substance in herbicides with names like Setanaflo, Setana SC, Relva VR, Kerb 400 SC, Kerb Flo and Solitaire. These herbicides are authorised for use in the cultivation of various fruits and vegetables.

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

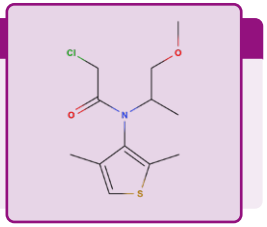
Distribution of contamination: the ERM target value was breached once, at Haringvliet.

Notable: in 2017, the ERM target value for propyzamide was also breached at Namêche and Liège.

Dimethenamid(-P) (CASRN 87674-68-8)

PMT **PMT-score 0,56 (P=0,58| M=0,50| T=0,61)**

CLP



Application: dimethenamid(-P) is a herbicide (weedkiller). Based on Implementing Regulation (EU) 2019/1137, dimethenamid-P will remain on the list of approved active substances until 31 August 2034. In Belgium and the Netherlands, the following plant protection products based on dimethenamid-P (CASRN 163515148) are approved: Agrologic Cleansoil (NL), Akris (BE, NL), Arundo (BE), Butisan Duo 400 Ec (BE), Butisan Gold (BE), Cropguard Metadimemix (NL), Frontier Elite (BE), Frontier Optima (NL), Grometa (BE), Spectrum (NL), Springbok (BE, NL), Tanaris (BE, NL), Terbudime 530 (BE), Wing P (NL) and Wopro Bodem Schoon (NL) (source: CTGB and Phytoweb). These plant protection products may be applied to many arable crops (vegetables, fruit etc.) and in floriculture in both countries. In the Netherlands, Frontier Optima may also be used on field verges and on temporarily uncultivated land.

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: dimethenamid was detected above the ERM target value at Tailfer, Namêche and Liège.

Notable: the drinking water companies' laboratory analysis methods usually present dimethenamid as a mix of stereo-isomers; the S-isomer dimethenamid-P is reported only once.

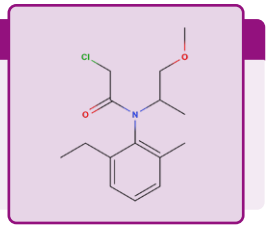
17 *https://www.riwa-maas.org/publicatie/riwa-jaarrapport-2021-de-maas/*

metolachlor (CASRN 51218-45-2)

PMT **PMT-score 0,58 (P=0,60 | M=0,43 | T=0,74)**

DWR **Drinking water-relevant**

CLP

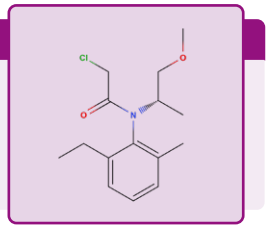


S-metolachlor (CASRN 87392-12-9)

PMT **PMT-score 0,58 (P=0,60 | M=0,43 | T=0,74)**

DWR **Drinking water-relevant**

CLP

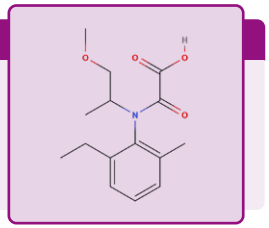


metolachlor-OA (CASRN 152019733)

PMT **PMT-score 0,43 (P=0,19 | M=0,73 | T=0,56)**

DWR **Drinking water-relevant**

CLP



Application: In both Belgium and the Netherlands, S-metolachlor (CASRN 87392129) was approved as a herbicide in the cultivation of various fruit and vegetables. Implementing Regulation (EU) 2024/20 of 23 December 2023 stipulates that the approval of the active substance S-metolachlor will not be renewed and that member states must have withdrawn all authorisations of plant protection products containing this active substance by 23 April 2024. This active substance could be found in the plant protection products with the names: Agan Metolachloor 960 (NL), Camix (BE, NL), Codal (BE), Cropguard S-Metolachloor (NL), Deluge Extra (BE), Dual 720 Ec (NL), Dual Gold (BE), Dual Gold 960 Ec (NL), Efica 960 Ec (BE, NL), Eternity (BE), Gardo Gold (BE, NL), Gardoprim (BE), Gardoprim Plus 500 Sc (NL), Jobber Plus 50 Wp (NL), Lecar (BE), Luxan Metolachloor (NL), Metallica (BE), Metolachloor 960 E.C. (NL), Metolagan 720 (NL), Primagram Gold (BE), S-Metolachlor 960 (BE) en Zeanett 500 Ec (NL) (source: CTGB and Phytoweb).

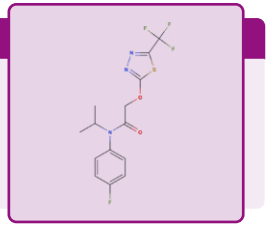
Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.). The drinking water companies' laboratory analysis methods present metolachlor as the racemic mixture of the R- and S-isomers.[18] Measurement results of both S-metolachlor and metolachlor can be considered representative of S-metolachlor, as the racemic mixture of metolachlor has been banned in the European Union since 30 November 2002 (Regulation No. 2002/2076/EC). The active substance S-metolachlor[19] was placed on Annex I to Directive 91/414/EEC by virtue of Directive 2005/5/EC with effect from 1 October 2005 and subsequently approved in accordance with Regulation (EC) No. 1107/2009 by Implementing Regulation (EU) No 540/2011.

Distribution of contamination: (S-)metolachlor was detected above the ERM target value at Heusden and Brakel. The concentration of metolachlor-OA (also called metolachlor oxanilic acid or metolachlor-C-metabolite) breached the ERM target value at Heusden. To date, the Dutch government has considered metolachlor-OA toxicologically irrelevant to humans. Since 2011, the Dutch government has applied a standard for metabolites toxicologically irrelevant to humans of 1 µg/L for the raw material for the production of drinking water (Dutch Drinking Water Regulation 2011). Since 2020, a list of metabolites of plant protection products toxicologically irrelevant to humans and their standards has been available22. The value of 1 µg/L was not exceeded. However, in support of the termination of the European authorisation, it was concluded that the metabolites of metolachlor are toxicologically relevant to humans. CTGB has adopted this and RIVM has advised the Ministry of Infrastructure and Water Management to accept the CTGB's assessment, update the status of metolachlor-OA and metolachlor -ESA and change the associated drinking-water quality requirements from 1 to 0.1 µg/l. The timeframe for this is currently unknown.

In Flanders, metolachlor-OA is tested against a precautionary value of 4.5 µg/L. This value was not exceeded.

18 The designations R- and S- are abbreviations of the Latin words rectus (right) and sinister (left).
19 the mixture of 80-100% S-metolachlor and 0-20% R-metolachlor

Flufenacet (CASRN 142459-58-3)



PMT **PMT-score 0,50 (P=0,96 | M=0,32 | T=0,42)**

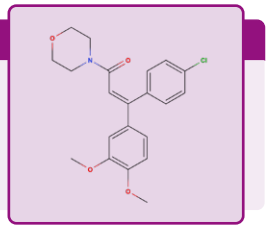
CLP

Application: flufenacet has been authorised as an active substance for herbicide use in Belgium with the following brand names: Andes, Arnold, Artist, Aspect T, Atta-Diflucan, Battle, Carpatus, Cevino 500 Sc, Dalupe, Fence, Fluent 500 Sc, Fluent 500 Sc, Flupicos 340 Sc, Giddo, Glosset Sc, Gofor, Graniprop 600 Sc, Herold Sc, Inter Retil Sc, Liberator, Loukoum 600 Sc, Malibu, Mertil, Naceto, Navigate, Nucleus, Pontos, Promess, Quirinus, Reliance, Seibold, Sirionova and Sunfire (source: fytoweb.be). In the Netherlands, Arnold, Fence, Glosset Sc, Gofor, Herold, Malibu, Mateno Forte, Pontos, Reliance and Sirionova have also been authorised for use (source: Ctgb.nl).

Origin: emissions during/after its use in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: flufenacet was detected once above the ERM target value, in Liège. According to the OECD definition, flufenacet is a PFAS and trifluoroacetic acid is one of its breakdown products. Since 15 November 2024, RIVM has classified flufanacet in the Netherlands as a Substance of Very High Concern because it belongs to the PFAS group.

Dimethomorph (CASRN 110488-70-5)



PMT **PMT-score 0,48 (P=0,76| M=0,43| T=0,33)**

CLP

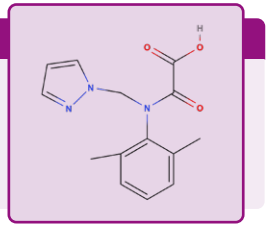
Application: dimethomorph, the active ingredient in a fungicide authorised in the cultivation of many crops. Dimethomorph is and was in plant protection products with names such as crobat DF (NL), Acrobat Wp (NL), Banjo Forte (BE, NL), Belomorph (BE), Brestan Combi (NL), Cabrio Duo (BE), Dimix 500 SC (NL), Diprospero (BE, NL), Foly Star 400 Sc (NL), Forum (NL), Inter Avigo (BE), Orvego (NL), Orvego Star (BE), Orvego Super (NL), Paraat (BE, NL), Presidium (BE, NL), Prevint (BE), Sitar (BE), Solide (NL) and Turbat Extra (NL) (source: CTGB and Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: dimethomorph was detected above the ERM target value at Bergsche Maas. RIVM views it as a Substance of Very High Concern.

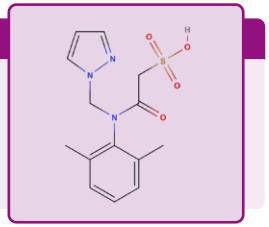
Notable: for two months in spring 2012, Dunea had to take emergency measures as a result of an illegal point discharge of dimethomorph by a horticultural company which resulted in substandard water quality in the Bommelerwaard and Afgedamde Maas rivers. This incident led to media coverage at the time.

Metazachlor-OA (CASRN 1231244-60-2)



DWR **Drinking water-relevant**

Metazachlor-ESA (CASRN 172960-62-2)



DWR **Drinking water-relevant**

Application: both metazachlor-OA (also metazachlor-C metabolite or metazachloric acid) and metazachlor-ESA (also metazachlor-S metabolite or metazachlor sulfonic acid) are a metabolite of metazachlor.

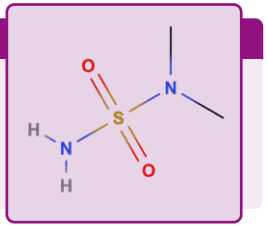
Origin: the parent substance metazachlor has been authorised in the Netherlands as a herbicide in the plant protection products Butisan S, Imex-Metazachlor-500, Springbok and Sultan 500 SC (source: Ctgb.nl]. In Belgium, authorisations based on metazachlor have been granted for the plant protection products BUTISAN GOLD, BUTISAN PLUS, BUTISAN S, FUEGO, METAROCK,

RAPSAN 500 SC, RAPSAN TDI, RAPSAN TURBO, SPRINGBOK, SULTAN 500 SC, SULTAN TOP and TORSO.

Distribution of contamination: metazachlor-S-metabolite was detected above the ERM target value at the Haringvliet monitoring point (and just below the ERM target value at Keizersveer). The Dutch government considers this metabolite toxicologically irrelevant to humans. Since 2011, the Netherlands government has applied a standard for metabolites toxicologically irrelevant to humans of 1 µg/L for the raw material for the production of drinking water (Dutch Drinking Water Regulation 2011). Since April 2020, a list of metabolites of crop protection agents toxicologically irrelevant to humans and their standards has been available (source: https://rvszoeksysteem.rivm.nl/Stoffen). The value of 1 µg/L was not exceeded.

N,N-Dimethylsulphamide (DMS, CASRN 3984143)

CLP



Application: DMS (N,N-dimethylsulfamide) is a breakdown product of tolylfluanid (CASRN 731271), the active substance in a biocide against mould, which is used in products for wood preservation. The use of tolylfluanid as an anti-mould product for wood protection increased sharply in the late 1980s, being used to replace the newly-prohibited pentachlorophenol. As of 1 October 2011, tolylfluanid was included in Annex I of the Biocides Directive 98/8/EC (Directive 2009/151/EC). DMS is seen as a relevant metabolite, because when ozonisation is used to produce drinking water, DMS is converted into the highly toxic NDMA. The toxicity of DMS itself was not the motivation to classify the substance as a relevant metabolite. The conversion of DMS into NDMA is an effect that occurs specifically through the use of ozone; other methods of disinfection and oxidation of drinking water do not show any formation of NDMA.

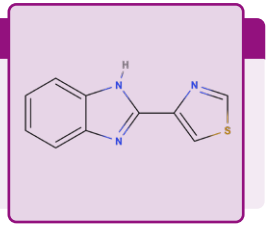
Origin: in the Netherlands, dichlofluanid is authorised as a dry film preservative (PT07) in Preventol A 4-S from Lanxess.

Distribution of contamination: DMS was only detected above the ERM target value at Brakel.

Thiabendazole (CASRN 148-79-8)

PMT-score 0,35 (P=0,18 | M=0,38| T=0,61)

CLP



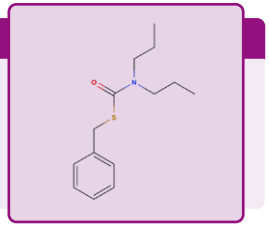
Application: thiabendazole is a biocide that is used against mould (fungicide) and parasites (parasiticide) and as a preservative (E233). Thiabendazole is used as medication to treat fungal infections and parasitic worms in humans and animals. Brand names include Mintezol and Tresaderm (for use in animals). It is sprayed on to citrus fruit and bananas to combat mould formation on the peel. Thiabendazole is authorised in agriculture and horticulture in Belgium and the Netherlands under the brand name Tecto as a systemic fungicide for the protection of chicory and potatoes after harvesting. It is also effective as a biocide in products for wood protection.

Origin: thiabendazole is probably mainly released during use of this substance as a biocide or preservative.

Distribution of contamination: thiabendazole was detected above the ERM target value at Namêche.

Notable: in 2020 and 2018 (Namêche and Liège), 2017 (Liège), 2016 (Namêche and Liège) and 2014 (Brakel), this substance was also detected above the ERM target value.

Prosulfocarb (CASRN 52888-80-9)



PMT PMT-score 0,35 (P=0,26| M=0,28| T=0,61)

DWR Drinking water-relevant

CLP

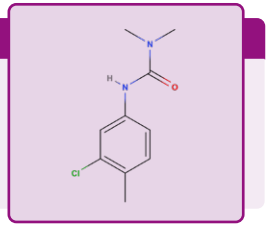
Application: prosulfocarb is the active ingredient in weedkillers (herbicides). Prosulfocarb-based products are no longer authorised in the Netherlands, but in the past, the herbicide Boxer with prosulfocarb as active ingredient was authorised for winter wheat and barley. In Belgium, prosulfocarb-based herbicides are authorised under brand names such as ADELFO, DEFI, FIDOX, FIDOX EC, JURA, ROXY 800 EC, ROXY EC and SPOW (source: Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: prosulfocarb exceeded the ERM target value at Heel.

Notable: in 2021, drinking water companies along the Meuse were also confronted with high levels of the pesticide prosulfocarb, originating in Wallonia. This was not the first time; there was also an incident involving the same substance in 2019. Ultimately, the source of the contamination was identified: Solirem, a company in Wandre that provides cleaning and reconditioning of cans and barrels. The company was also found to have cleaned drums containing residues of plant protection products, even though it had not been licensed to do so. Service Public de Wallonie (SPW), the public authority similar to Rijkswaterstaat that issues permits to Walloon companies, has initiated action against the company and the company was ultimately fined.

Chlorotoluron (CASRN 15545-48-9)



PMT PMT-score 0,51 (P=0,38| M=0,47| T=0,74)

CLP

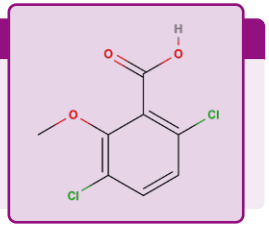
Application: herbicides based on the active substance chlorotoluron have been authorised in Belgium for use as a herbicide in the cultivation of spelt, triticale, winter barley, winter wheat and in nurseries of fruit trees and shrubs (apple and pear trees) and ornamental trees and shrubs (source: https://fytoweb.be). These herbicides have not been authorised in the Netherlands for many years now.

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: chlorotoluron breached the ERM target value at Tailfer and Liège.

Notable: chlorotoluron was found above the ERM target value once at Liège in November 2017. It was detected above the ERM target value once at Tailfer in November 2016. The last time chlorotoluron was found above the ERM target value was in Tailfer again, in November 2012.

Dicamba (CASRN 1918-00-9)



PMT PMT-score 0,49 (P=0,48 | M=0,60 | T=0,42)

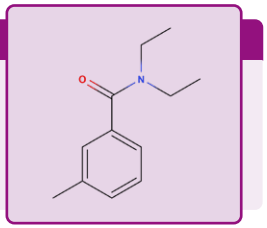
Application: dicamba is a herbicide and plant growth regulator. It is used in agriculture, in the cultivation of maize and other cereal crops, for keeping fallow land and grasslands weed-free and on lawns and grass fields. plant protection products containing dicamba were authorised in the Netherlands in 2024 with the names Arrat, Banvel 4S, CASPER, COMPO Gazonmeststof Plus Onkruidbestrijder, DICASH, DICOPHAR SL, Diniro, Jepolinex Pro, Kalimba (480 SL), Pokon Onkruid Weg!, Rosan, Roundup Gazon Onkruidvrij and Spandis.

Previously, there were a total of 58 plant protection products authorised with dicamba as an active substance (source: Ctgb). In Belgium, plant protection products containing dicamba as an active substance are authorised with names such as Banvel, Callisto Plus, Caluma Plus, Dicavel Sl, Diniro, Kamba 480 Sl, Landscaper Pro Weed Control + Fertilizer, Lumestra Plus, Spandis, Dicash, Dicotex, Callam, Casper, Clabod, Frisk, Interproba, Piorun and Rosan (source: Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, drift, etc.).

Distribution of contamination: dicamba breached the ERM target value at Roosteren.

Diethyltoluamide (DEET, CASRN 134-62-3)



PMT-score 0,38 (P=0,24| M=0,52| T=0,44)

CLP

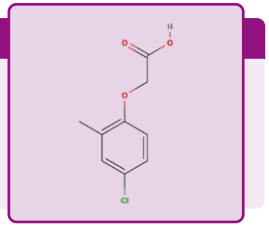
Application: DEET (N,N-diethyl-m-toluamide) is the active ingredient in biocides authorised in many insect repellent products, such as sprays, gels, sticks and roll-ons. DEET, in particular, protects against tick bites that can cause Lyme disease and mosquito bites that can cause dengue, West Nile fever and malaria.

Origin: emissions after use of this substance (via skin, clothing, etc. after washing or direct contact with water).

Distribution of contamination: DEET breached the ERM target value at the Bergsche Maas abstraction point.

Notable: DEET was detected above the ERM target value in Heusden in 2023 and in Heel in 2016. Previously, DEET was measured above the ERM target value in 2015 at Heusden, in 2014 at the Heusden and Keizersveer monitoring points and in 2013 at the Heel abstraction point.

4-chloro-2-methylphenoxyacetic acid (MCPA, CASRN 94-74-6)

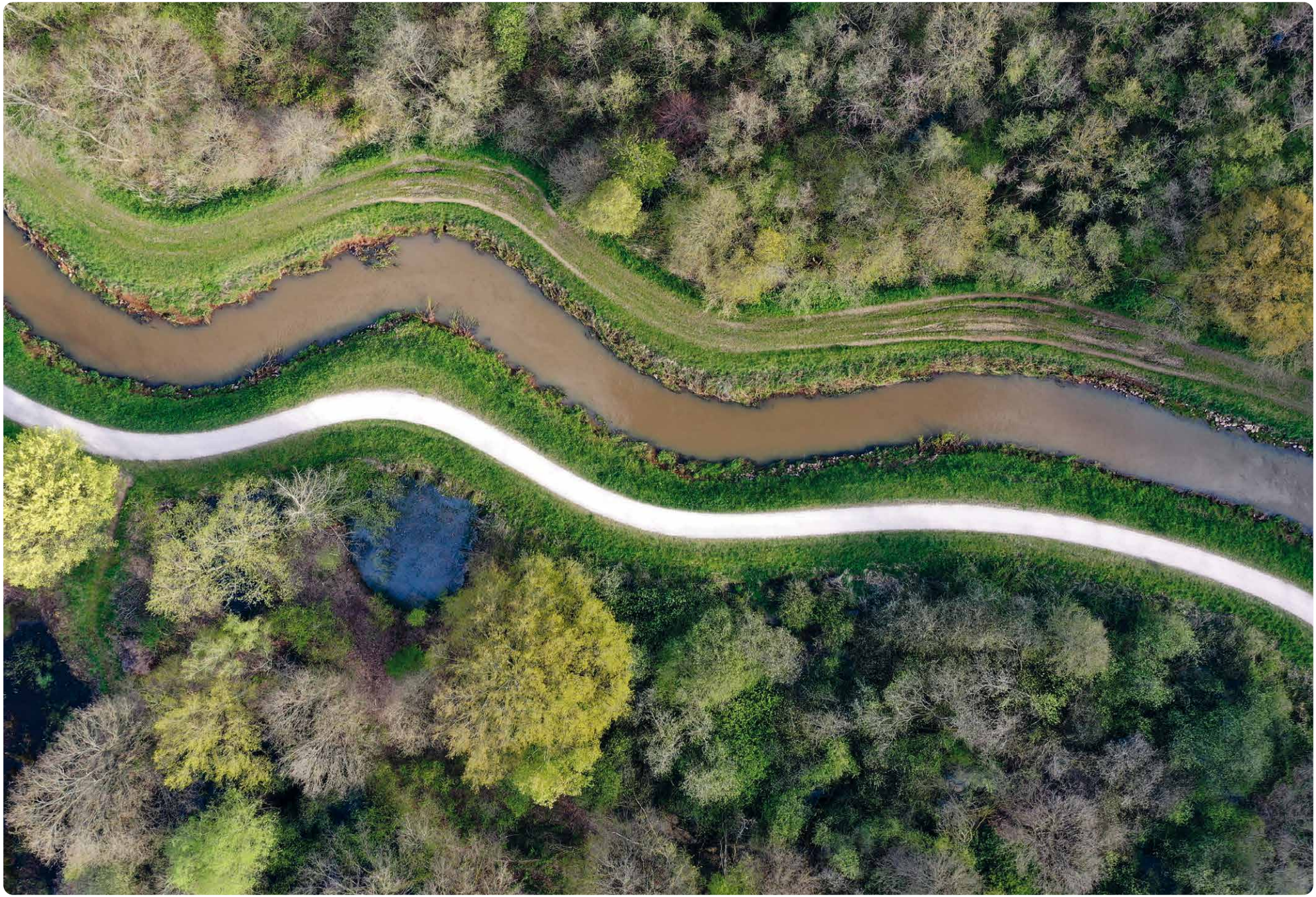


PMT-score 0,37 (P=0,17 | M=0,50 | T=0,61)

Application: MCPA is a herbicide. Based on Implementing Regulation (EU) 2023/1757, MCPA will remain on the list of approved active substances until 15 August 2026. There used to be 45 plant protection products authorised in the Netherlands containing MCPA as an active substance. Now, only the following MCPA-based plant protection products are authorised in the Netherlands: Agroxone MCPA, Cirran, CropGuard MCPA 500, Dicophar SL, Jepolinex Pro and U 46 MCPA (source: CTGB). In the Netherlands, the following plant protection products based on MCPA are approved: Cirran, Agroxyl 750, Cirran Extra, Damex, Forte Super, Dicotex, Duplosan Super, Gramix Super, MCPA 750, Phybelcozan, U 46 M, U 46 M750, Bofix and Kinvara (source: Phytoweb).

Origin: emissions from the use of this substance in agriculture (farmyard run-off, spray drift, etc.).

Distribution of contamination: MCPA breached the ERM target value at Brakel.



Annex 2

Abstraction stops and restrictions due to water pollution

There were no abstraction stops or restrictions at Tailfer (statement from Vivaqua).

Point of intake: Water-Link, Broechem (Albertkanaal)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
1	ma 08/01/24 18:00	di 09/01/24 18:00	1,00	24,00	Other	Other
2	vr 22/03/24 04:00	vr 22/03/24 08:00	0,17		Defect	Chlorophyll -a
3	ma 25/03/24 12:00	ma 25/03/24 21:00	0,38		Notification other organisation	Dredging work
4	vr 26/04/24 01:27	vr 26/04/24 02:40	0,05		Defect	Defect
5	za 04/05/24 17:00	zo 05/05/24 09:30	0,69	16,50	Notification water manager	Mineral oil
6	zo 26/05/24 10:00	zo 26/05/24 19:00	0,38	9,00	Other	Competition
7	di 25/06/24 01:50	di 25/06/24 08:00	0,26	6,17	Own measurement	UV extinction , 254 nm
8	do 11/07/24 04:00	do 11/07/24 16:00	0,50	12,00	Own measurement	UV extinction , 254 nm
9	za 13/07/24 19:00	zo 14/07/24 01:00	0,25	6,00	Own measurement	UV extinction , 254 nm
			3,66	**73,67**	**Total**	

Point of intake: water-Link, Lier (Nete Canal)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
10	ma 18/03/24 10:00	ma 18/03/24 11:30	0,06		Defect	Defect
11	di 19/03/24 07:00	di 19/03/24 07:40	0,03		Defect	Defect
12	zo 11/08/24 19:30	ma 12/08/24 08:30	0,54		Defect	Defect
			0,63	**0,00**	**Total**	

Point of intake: WML, Heel (Lateraal Canal)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
13	ma 01/01/24 00:00	di 02/01/24 00:00	1,00		Operational	Operational
14	di 02/01/24 00:00	wo 10/01/24 00:00	8,00	192,00	Own measurement	GCAqua-0006 and GCAqua-0007 above alarm value
15	ma 15/01/24 00:00	ma 22/01/24 00:00	7,00	168,00	Notification water manager	DIPE above alarm value
16	ma 22/01/24 00:00	wo 24/01/24 00:00	2,00		Operational	Dredging work
17	wo 24/01/24 00:00	ma 29/01/24 00:00	5,00	120,00	Own measurement	Unknown component group above alarm value
18	ma 29/01/24 00:00	wo 31/01/24 00:00	2,00		Operational	Plugging the intake line
19	ma 05/02/24 00:00	zo 25/02/24 00:00	20,00	480,00	Own measurement	GCAqua-0132 and GCAqua-025 above alarm value
20	do 29/02/24 00:00	vr 01/03/24 00:00	1,00		Operational	Dredging work
21	vr 01/03/24 00:00	ma 11/03/24 00:00	10,00	240,00	Own measurement	Unknown component group above alarm value
22	wo 13/03/24 00:00	vr 22/03/24 00:00	9,00	216,00	Own measurement	GCAqua-0006 and GCAqua-0007 above alarm value
23	ma 25/03/24 00:00	zo 31/03/24 00:00	6,00	144,00	Own measurement	GCAqua-0251 above alarm value

Continuation Point of intake: WML, Heel (Lateraal Canal)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
24	ma 01/04/24 00:00	vr 12/04/24 00:00	11,00	264,00	Own measurement	GCAqua-0251 above alarm value
25	do 18/04/24 00:00	di 30/04/24 00:00	12,00	288,00	Notification water manager	Acetone above alarm value
26	wo 01/05/24 00:00	do 02/05/24 00:00	1,00		Operational	Dredging work
27	ma 06/05/24 00:00	ma 13/05/24 00:00	7,00	168,00	Own measurement	GCAqua-0006, GCAqua-0007 and GCAqua-0092 (Neophytadiene) above alarm value
28	ma 13/05/24 00:00	vr 17/05/24 00:00	4,00	96,00	Notification water manager	DIPE above alarm value
29	di 21/05/24 00:00	vr 31/05/24 00:00	10,00	240,00	Own measurement	GCAqua-0132 above alarm value
30	zo 09/06/24 00:00	zo 16/06/24 00:00	7,00	168,00	Own observation	Alarm Daphnia Toximeter
31	ma 17/06/24 00:00	do 20/06/24 00:00	3,00	72,00	Notification water manager	1,2 - dichloroethane above alarm value
32	ma 24/06/24 00:00	wo 26/06/24 00:00	2,00	48,00	Own measurement	GCAqua-0132 and GCAqua-0261 above alarm value
33	vr 28/06/24 00:00	zo 30/06/24 00:00	2,00	48,00	Own measurement	GCAqua-0132 and GCAqua-0261 above alarm value
34	ma 01/07/24 00:00	wo 03/07/24 00:00	2,00	48,00	Own measurement	GCAqua-0132 and GCAqua-0261 above alarm value
35	ma 08/07/24 00:00	wo 10/07/24 00:00	2,00	48,00	Notification water manager	1,2-dichloroethane and propamocarb above alarm value
36	ma 15/07/24 00:00	ma 15/07/24 00:00	0,00	0,00	Own observation	Alarm Daphnia Toximeter and Mussel monitor
37	wo 17/07/24 00:00	vr 19/07/24 00:00	2,00	48,00	Notification water manager	Propamocarb above alarm value
38	wo 31/07/24 00:00	wo 31/07/24 00:00	0,00	0,00	Own measurement	Neophytadiene and GCAqua-0093 above alarm value
39	do 01/08/24 00:00	vr 02/08/24 00:00	1,00	24,00	Own measurement	Neophytadiene and GCAqua-0093 above alarm value
40	di 06/08/24 00:00	ma 12/08/24 00:00	6,00	144,00	Own measurement	4-nonylphenol above the alarm value
41	wo 21/08/24 00:00	ma 26/08/24 00:00	5,00	120,00	Own measurement	Neophytadiene above alarm value
42	vr 13/09/24 00:00	ma 16/09/24 00:00	3,00	72,00	Own measurement	Sucralose above alarm value
43	do 19/09/24 00:00	ma 30/09/24 00:00	11,00	264,00	Own measurement	Neophytadiene above alarm value
44	di 01/10/24 00:00	ma 07/10/24 00:00	6,00		Operational	Defect
45	do 10/10/24 00:00	di 15/10/24 00:00	5,00	120,00	Notification water manager	Ship at Borgharen weir suffered damage and lost oil
46	vr 25/10/24 00:00	ma 28/10/24 00:00	3,00	72,00	Own measurement	1-Dodecanal and Cyclododecane above the alarm value
47	vr 01/11/24 00:00	ma 04/11/24 00:00	3,00	72,00	Own measurement	LCAqua-592 above alarm value
48	di 05/11/24 00:00	wo 06/11/24 00:00	1,00		Operational	Maintenance / inspection
49	ma 11/11/24 00:00	di 12/11/24 00:00	1,00	24,00	Own observation	Alarm mussel monitor
50	di 19/11/24 00:00	vr 22/11/24 00:00	3,00	72,00	Notification water manager	Acetone above alarm value , alarm Mussel monitor and Daphnia Toximeter
51	wo 27/11/24 00:00	vr 29/11/24 00:00	2,00	48,00	Notification water manager	1,2 - dichloroethane above alarm value
52	vr 29/11/24 00:00	zo 01/12/24 00:00	2,00	48,00	Own measurement	Prosulfocarb above alarm value
53	zo 01/12/24 00:00	ma 02/12/24 00:00	1,00	24,00	Own measurement	Prosulfocarb above alarm value
54	vr 06/12/24 00:00	za 07/12/24 00:00	1,00	24,00	Own observation	Alarm mussel monitor
55	ma 09/12/24 00:00	ma 16/12/24 00:00	7,00	168,00	Notification water manager	1,2-dichloroethane above alarm value, several peaks above alarm value

Continuation Point of intake: WML, Heel (Lateraal Canal)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
56	do 19/12/24 00:00	do 19/12/24 00:00	0,00	0,00	Own observation	Alarm mussel monitor
57	di 24/12/24 00:00	di 31/12/24 00:00	7,00		Operational	
			204,00	**4392,00**	**Total**	

Point of intake: Dunea, Brakel (Afgedamde Maas))

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
58	zo 14/07/24 00:00	ma 19/08/24 00:00	36,00	864,00	Own measurement	Exceeding the standard

Point of intake: Evides Waterbedrijf, Bergsche Maas (Bergsche Maas)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
59	ma 08/01/24 09:15	do 11/01/24 14:30	3,22	77,25	Own measurement	Elevated turbidity
60	wo 28/02/24 13:30	vr 01/03/24 12:30	1,96	47,00	Notification other organisation	Warning water board
61	za 02/03/24 07:17	ma 04/03/24 13:00	2,24	53,72	Own measurement	Alarm biomonitoring (daphnia)
62	vr 08/03/24 18:00	ma 11/03/24 18:00	3,00	72,00	Notification other organisation	Warning co-worker drinking water company
63	di 12/03/24 05:33	wo 13/03/24 11:20	1,24	29,78	Own measurement	Alarm biomonitoring (daphnia)
64	wo 24/07/24 09:30	ma 29/07/24 14:00	5,19	124,50	Own measurement	Regular measurement
65	ma 14/10/24 10:00	do 17/10/24 12:00	3,08	74,00	Own measurement	Elevated turbidity
66	ma 28/10/24 20:00	di 29/10/24 08:30	0,52	12,50	Own measurement	Alarm biomonitoring (daphnia)
67	wo 06/11/24 08:30	do 07/11/24 17:30	1,38		Operational	Other
			21,82	**490,75**	**Total**	

Point of intake: Evides Waterbedrijf, Haringvliet (Haringvliet)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
68	zo 07/01/24 17:00	ma 08/01/24 09:30	0,69	16,50	Own measurement	Elevated turbidity
69	ma 08/01/24 19:30	di 16/01/24 12:00	7,69	184,50	Own measurement	Elevated turbidity
70	ma 12/02/24 13:30	di 13/02/24 10:30	0,88	21,00	Own measurement	Elevated turbidity
71	ma 19/02/24 09:00	do 22/02/24 14:00	3,21		Maintenance	Other
72	za 24/02/24 12:30	ma 26/02/24 08:30	1,83	44,00	Own measurement	Elevated turbidity
73	ma 26/02/24 15:00	di 27/02/24 04:30	0,56	13,50	Own measurement	Elevated turbidity
74	vr 01/03/24 01:00	vr 01/03/24 08:00	0,29	7,00	Own measurement	Elevated turbidity
75	di 16/04/24 09:30	wo 17/04/24 07:00	0,90	21,50	Own measurement	Elevated turbidity
76	wo 17/04/24 16:30	wo 17/04/24 21:00	0,19	4,50	Own measurement	Elevated turbidity
77	vr 03/05/24 00:00	vr 03/05/24 07:00	0,29		Operational	Other
78	vr 03/05/24 14:00	ma 06/05/24 13:30	2,98		Operational	Other
79	vr 10/05/24 15:00	di 14/05/24 13:30	3,94		Defect	Other
80	do 06/06/24 15:00	vr 07/06/24 22:00	1,29		Defect	Other
81	vr 14/06/24 14:00	vr 14/06/24 19:00	0,21		Defect	Other
82	za 15/06/24 01:00	za 15/06/24 07:00	0,25		Defect	Other
83	di 18/06/24 18:00	wo 19/06/24 07:00	0,54		Defect	Other
84	wo 19/06/24 18:00	do 20/06/24 09:00	0,63		Defect	Other
85	wo 10/07/24 07:00	do 11/07/24 12:30	1,23		Maintenance	Other

Continuation Point of intake: Evides Waterbedrijf, Haringvliet (Haringvliet)

Nr.	Start	End	Duration [d]	Duration [h]	Type	Cause
86	za 27/07/24 09:00	za 27/07/24 16:30	0,31		Defect	Other
87	di 15/10/24 02:00	di 15/10/24 08:00	0,25		Defect	Other
88	ma 28/10/24 09:00	ma 04/11/24 11:00	7,08		Maintenance	Other
89	ma 04/11/24 16:00	di 05/11/24 12:00	0,83		Defect	Other
90	vr 08/11/24 01:00	vr 08/11/24 08:30	0,31		Defect	Other
91	di 19/11/24 23:00	za 14/12/24 23:00	25,00		Defect	Other
92	wo 18/12/24 07:00	wo 18/12/24 18:00	0,46		Maintenance	Other
93	wo 18/12/24 21:30	do 19/12/24 14:30	0,71		Defect	Other
94	za 28/12/24 02:30	zo 29/12/24 14:30	1,50	36,00	Own measurement	Elevated turbidity
			64,04	**348,50**	**Total**	

Annex 3

Target values in the European River Memorandum (ERM)

(maximum values, unless stated otherwise)

	Unit	Target value
General parameters		
Oxygen content	mg/L	>8
Electrical conductivity	mS/m	70
Acidity	pH	7–9
Temperature	°C	25
Chloride	mg/L	100
Sulphate	mg/L	100
Nitrate	mg/L	25
Fluoride	mg/L	1.0
Ammonium	mg/L	0.3
Organic group parameters		
Total Organic Carbon (TOC) ***	mg/L	4
Dissolved Organic Carbon (DOC) ***	mg/L	3
Adsorbable organic halogen compounds (AOX)	µg/L	25
Adsorbable organic sulphur compounds	µg/L	80
Anthropogenic substances foreign to nature with effects on biological systems		
Pesticides and their breakdown products, by substance	µg/L	0.1*
Endocrine active substances, by substance	µg/L	0.1*
Pharmaceuticals (incl. antibiotics), by substance	µg/L	0.1*
Biocides by substance	µg/L	0.1*
Other organic halogen compounds, by substance	µg/L	0.1*
Evaluated substances without biological effect		
Microbiologically difficult to degrade substances, by substance	µg/L	1.0
Non-evaluated substances		
(substances that possibly penetrate** into the drinking water, or substances that form uncharacterised breakdown and transformation products) by substance	µg/L	0.1
Health and hygiene/microbiological quality		
The health and hygiene/microbiological quality of the surface water must be improved to such an extent that excellent swimming water quality as stipulated in EU Directive 2006/7/EC is permanently guaranteed.		

** unless, as a result of advancing toxicological insight, a lower value must be kept to here, for example for genotoxic substances.*
*** substances that are not or are not satisfactorily removed with natural methods for the purification of drinking water.*
**** unless, owing to the geogenic relationships, higher values must be kept to here.*

From 2021, testing is done for the following substances against the ERM target value of 1 µg/L, where previously testing was still done against 0.1 µg/L:

Substance name	CASRN	ERM-tv		IDWR	
1,3,5-trimethylbenzene	108-67-8	1	µg/L	70	µg/L
10,11-dihydro-10,11-dihydroxycarbamazepine	58955-93-4	1	µg/L	50	µg/L
2,5-furandicarboxylic acid	3238-40-2	1	µg/L	1,1	µg/L
2-methoxypropanol	1589-47-5	1	µg/L	10.5	µg/L
2-methyl-2-propanol	75-65-0	1	µg/L	1.5	mg/L
4-methyl-1H-benzotriazole	29878-31-7	1	µg/L	350	µg/L
acesulfame K	55589-62-3	1	µg/L	3,2	µg/L
diatrizoic acid (amidotrizoic acid)	117-96-4	1	µg/L	250	mg/L
1,2,3-benzotriazole	95-14-7	1	µg/L	700	µg/L
butanone	78-93-3	1	µg/L	1.3	mg/L
butoxypolypropylene glycol	9003-13-8	1	µg/L	1,4	µg/L
caffeine	58-08-2	1	µg/L	1,5	µg/L
carbamazepine	298-46-4	1	µg/L	50	µg/L
cis-4,4-diaminostilbene-2,2-disulfonate disodium salt	7336-20-1	1	µg/L	7	mg/L
cis-4,4-diaminostilbene-2,2-disulfonic acid	81-11-8	1	µg/L	7	mg/L
cyclamate	100-88-9	1	µg/L	2,5	µg/L
diethylenetriaminepentaacetic acid	67-43-6	1	µg/L	700	µg/L
diisopropyl ether	108-20-3	1	µg/L	1,4	µg/L
ethylenediaminetetraacetic acid	60-00-4	1	µg/L	600	µg/L
ethylene glycol dimethyl ether	111-96-6	1	µg/L	440	µg/L
ethyl lactate	97-64-3	1	µg/L	500	µg/L
gabapentin	60142-96-3	1	µg/L	100	µg/L
guanylurea	141-83-3	1	µg/L	22.5	µg/L
hexamethylenetetramine	100-97-0	1	µg/L	500	µg/L
iohexol	66108-95-0	1	µg/L	375	mg/L
iomeprol	78649-41-9	1	µg/L	1	mg/L
iopamidol	60166-93-0	1	µg/L	415	mg/L
ioxitalamic acid	28179-44-4	1	µg/L	500	mg/L
metformin	657-24-9	1	µg/L	196	µg/L
methyl-tert-butyl ether	1634-04-04	1	µg/L	9,42	µg/L
naphthalene-1,3,5-trisulfonic acid	6654-64-4	1	µg/L	0.7	mg/L
naphthalene-1,3,6-trisulfonate trisodium salt	5182-30-9	1	µg/L	0.7	mg/L
naphthalene-1,3,6-trisulfonic acid	86-66-8	1	µg/L	0.7	mg/L
naphthalene-1,3,6-trisulfonate sodium salt	19437-42-4	1	µg/L	0.7	mg/L
naphthalene-1,5-disulfonate disodium salt	1655-29-4	1	µg/L	0.7	mg/L
naphthalene-1,5-disulfonic acid	81-04-9	1	µg/L	0.7	mg/L
naphthalene-1,7-disulfonic acid	5724-16-3	1	µg/L	0.7	mg/L
naphthalene-2,7-disulfonic acid	92-41-1	1	µg/L	0.7	mg/L
nitriloacetic acid	139-13-9	1	µg/L	400	µg/L

Continuation

Substance name	CASRN	ERM-tv		IDWR	
polysorbate 60	9005-67-8	1	µg/L	175	mg/L
saccharine	81-07-2	1	µg/L	1,3	µg/L
Sotalol	3930-20-9	1	µg/L	80	µg/L
sucralose	56038-13-2	1	µg/L	5	µg/L
tolyltriazole	29385-43-1	1	µg/L	350	µg/L
tetraethylene glycol dimethyl ether	143-24-8	1	µg/L	440	µg/L
tributyl phosphate	126-73-8	1	µg/L	350	µg/L
trichloromethane	67-66-3	1	µg/L	25	µg/L
triethyl phosphate	78-40-0	1	µg/L	1,4	µg/L
triglyme	112-49-2	1	µg/L	440	µg/L

CASRN = CAS registry number, ERM-tv = target value in the European River Memorandum, IDRW = indicative drinking water target

In addition to/in deviation from the above, in this report, the following target values are kept to for Meuse water from which drinking water is prepared:

- All PFAS: 4.4 ng of PFOA equivalents/L (= indicative drinking water target)
- NDMA: 12 ng/L (based on the Netherlands Drinking Water Decree)
- Bromate: 1 µg/L (based on https://www.rivm.nl/publicaties/risicogrenzen-voor-bromaat-in-oppervlaktewater-afleiding-volgens-methodiek-van)
- Bromide: 70 µg/L

The target values for bioassays in this report are the effect-based trigger (EBT) values for human health in Been et al., 2021:
ER-CALUX 17ß-estradiol (E2): 0.25 ng E2-eq/L (0.083)
Anti-AR CALUX Flutamide (Flut): 4800 ng Flut-eq/L (270)
AR-CALUX Dihydrotestosterone (DHT): 4.5 ng DHT-eq/L (0.51)
PR-CALUX Progesterone (P4): 15.5 ng P4-eq/L (0.22)
GR-CALUX Dexamethasone (DEX): 47.9 ng DEX-eq/L (1.7)
PAH-CALUX Benzo[a]pyrene (BaP): 24.4 ng BaP-eq/L (19)

Annex 4

List of abbreviations used

AMPA	aminomethylphosphonic acid
BPA	bisphenol-A
C3S	Copernicus Climate Change Service
CALUX	Chemical Activated LUciferase gene eXpression
CAS(RN)	Chemical Abstracts Service (Registry Number)
CTGB	Board for the Authorisation of Plant Protection Products and Biocides
DEHP	Di-2-EthylHexyl Phthalate (bis(2-ethylhexyl)phthalate)
DIPE	di-isopropyl ether
DOC	Dissolved Organic Carbon
EDC	Endocrine-Disrupting Chemicals
ERM	European River Memorandum
ESOTC	European State of the Climate
IAZI	integrated waste-water treatment plant
IDRW	indicative drinking water guide value
IPCC	Intergovernmental Panel on Climate Change
KMI	Royal Meteorological Institute of Belgium
KNMI	the Royal Netherlands Meteorological Institute
WFD	Water Framework Directive
PEQ	PFOA equivalents
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PMT	Persistent, Mobile, Toxic
pZZS	potential substance of concern
RIVM	National Institute of Public Health and the Environment
RIWA	Association of River Water Companies
RPF	Relative Potency Factor
RWZI	wastewater treatment plant
SPW	Service Public de Wallonie

Continuation List of Used Abbreviations

SVHC	Substance of Very High Concern
TBP	tributyl phosphate
TFA	trifluoroacetic acid (trifluoroacetate)
TOC	Total Organic Carbon
VMM	Flemish Environment Agency
vPvM	very Persistent, very Mobile
WMO	World Meteorological Organization
WUR	Wageningen University & Research
ZeroPM	Zero Pollution of Persistent, Mobile Substances, an EU project (https://zeropm.eu/)
SVHC	Substance of Very High Concern

Imprint

Texts and final editing	Thessa Lageman (Tekstbureau Onder Woorden) André Bannink (RIWA-Meuse) Maarten van der Ploeg (RIWA-Meuse) Thijs Blom (RIWA-Meuse) Jasper Ford (Evides Water Company) Arco Wagenvoort (Aqwa)
External contributions	Members of the Expertgroep Waterkwaliteit Maas (Meuse Water Quality Expert Group) RIWA-Meuse Management
Infographics	Ilva Besselink (Studio Ilva)
Publisher	RIWA-Meuse (Association of River Water Companies)
Designer	Make My Day, Wormer
Photography	© Eelkje Colmjon (eelk.nl fotografie) © Maarten de Penning © Shutterstock, Shutterstock.com *Markus Mainka, Foto Para Ti, Werner Lerooy, 8055juma, Melnikov Dmitriy, Estelle R, Art Tim, Sabrina Tollenaers, PeopleImages.com - Yuri A, Watcher Fox, Natalia Paklina, Rudmer Zwerver, DigitalWork.be*
ISBN/EAN	9789083357454
Publication date	02 September 2025