

NIAGARA : A New Wave for Safe Drinking Water

MAIN OUTCOMES

OUTCOME 1

Multi-analyte biosensors with real time monitoring for BPA, *Helicobacter pylori*, imazalil, and ibuprofen/paracetamol.

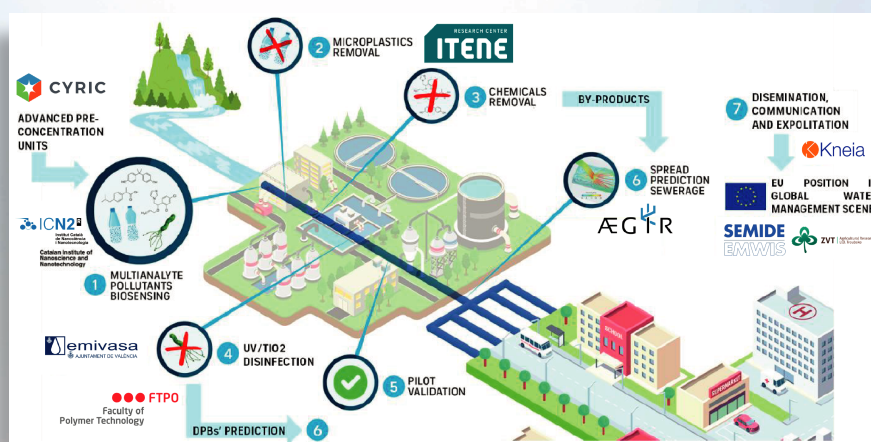
OUTCOME 2

Disinfection system formed by two immobilised enzymes degradation systems biofilters and a UV/TiO₂ photoreactor. Total removal of the 4 analytes and Organic Carbon removal of >70%, exceeding current state of the art. Removal of micro-nanoplastics.

OUTCOME 3

A fast and cost-effective hydraulic model based on Smooth Particle Hydrodynamics (SPH) for real-time monitoring of the propagation of these 4 contaminants (second vs weeks, 60% accuracy).

Access to clean drinking water is essential for safeguarding public health, supporting sustainable development, and ensuring the well-being of communities. The preservation of drinking water quality and availability is a priority that requires a shared responsibility from everyone. However, Europe's drinking water sources — surface water and groundwater — are currently exposed to hazardous substances that are degrading human health and environment. Several substances of concern – such as endocrine disruptors, microplastics, carcinogens and substances with targeted toxicity for humans – are currently detected in Member States' drinking water sources, in some cases at high levels. The presence of such pollutants in drinking water is a result of residue emissions from diverse activities that occur prior to water extraction, or that diffuse into the environment and end up in drinking water sources. Once polluted, aquifers can take decades to recover.



What is NIAGARA ?

NIAGARA is a ground-breaking initiative aligned with HORIZON-CL6-2022-ZEROPOLLUTION-01 that addresses the monitoring of chemical and biological pollution in drinking water at the Drinking Water Treatment Plants (DWTPs) level, new technologies for their removal, their associated potential toxicological effects, and the prediction of their spread and human exposure. Moreover, it also develops a detailed characterisation of these solutions and investigations of the overall toxicity, risks and sustainability associated with their future scaling. This way, NIAGARA is an answer to the challenges that DWTPs are facing in the fight against drinking water pollution.

NIAGARA joins the list of initiatives aimed at guaranteeing the safety and quality of the drinking water supply representing an advance in technological terms and a solid commitment to the health and well-being of the population.

DRINKING WATER POLLUTION: CHALLENGES THAT LIE AHEAD FOR THE EU

With the European Green Deal, the EU has set ambitious environmental goals to achieve a zero-pollution environment by 2030, including in all water sources [1]. Since its revision in 2020, the Drinking Water Directive (DWD) also reinforced protection standards for drinking water. However, these goals have not yet been met. A 2024 ECHA report revealed that no clear improvement in the overall chemical status in ground waters has been noticed since 2015, while a slight decrease even occurred in surface waters [2]. This results in the persistence of certain pollutants in drinking water sources in Europe, such as Imazalil, BPA, micro-nanoplastics, *Helicobacter pylori*, Ibuprofen and Paracetamol – 6 pollutants NIAGARA aims to tackle and monitor. Their main pathways into drinking water are emissions from industrial, agricultural, textile and cosmetics sectors [3]. Wastewater can also be saturated with pollutants which, once released into the environment, diffuse into and reach drinking water sources. Many data issued from MS reports, EU agencies and regulatory instruments from EU policies endorse the hazardous properties of the six pollutants. However, current regulations regarding their presence in drinking water specifically remain incomplete and insufficient in EU legislation. Ultimately, securing access to clean drinking water for all and achieving environmental targets by 2030 is not yet guaranteed and requires further action from the EU.

Micro-nanoplastics

- Small polymer particles
- Accumulate in the environment and in the human body
- Can penetrate the brain, liver, kidneys, lungs, placenta
- Data on health impact are still uncertain

Ibuprofen and Paracetamol

- Pharmaceuticals used worldwide
- Ibuprofen is resistant to biodegradation
- Paracetamol is highly toxic to the liver above a certain threshold
- Highly present in wastewater

Bisphenol A

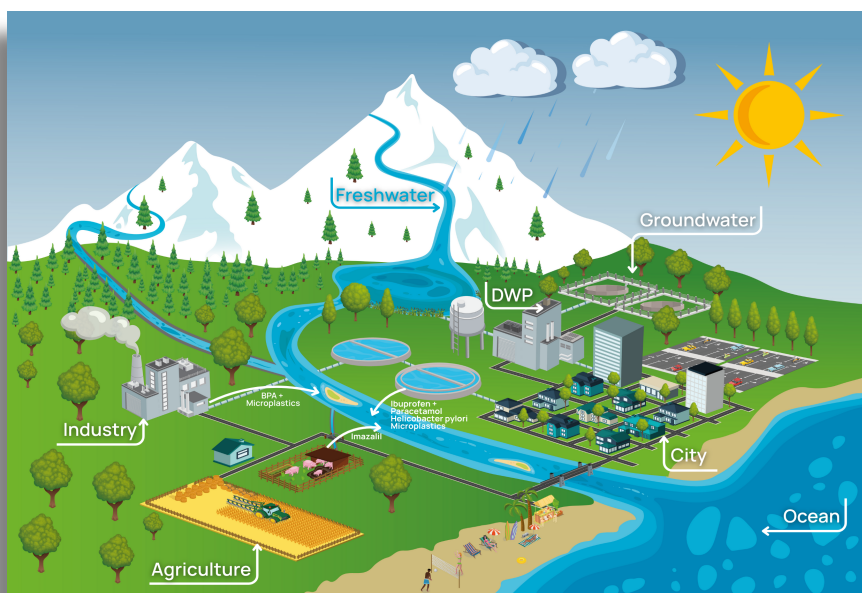
- Chemical substance used in industry
- Endocrine disruptor and toxic to reproduction
- Negatively affects the immune system
- Very toxic to aquatic life

Imazalil

- Chemical substance used as fungicide
- Potential endocrine disruptor
- Suspected to be carcinogenic
- Very toxic for aquatic life

Helicobacter pylori

- Bacterium
- Carcinogen
- Persistent in the human body if not treated properly
- Is increasingly resistant to antibiotics



Pathways of
pollutants into
drinking water.

Complete regulatory governance

- **Coordinate the various legislative instruments that constitute the regulatory framework for monitoring pollutants in drinking water at EU level:**

The EU legal framework on water bodies protection and monitoring is rather complex, and lead to overlapping obligations that can mitigate the effectiveness of regulatory instruments. Facilitating, coordinating and merging some provisions from the various instruments relevant to drinking water monitoring – from the DWD, WFD, EQSD and the GWD – could enable better implementation. For instance, combining all watch lists into a single regulatory instrument could lead to a more comprehensive European legal framework.

- **Expand the scope of the DWD to include NIAGARA targeted pollutants:**

While the respective hazardous properties of the NIAGARA-targeted substances are well established in several reports from MS and EU specialised agencies, and in many EU regulatory instruments, some of them are still not explicitly addressed by the DWD. Their integration into the DWD would result in a harmonised and adequate monitoring throughout the EU territory, and would also ensure a more preventive approach to public health protection.

Enhanced monitoring

- **Maintain and strengthen the use of watch lists:**

According to a 2025 European Commission's report, maintaining the inclusion of pollutants in watch lists enables MS to obtain further data on their occurrence in their water bodies [4]. In this regard, it seems necessary to enforce the Groundwater voluntary watch list. Maintaining watch lists facilitates the assessment of which of the pollutants are of most concern in their territory, and which of the products developed by NIAGARA could be suitable depending on their context.

- **Adapt the revision procedures for the annexes and watch lists of the WFD, the EQSD, the GWD and the DWD:**

The 2022/0344 proposal for Directive considers revising the frequency of watch list revision of the GWD and EQSD from 24 to 36 months [5]. Additionally, the proposal to change from an ordinary legislative procedure to implementing acts to update the various pollutant watch lists was rejected by the European Parliament. These evolutions could mitigate their effectiveness if no provisions allowing for a rapid update and adoption are considered. Including a reaction clause allowing the Commission to adopt an emergency amendment in the event of alarming scientific observations could address these issues.

Cost-effective innovative solutions

- **Strengthen the integration of best available techniques (BAT) into drinking water quality management policies:**

NIAGARA's products offer concrete tools to implement the EU's preventive, risk-based approach to drinking water safety. They support real-time monitoring and early detection of pollutants, helping utilities comply with the DWD standards; and therefore align with several BAT conclusions under the Industrial Emissions Directive. Authorities are encouraged to integrate them into Water Safety Plans and test them in EU-funded projects to upgrade water infrastructure to BAT standards and improve pollution control.

- **Prioritise the 'polluter pays' principle:**

The adoption, exploitation and maintenance of innovative technologies such as NIAGARA's products can be onerous for MS. However, given the increasing number of concerning pollutants in drinking water, effective and high-performing technologies should not be disregarded for economic considerations. Producers of hazardous pollutants should be held accountable for their impact on human health and the environment. Therefore, ensuring that the 'polluter pays' principle applies to drinking water monitoring requirements could allow MS to reduce the costs related to their monitoring obligations and adopt effective technologies and would significantly contribute to the EU's pollution reduction goals

Cooperative approach

- **Map the occurrence of pollutants targeted by NIAGARA at the European level:**

The pollutants targeted by NIAGARA are currently of EU's concerns, but their presence in drinking water is uneven and not uniform across the territory. The concerns associated with each pollutant targeted by NIAGARA therefore vary between MS or regions. It is recommended to use the monitoring results from MS to develop an EU map indicating the concentration of each emerging pollutant targeted by NIAGARA in drinking water. This would help MS and the EU determine which of the pollutants are of concern at the national level, so that they can adopt the appropriate products developed by NIAGARA only when necessary.

- **Strengthen cooperation on the collection of pollutants data:**

Drinking water is vulnerable to pollution dispersion, industrial emissions, and contamination from external factors, particularly when a drinking water source is shared between MS. Since the activities of MS can directly impact the quality of drinking water in other territories, it is necessary that each MS complies with its monitoring obligations and share its results at the EU level. In this regard, an active collaboration between MS, complemented by collaboration between specialised EU agencies – ECHA, EEA, EMA, JRC and EFSA – should be maintained and strengthened.

Further reading

References:

[1] European Commission: Directorate-General for Environment, COM (2020) 667 final, Brussels, 14 October 2020.

[2] EEA, 'Europe's State of Water 2024: The Need for Improved Water Resilience', Publications Office of the European Union, 15 October 2024.

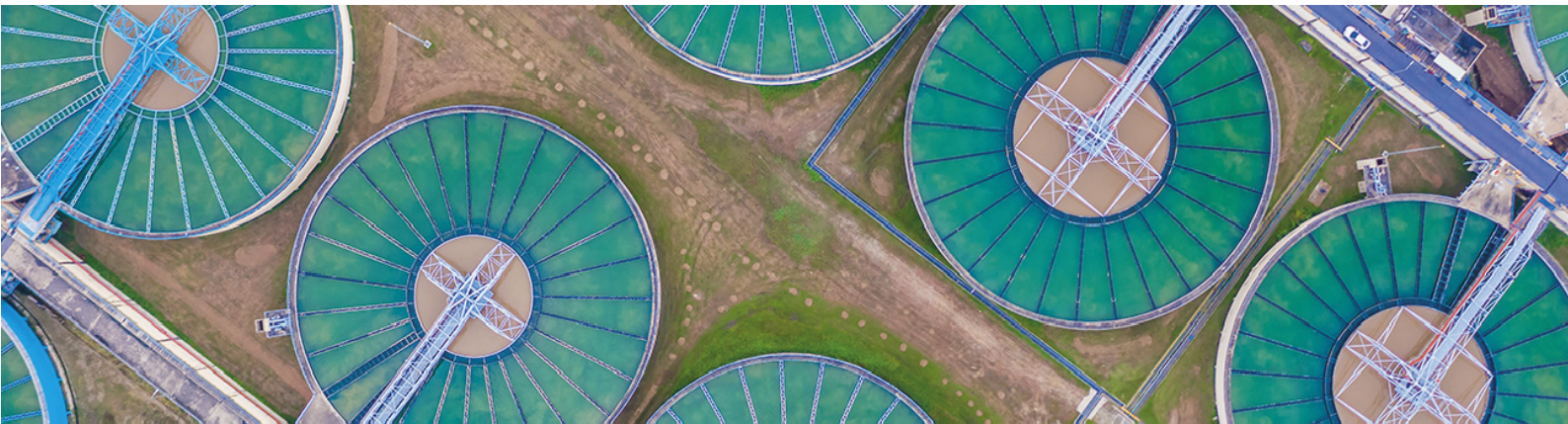
[3] Ayscough, N.J. et al., 'Review of Human Pharmaceuticals in the Environment', R&D Technical Report P390, Environment Agency, Bristol, 2000.

[4] European Commission, COM(2025) 2 final, Brussels, 4 February 2025.

[5] European Parliament, P9_TA(2024)0358 (COM(2022)0540 – C9 0361/2022 – 2022/0344 (COD)), 24 April 2024.

Main Stakeholders

Private Water utilities, Public Water utilities, Mineral water providers (private), Suppliers of raw materials, Engineering and Consulting, Technology and Software providers, Integrators, Research institutes and centres, Universities, Water quality control laboratory, Ministry in charge of water resource, Ministry in charge of potable water, Authorities of Health, Hydrographic Basin agencies, Municipalities, Citizen associations and communities, Media, Food industry, Industry, Investment and financing bodies, Water consumers associations and Environmental NGO.



Further reading:

[Drinking Water Directive](#)
[Water Framework Directive](#)
[Environmental Quality Standards Directive](#)
[Groundwater Directive](#)
[European water resilience strategy](#)

List of acronyms:

MS: Member states
DWD: Drinking Water Directive
BAT: Best Available Technologies
BPA : Bisphenol A
DWTP: Drinking water treatment plant

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