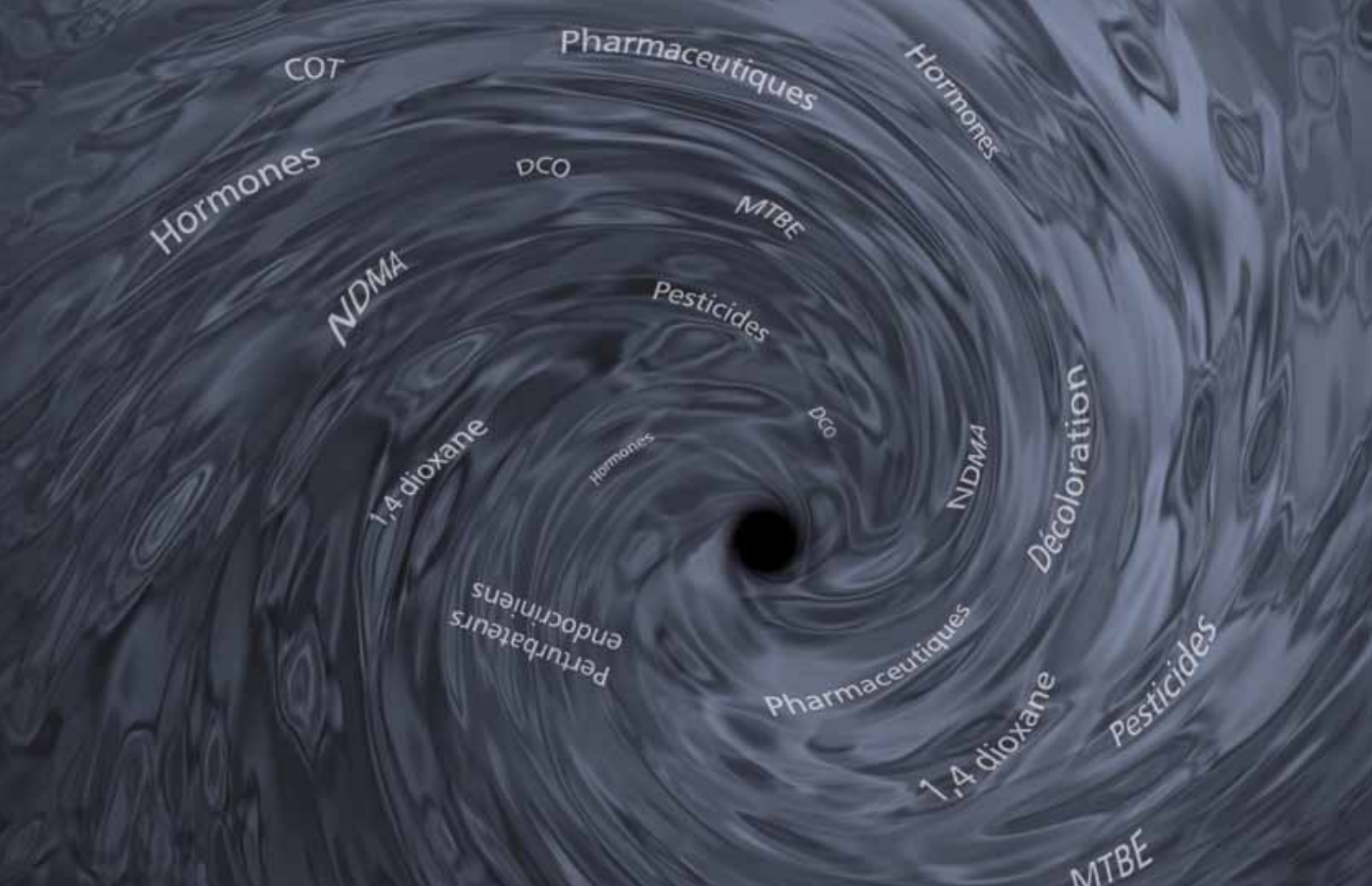




WEDECO MiPRO™

INCLUSIVE WEDECO'S NEW AOP SOLUTION PROMIX

WEDECO
a xylem brand

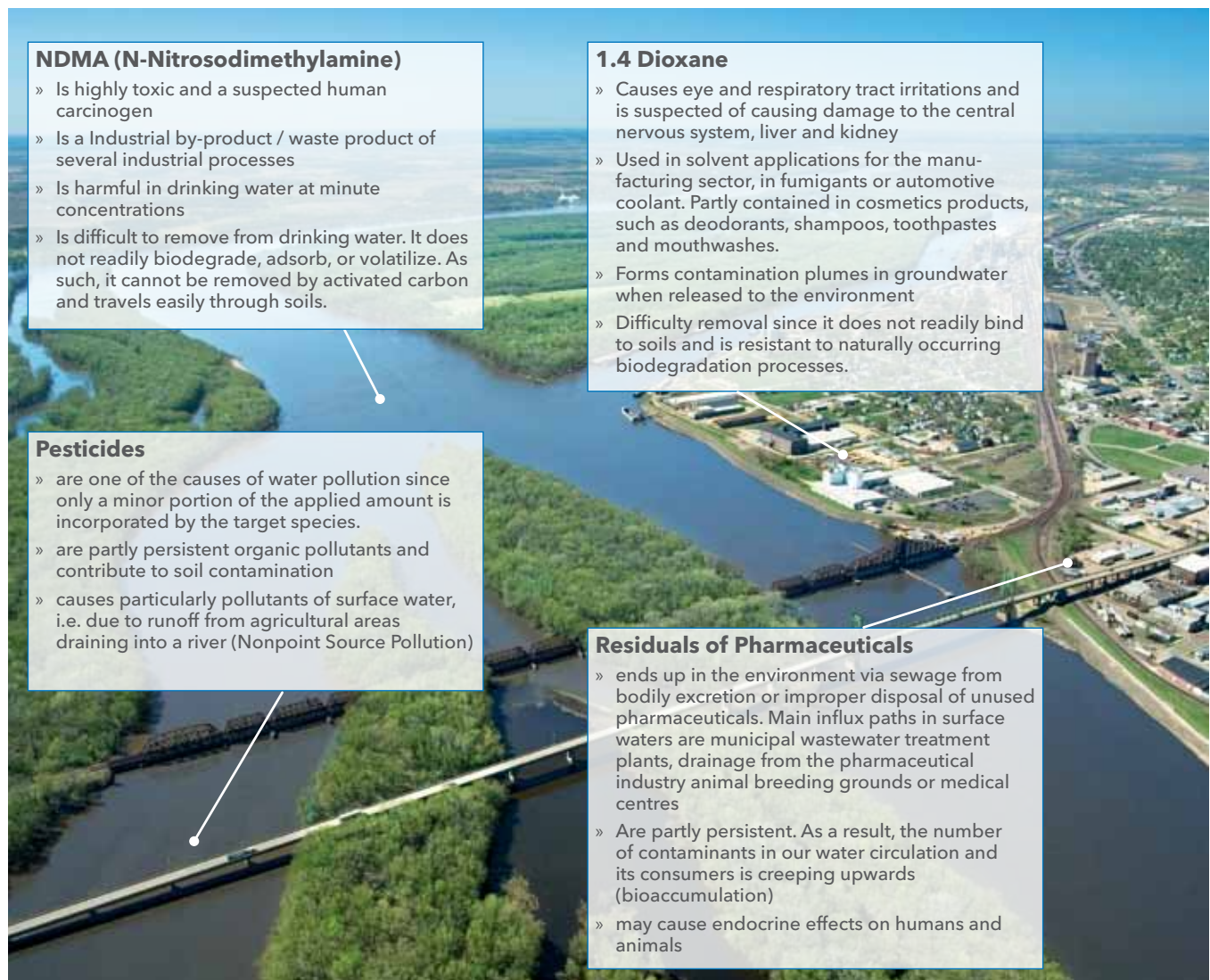
Why Advanced Oxidation Process?

Water utilities are reporting a world-wide rising trend as far as problematic micropollutants in water resources are concerned. Traces of organic / anorganic pollutants like NDMA, MTBE, 1.4 Dioxan, EDC, etc. are often found in ground and surface water.

The reasons for the increasing degree of contaminations are to be found in the process of industrialization, intensive agriculture as well as all-round medical provision for humans. Once these micro-pollutants enter the human food chain via

drinking water, there is a long term risk to health or even to human or animal genetic material. Traditional treatment methods are no longer sufficient to guarantee complete removal of these contaminants.

Due to climate and demographic changes, many water utilities are expecting further pollutions of the drinking water resources in the near future. As a consequence, there is a higher risk of water scarcity and thus there will be an increasing demand for direct or indirect reuse of wastewater for drinking water purposes.



NDMA (N-Nitrosodimethylamine)

- » Is highly toxic and a suspected human carcinogen
- » Is a Industrial by-product / waste product of several industrial processes
- » Is harmful in drinking water at minute concentrations
- » Is difficult to remove from drinking water. It does not readily biodegrade, adsorb, or volatilize. As such, it cannot be removed by activated carbon and travels easily through soils.

Pesticides

- » are one of the causes of water pollution since only a minor portion of the applied amount is incorporated by the target species.
- » are partly persistent organic pollutants and contribute to soil contamination
- » causes particularly pollutants of surface water, i.e. due to runoff from agricultural areas draining into a river (Nonpoint Source Pollution)

1.4 Dioxane

- » Causes eye and respiratory tract irritations and is suspected of causing damage to the central nervous system, liver and kidney
- » Used in solvent applications for the manufacturing sector, in fumigants or automotive coolant. Partly contained in cosmetics products, such as deodorants, shampoos, toothpastes and mouthwashes.
- » Forms contamination plumes in groundwater when released to the environment
- » Difficulty removal since it does not readily bind to soils and is resistant to naturally occurring biodegradation processes.

Residuals of Pharmaceuticals

- » ends up in the environment via sewage from bodily excretion or improper disposal of unused pharmaceuticals. Main influx paths in surface waters are municipal wastewater treatment plants, drainage from the pharmaceutical industry animal breeding grounds or medical centres
- » Are partly persistent. As a result, the number of contaminants in our water circulation and its consumers is creeping upwards (bioaccumulation)
- » may cause endocrine effects on humans and animals

Run your most efficient path of AOP

The Advanced Oxidation Process (AOP) is the ideal approach on this new kind of water contaminations. AOP is the combination of two or more processes to generate hydroxyl radicals (OH radicals) or to increase the number of them. The OH radicals contribute to the oxidation of undesirable substances. Compared to other oxidants, the OH radical has a considerably higher oxidation potential.

Once hydroxyl radicals have formed in water, they immediately react to virtually all existing oxidizable substances. The high degradation performance and the quick reaction kinetics of this process are the formula for success when it comes to eliminate numerous persistent contaminations.

In theory, there are 20 different methods to technically create hydroxyl radicals. In practice, two basic processes have become established:



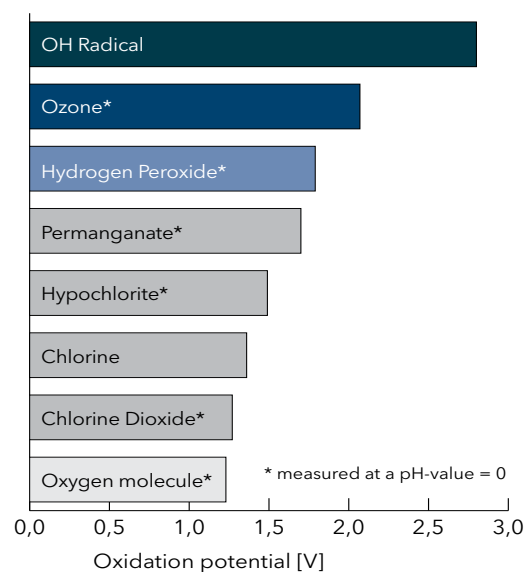
Ozone + Hydrogen Peroxide

In the presence of hydrogen peroxide (H_2O_2), ozone (O_3) reacts with the anion of the hydrogen peroxide (HO_2^-), and creates hydroxyl radicals in this way. This reaction is quicker and more effective than the reaction of ozone with water by itself.

UV Light + Hydrogen Peroxide

In this process, the electromagnetic irradiation (UV light) is absorbed by the hydrogen peroxide dissolved in the water. In theory, this process leads to the formation of two OH radicals, made from one H_2O_2 molecule.

Compared to other oxidants, OH radicals have a considerably higher oxidation potential



PROMIX – one of WEDECO's AOP solution systems

Promix is an intelligent ozone introduction and reaction system enabling ozone treatment in an elegant, slender and intelligent design even in cases of high level bromide in source water.

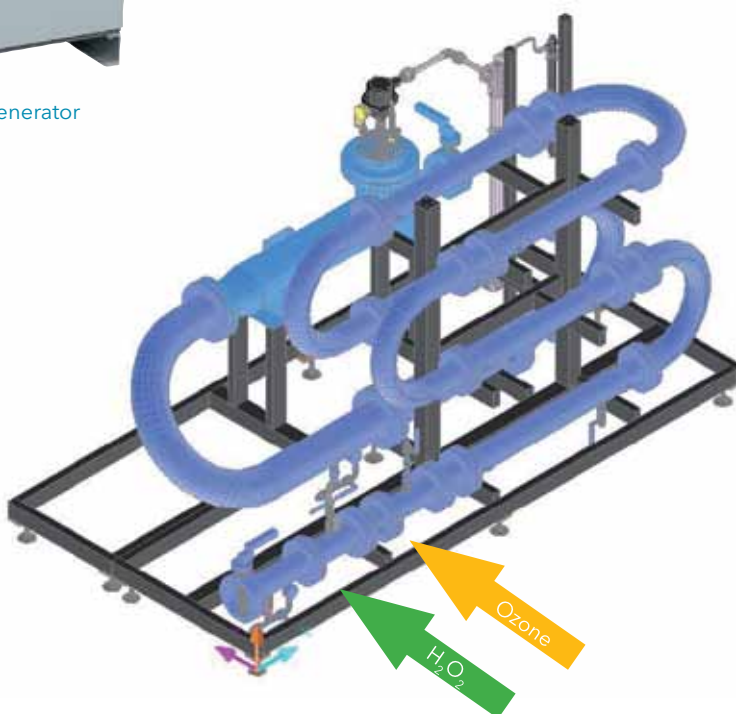
The Challenge: bromide

Some water utilities worldwide have to deal with high levels of bromide in their water sources. The ozone oxidation (e.g. AOP treatment) of affected drinking water sources with ozone can lead to Bromate formation in the product water. Bromate in drinking water is undesirable as it's a suspected human carcinogen.



Ozone generator

PROMIX₃



H₂O₂ dosing station

The Solution: PROMIX

Promix is an innovative new product that is allowing to use ozone in a novel way and solves this problem. The new introduction system keeps Bromate formation under control whilst treating unwanted contaminants.

In drinking water treatment, ozone oxidation is typically one of the most popular alternatives to chlorination as it does not usually produce THMs or other chlorinated

by-products. Water utilities worldwide might have to deal, regionally, with high levels of bromide in their water sources (i.e treatment of surface waters). However, water sources with elevated Bromide levels can lead to undesired Bromate formation in the product water. Bromate in drinking water is regulated by the WHO (less than 10 µg/l).



AOP solutions can also be simply implemented in retro-fit situations by upgrading existing ozone systems. There is no need for altering civil structures or existing treatment chains. Please contact our Xylem AOP expert team for a detailed solution.

Promix provides packaged treatment systems minimizing the overall footprint of the full oxidation solution. This AOP design can

make large contacting systems obsolete and is the perfect choice for small and mid sized waterworks.

Promix systems are available in various standardized treatment skids for flows from 30 to 420 m³/h. Larger flows utilize combinations of Promix skids or engineered to order solutions.

Your choice: the Best Available Technology

Ideally, contaminated water should always be treated using the most efficient of the various processes. This is why the implementation of an Advanced Oxidation Process in water or waste water works should always begin with the correct selection of the process to be used.

Xylem can help you to find the right solution before you make any kind of long-term commitment. You benefit from our many years of experience in AOP and its core components. WEDECO UV and ozone technologies provide fully developed treatment systems that have been setting standards in modern water treatment for more than three decades.

Application	Contaminants	Ozone	UV	MiPRO™ _{eco₃}	MiPRO™ _{photo}	MiPRO™ _{eco₃ plus}
Industrial Chemicals	1,4-Dioxane	0	0	++	+	++
	MTBE	0	0	++	0	++
	NDMA	0	+	+	++	++
Pesticides	Atrazine	+	0	++	+	++
	Bromacile	++	0	++	+	++
Pharmaceuticals	Diclofenac	++	+	++	++	++
	Carbamazepine	++	0	++	+	++
	Ibuprofene	+	0	++	+	++
	Amidotrizoic Acid	+	+	+	++	++
	Iohexol	+	+	++	++	++
	Hormones	++	0	++	+	++
Taste & Odor	Geosmin	++	0	++	+	++
	MIB	++	0	++	+	++
Decolorisation		++	0	++	0	++
TOC-Removal		0	0	+	0	+
Disinfection		+	++	+	++	++

++ = Removal of 81 - 100%

+ = Removal of 51 - 80 %

0 = Removal smaller 50%

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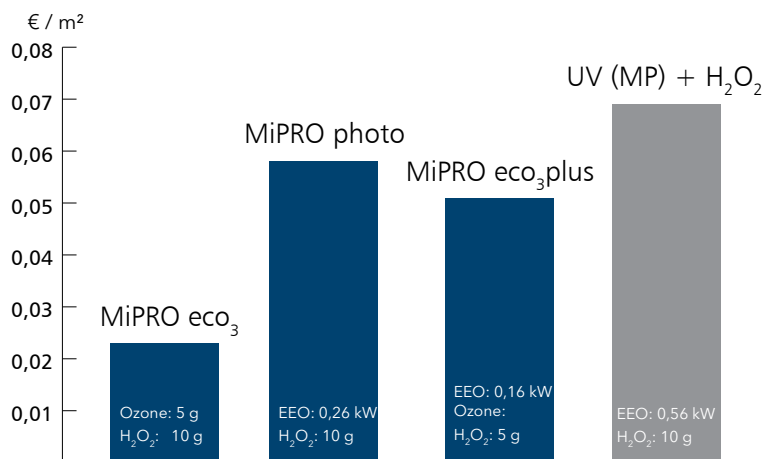
Frequently Asked Questions

"Isn't really medium pressure UV and Hydrogen Peroxide the best AOP process?"

The combination of medium pressure UV and Hydrogen Peroxide is well known as AOP process, but it is not the only one. Combinations of low pressure UV, Hydrogen Peroxide and/or Ozone do in many cases offer advantages regarding operating costs, power consumption, removal efficiency or footprint. Xylem under its WEDECO brand is able to offer competency based on both core technologies - UV and Ozone.

"Can Bromate be formed in the case of ozone application with AOP?"

Generally, the formation of Bromate is only possible if relevant quantities of Bromide are present in the water. Wedeco offers a new AOP system allowing ozone treatment in cases of high Bromide level in the source water. Promix is an intelligent and easy ozone introduction system enabling ozone treatment through an elegant, slim and intelligent design.



The diagram compares costs and consumption (energy, ozone, H₂O₂) per m³. The treatment goal of this case is the reduction of pesticides and pharmaceuticals at a water flow of 2.000 m³/h. The costs includes capital costs, footprint, oxygen, energy, H₂O₂ and maintenance.

In addition to our established expertise, we possess our own lab and research facilities for water treatment, which investigate the specific research requirements of our customers.

Our experts determine the right procedure for your situation on site at your facility using mobile AOP validation stations. This does not only apply to new treatment systems - it can also be used to optimize existing processes. The various procedures can be tested based on your specific parameters in just a short period of time. Practical experience, after all, provides results that are more tangible and more promising than theoretical approaches.



“How can a combination of O₃, H₂O₂ and UV be less expensive than H₂O₂ / UV?”

Different water contaminants are treated best with the most suitable technology, tailored for the specific contaminant removal. The MiPRO™ eco3 plus solution allows to design each single step to the optimum. This optimisation results in lower total treatment cost.

“Why does low pressure UV irradiation work especially well with AOP?”

In many cases, photosensitive substances like NDMA or Amidotrizoic Acid are directly degraded very efficiently with UV light (254 nm). By photolysis, the UV light causes the breaking up of the chemical compounds and thus the degradation of the pollutants. In addition, the activation of Hydrogen Peroxide leads to effective oxidation of micro-pollutants.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots
- 2) A leading global water technology company

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, longstanding relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to xyleminc.com.



WEDECO



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