

# **VuOxi PLASMA OXIDIZER™**

**Powerful Water Purification**





# Plasma Oxidation Basics

VuOxi Plasma Oxidizer™ is awesome plasma technology for industrial water purification. Plasma-generated oxidants effectively remove colour, odour and organic residues while disinfecting the water. VuOxi Plasma Oxidizer is the superb alternative to ozone, UV and chemical treatment.

## VuOxi Plasma Oxidizer Replaces Chemicals with Plasma

VuOxi Plasma Oxidizer is unique industrial water treatment technology as it uses non-thermal plasma in direct contact with water to destroy dissolved organic pollutants. It eliminates the need for transportation, storage and handling of risky disinfection chemicals, thereby mitigating costs and environmental risks. VuOxi Plasma Oxidizer is safer and environmentally friendlier solution.

## Plasma Oxidation Explained

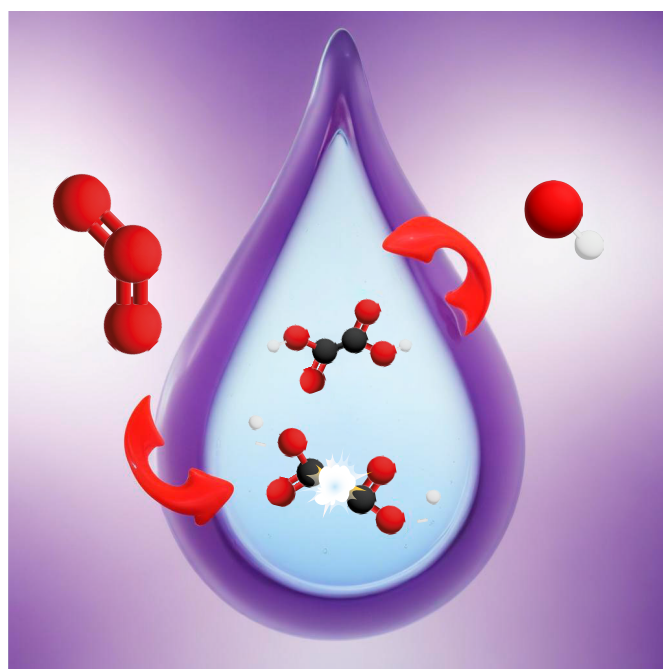
Non-thermal plasma oxidation is based on direct water contact with partially ionized atmospheric gas, i.e. plasma. The core principle is to accurately focus electric energy into gaseous electrons that initiate desirable reactions for the process. The presence of water and air under these conditions result in formation of highly reactive oxidants, hydroxyl radicals and ozone.

The radical oxidants are generated from the treated water itself by plasma electron bombardment, and ozone forms from ambient oxygen. The VPO reactor is a vertical wire-plate configuration where the water is introduced to a large plasma volume in form of droplets. This maximizes the plasma-water contact and provides ample source for radical oxidants and a large mass transfer interface for ozone.

The initial motivation to develop water treatment technology based on direct plasma contact basically stemmed from two things:

1. Creating fast-reacting oxidants *in situ* (right where the water is)
2. Providing more powerful oxidation than achievable with ozone alone

**“ VuOxi Plasma Oxidizer:  
the paradigm shift in  
oxidative water treatment ”**



Contaminants in the water are subjected to strong oxidation in plasma contact.

Conventional systems:	Your value from VuOxi Plasma Oxidizer:
Ozone systems	<ul style="list-style-type: none"><li>× Recirculation of excess ozone</li><li>× No compressors needed</li><li>× No air pretreatment</li><li>× Lower energy consumption</li><li>× More powerful oxidation for the money</li></ul>
UV systems	<ul style="list-style-type: none"><li>× Robust design ► low maintenance</li><li>× Insensitive towards turbidity</li><li>× No UV lamps</li></ul>
Chemical treatment	<ul style="list-style-type: none"><li>× No chemical logistics, storage and use</li><li>× No chlorinated byproducts</li><li>× Only electricity is used</li><li>× Reduced safety protocols</li></ul>

# Tested & Proven Process Water Microbial Control

## Challenge:

- × Biofilm forming, foul smell
- × Inability to reuse water
- × High freshwater consumption, high costs

## Solution:

VuOxi Plasma Oxidizer, 2-kW unit

## Results:

- × Plasma oxidation eliminates microbes, results in fresh and clear waters
- × Able to reuse water, sustainability
- × Saves the customer hundreds of m<sup>3</sup> water each day

A dairy products plant circulates a lot of process waters for cooling and washing purposes. The waters are collected from various sources and processes to a collection tank and periodically pumped forward to application according to need.

## Issue: Inability to Reuse Water

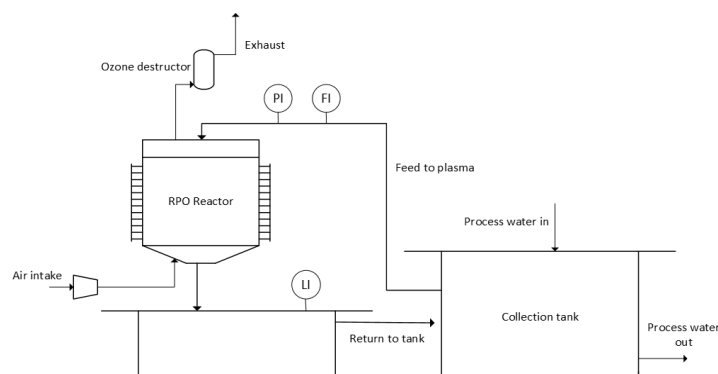
The site had problems with the quality of these waters due to microbiological activity. Bacterial growth created biofilms and foul smell, disabling reuse of the water. This resulted in need to draw freshwater from the municipal network beyond permitted daily rates, followed by substantial costs.

## Oxidation Treatment Saves Freshwater and Lowers Costs

VuOxi Plasma Oxidizer (VPO) offers a convenient solution for improving the water quality and maintaining it at reusable level. The VPO system was installed adjacent to the collection tank to circulate the tank water continuously through the plasma. Very swiftly, the water quality improved and is maintained at an acceptable level, clear and fresh. Being able to reuse the process waters saves the customer hundreds of m<sup>3</sup> water each day.

## DAIRY PLANT PROCESS WATERS

Plasma output power	2 kW
Circulation through plasma	30 m <sup>3</sup> /h (0,067 kWh/m <sup>3</sup> )
Total process flowrate	40 m <sup>3</sup> /h (0,05 kWh/m <sup>3</sup> )
Water temperature	30 °C
Unit special features	<ul style="list-style-type: none"> <li>× 20' shipping container</li> <li>× outdoor installation</li> <li>× high level automation</li> </ul>
Problem	<ul style="list-style-type: none"> <li>× microbial growth</li> <li>× smelly waters</li> <li>× poor visual quality</li> </ul>
Result	<ul style="list-style-type: none"> <li>× microbial control</li> <li>× fresh and clear waters</li> <li>× used up to 100-200 m<sup>3</sup>/day less water</li> </ul>





# Say Goodbye to Ethoxylated Phenols

## Challenge:

- × Tightening EU regulations
- × Water containing ethoxylated phenols is difficult to treat
- × High costs – not possible to discharge water into municipal network

## Solution:

VuOxi Plasma Oxidizer, 2-kW unit, the only non-incinerating approach

## Results:

- × Effective batch oxidation treatment removes phenols
- × Waters can be discharged to sewer
- × Lower handling costs

A manufacturing and services company in chemical analysis produces difficult wastewaters containing ethoxylated phenols. Tightening regulation in the EU has set limitations to discharging wastewaters containing ethoxylates into the municipal network.

## Issue: Costly Water Disposal

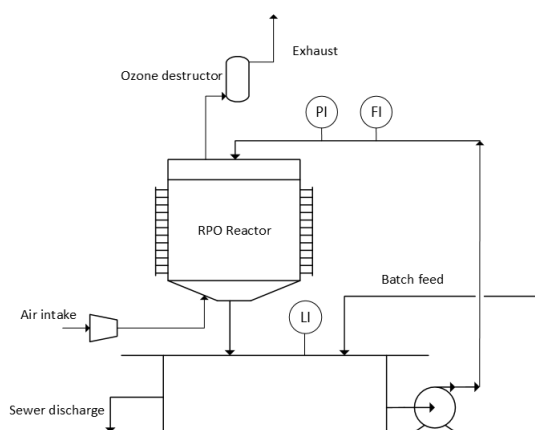
There are multiple point sources on site where they collect problematic wastewaters containing ethoxylates. Not being able to discharge to sewer, the company had to transport all these waters to hazardous waste treatment with high fees and logistic costs

## Cleaner Water Meets Limits for Sewer Discharge

VuOxi Plasma Oxidizer enables onsite treatment of the wastewaters to allow sewer discharge. These surface active, refractory substances are not the easiest ones to be removed or oxidized, which means intense treatment is required. VuOxi Plasma Oxidizer is used for batch treatment of the wastewaters onsite.

## CHEMICAL WASTEWATERS

Plasma output power	2 kW
Batch volumes	0,2...1,5 m <sup>3</sup>
Total volumes	4-10 m <sup>3</sup> /week
Water temperature	Ambient
Unit special features	<ul style="list-style-type: none"><li>× 20' shipping container</li><li>× outdoor installation</li><li>× batch mode</li></ul>
Challenge	<ul style="list-style-type: none"><li>× EU regulation requires best available treatment for ethoxylated phenols</li></ul>
Winning solution	<ul style="list-style-type: none"><li>× Plasma oxidation is the only, successfully demonstrated non-incinerating approach</li></ul>





# Eliminate Biocides from Greenhouse Waters

## Challenge:

Persistent organic pollutants are difficult to remove from greenhouse waters

## Solution:

VuOxi Plasma Oxidizer, 2-kW unit

## Results:

- × Chemical-free treatment with non-thermal plasma
- × Plasma oxidation studied for degradation of more than 70 organic contaminants

Pesticides, fungicides, insecticides and other biocides are biologically active. Although they are important chemicals for securing food production, they can cause many problems when released and accumulated in the environment. One of their environmental effects is for example toxicity for bees and other important pollinators. These persistent organic pollutants (POPs) eventually also end up in freshwater supplies and drinking water.

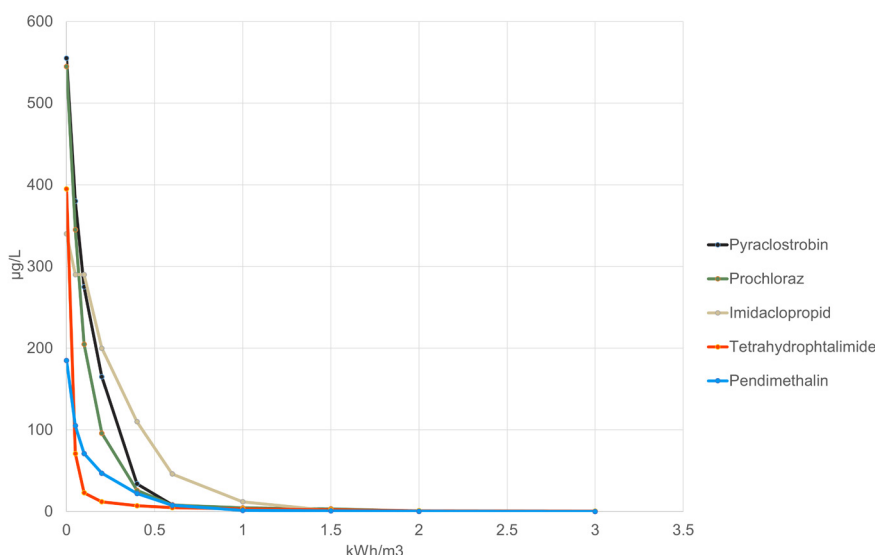
## Effective Plasma Oxidation Technology

Many technological approaches have been applied to address the challenge. Advanced oxidation processes

(AOPs) have been identified as one particularly effective due to reliance on hydroxyl radicals – the most powerful oxidant feasible for water treatment. Non-thermal plasma in direct contact with water produces abundant radical oxidants for efficient destruction of POPs.

## Plasma Eliminates 70+ Organic Pollutants

VuOxi Plasma Oxidizer has been tested and trialed for successful destruction of dozens of POPs, biocides as one important group. We have tested more than 70 chemical compounds for their degradability in the process, including pharmaceuticals, phenolics, surfactants and fuel additives.







## Get Effective Microbial Control for Ice Water

### Challenge:

- × Ice water disinfection
- × Maintaining constant high quality of water

### Solution:

VuOxi Plasma Oxidizer, 3 kW unit

### Results:

- × Plasma disinfects water with a lasting effect
- × Very cold water ideal for maximum efficiency
- × Replacing chemicals with plasma reduces work and improves safety

In the dairy industry, ice water is used for cooling milk before processing. The water is usually chilled to a temperature of 0-1 °C. The quality of the water must be high with no observable contaminants or smells, and no microbial growth. Periodic changes in ice water quality and occasional blooms in microbial growth can be a major challenge for a dairy products plant.

### Low Energy Input, Maximum Results

Plasma oxidation relies on reactive oxygen species. In colder temperatures the rates of non-desirable oxidant decay reactions are slower. Consequently, the plasma technology is even more efficient in those conditions. This means that ice water quality control is an ideal application for plasma oxidation – very low specific energy input can achieve and maintain the desired quality.

### Water Disinfection with a Lasting Effect

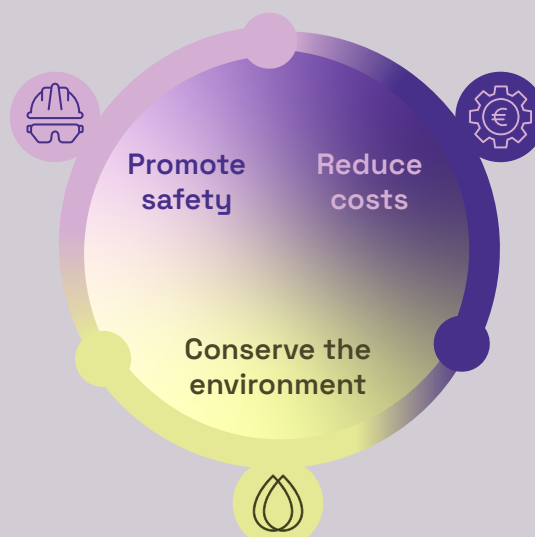
VuOxi Plasma Oxidizer can be used to keep waters free of microbial activity and rid of attributable quality problems. A low-power system can be enough to generate enough oxidants even for large volumes of water, directly from ambient air and the treated water itself, with no need for chemical input.

### DAIRY PLANT ICE WATERS

Plasma output power	3 kW per module
Maximum throughput capacity	up to 65 m³/h per module
Water temperature	0...1 °C
Disinfection target	3-7 log (typical)

### Non-thermal plasma benefits:

- × Robust technology, no moving parts
- × No mercury (or any) lamps to replace
- × Insensitivity towards turbidity
- × OH-radicals as primary oxidant
- × Ozone as secondary oxidant
- × No compressors or oxygen vessels required
- × Low temperature = maximized efficiency
- × No chemical storage and use



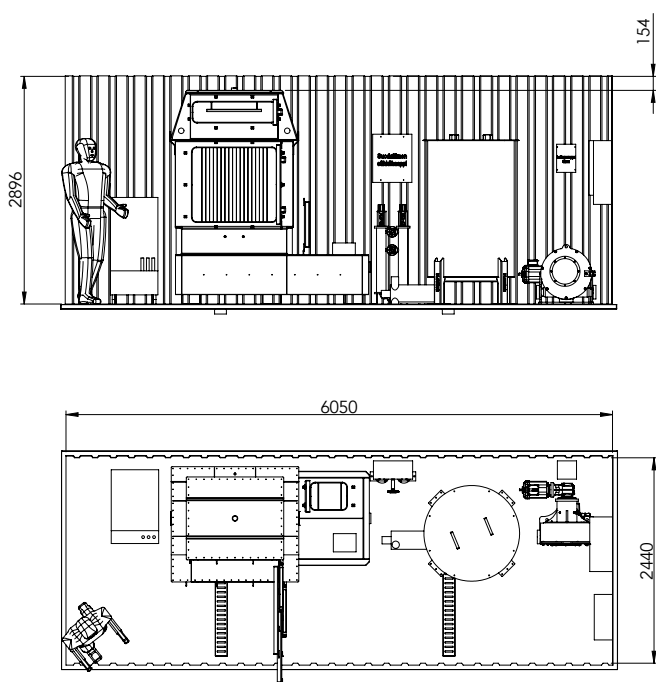


# VuOxi Plasma Oxidizer™, Full-Scale Demonstration Unit 3,5 kW

**VuOxi Plasma Oxidizer Test Unit is a full-scale 3,5 kW unit for on-site pilot testing.**

It can be used for both batch testing and continuous flow-through operation. The unit is built in a standard 20' HC OS shipping container for fast and easy installation. The container is equipped with insulation, heating and air conditioning for year-round piloting. The setup is equipped with a HMI interface for on-site operation as well as full remote monitoring and control possibilities.

## External dimensions (mm)



Configuration may vary according to specific requirements.

## Technical Data

Container	20' HC OS (High-cube open-side)
Net weight	Approx. 6000 kg
Gross weight	Approx. 7000 kg
Water tank volume l	850 l
Volumetric capacity	1–65 m <sup>3</sup> /h
Input power	~6,5 kW
Nominal plasma power	3,5 kW
Voltage / frequency	400 V / 50 Hz 3 phase 32 A, Power plug
Water continuous inlet	DN50
Water outlet	DN100
Water overflow	DN100
Water batch inlet	3/4"
Water tank drain	1"
Min. & max. ambient temp.	-30 °C to 35 °C
Min. & max. water temp.	1 °C to 35 °C
Inputs	24 V DC for remote operation
Outputs	24 V DC, 230 VAC relays indicating system operation & alarms
Materials in contact with water	AISI 316, porcelain, silicone, PTFE
Measurements	Water tank level
	Flow
	Reactor inlet pressure
	Container flooding
(Accessories) * depending on case requirements	Oxygen concentrator
	Air pump
	Circulation pump
	Duplex basket strainer

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## About us

At VuOxi, our team is the driving force behind our mission to secure and purify vital water resources for industries worldwide. Combining decades of specialized research, technical expertise, and a shared commitment to sustainability, we are dedicated to delivering innovative solutions that redefine water purification.

Guided by our philosophy, “almost pure is not pure,” our team works tirelessly to develop cutting-edge technologies that address today’s challenges while safeguarding resources for future generations.