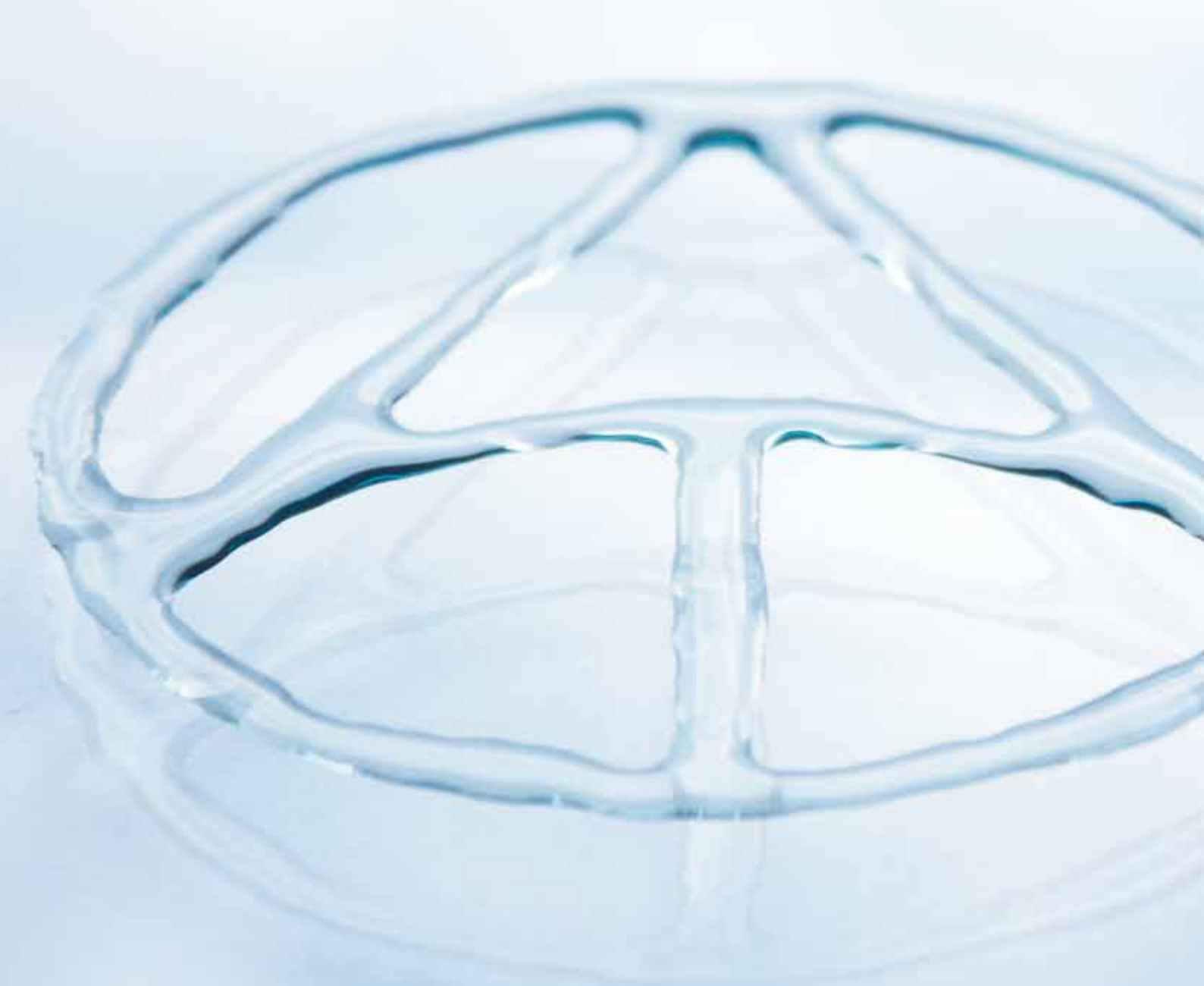
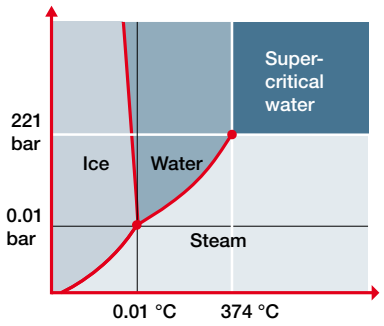


Aquarden
TECHNOLOGIES

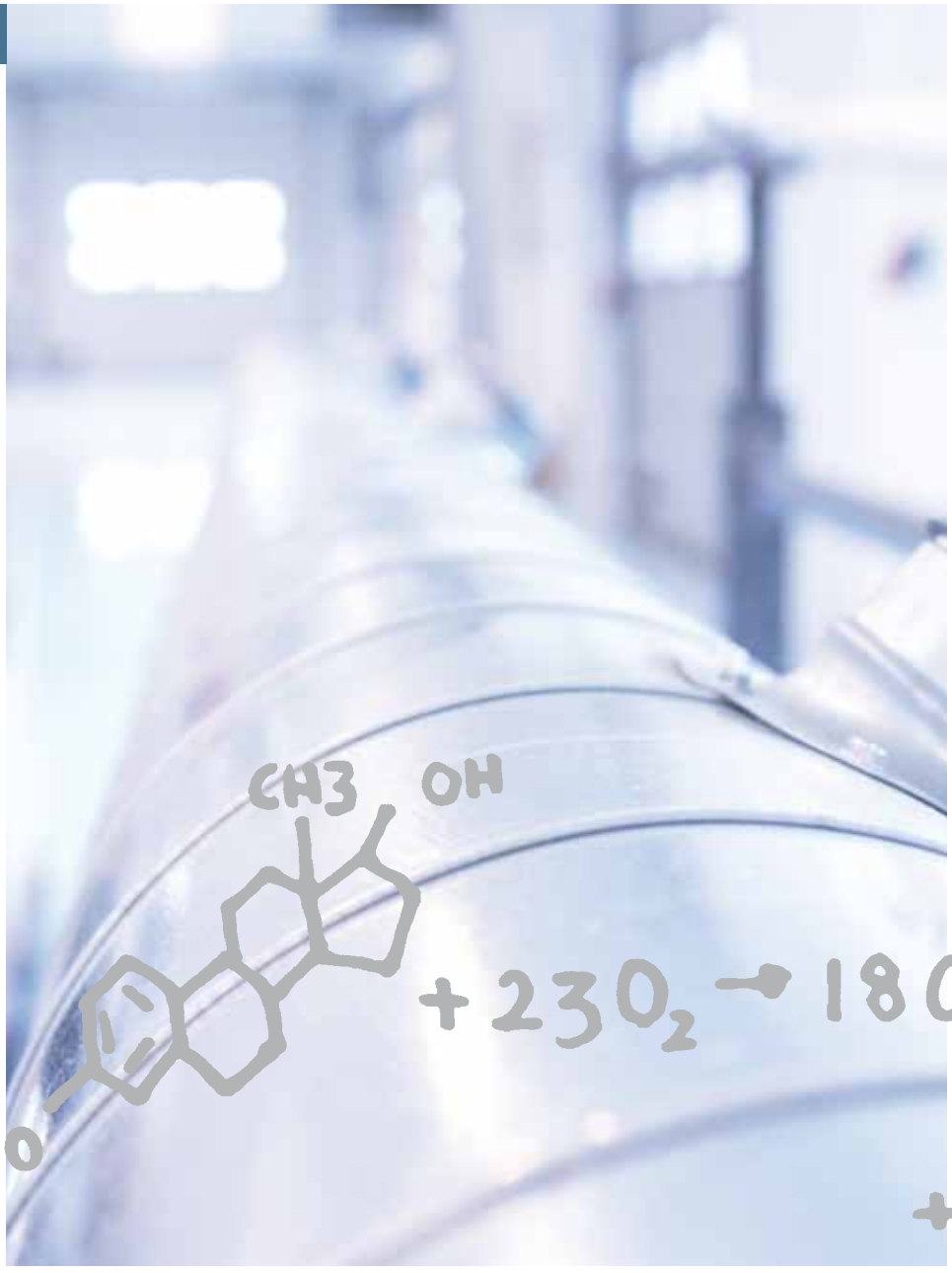
Total purification of wastewater
containing hardly-degradable pollutants

Aquarden Intro

Water has several appearances: Ice, liquid water, or steam. Furthermore, it can exist in a fourth state, called supercritical. Supercritical water readily dissolves organics and oxygen, making it the perfect medium for oxidizing even the most persistent organic pollutants.



Samples of wastewater before and after treatment in Aquardens SCWO system: From left to right: Polluted waste stream, purified waste stream, and salt concentrate.



Cleantech systems for treating problematic wastewater

Companies that generate or treat wastewater with hardly-degradable organic compounds face the challenge of finding a complete, environmentally friendly, and cost-efficient solution. Aquarden develops and markets solutions that meet these challenges and provides a new way of treating problematic wastewater streams that have a high chemical oxygen demand (COD).

Aquarden's technology benefits a number of different industries that produce tough wastewater streams. These include:

- Pharmaceutical
- Chemical and biotech
- Petrochemical
- Hospital
- Landfill

All organics eliminated

Aquarden's systems for wastewater treatment are based on a technology called SCWO – SuperCritical Water Oxidation. 'Supercritical' is a physical state that water reaches when it is heated above 374 °C and pressurized above 221 bar.

When wastewater turns supercritical, it becomes a great medium for oxygen and organic molecules to react with one another. And in Aquarden's system, all hardly-degradable organic pollutants and ammonia (NH_3) are rapidly destroyed in the oxidation process, producing only non-toxic compounds such as water, carbon dioxide (CO_2), and nitrogen (N_2). Furthermore, the process effectively removes salts and heavy metals for safe disposal.

Destruction over dilution

Aquarden has raised SCWO technology to a level where it has become a new and highly efficient method for treating toxic waste streams. All organic substances can be completely eliminated in the process. Aquarden's SCWO technology excels where other methods such as conventional biological treatment are only capable of diluting hardly-degradable organics.

The Company

A creative, passionate, and professional team of devoted technicians, engineers, and chemists – Aquarden's greatest asset.

A story of vision

Clean water is critical for our survival. Failure to properly treat our wastewater can leave a lasting negative impact on our environment and health. With that concern in mind, Aquarden was founded in 2005 and started its activities based on the results of an EU research project that demonstrated the unique capabilities of the SCWO method.

Since then, the Aquarden team has successfully improved its SCWO technology to design a safe, robust, and efficient solution for purifying even the most demanding wastewater streams while complying with the strictest environmental regulations.

Passion for innovation

Aquarden comes from the Latin words *aqua* and *ardens*. *Aqua* means water, while *ardens* denotes burning, passion, and brilliance. Hence, the name reflects the principles of our technology – the burning of organic contaminants in water – while conveying our passion for innovation in wastewater treatment.

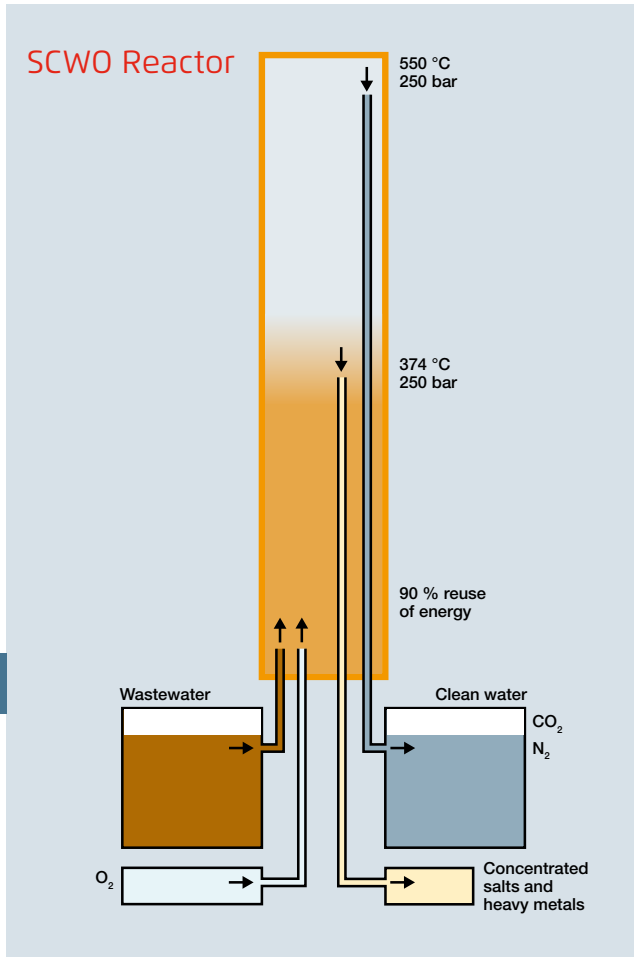
Our assets

The Aquarden team consists of highly skilled and devoted technicians, engineers, and chemists. Aquarden's state-of-the-art production facilities and laboratory ensure high-quality manufacturing of precision parts and accurate chemical analyses for optimizing our product. In addition, Aquarden partners with consultants and international experts in the field of SCWO and wastewater treatment to provide the best available technique for treating a wide range of waste streams.

Strong foundations

Aquarden receives funding from international investors with over 40 years of experience as market leaders in the area of fluid system solutions.

The SCWO Technology



The SCWO reactor principle: Salts and heavy metals are concentrated and removed at a temperature of around 374 °C while organics oxidize further up in the reactor at 450-550 °C.

Cost-benefit analyses show that SCWO treatment obtains both attractive operating costs per m³ and COD-reduction compared to other destruction methods such as incineration and other chemical oxidation techniques.

The technology and its perspectives

Aquarden's systems are based on SCWO technology, short for Supercritical Water Oxidation. Aquarden has refined the SCWO process over years of research and development, making it ideal for treating wastewater with hardly-degradable organic pollutants from various industries. These include the chemical, biotech, pharmaceutical, hospital, landfill, and wastewater treatment industries.

Best available technique

The SCWO method is superior to other conventional methods such as biological treatment where tough pollutants like hormones, medicinal drugs, and many organic solvents withstand degradation. SCWO has also proven to be a cost-effective alternative to other methods, including incineration and other chemical oxidation techniques.

An all-in-one process

The principle of the SCWO method is simple. Wastewater and air are led into the Aquarden reactor where they are heated above 374 °C and pressurized above 221 bar. When the wastewater turns supercritical, the solubility of inorganic substances drops significantly. Salts and heavy metals can therefore be concentrated and extracted.

The salt-free supercritical wastewater is further heated to 450-550 °C, where the following occurs:

- All organic compounds are completely oxidized to benign products like carbon dioxide (CO_2) and water.
- Ammonia (NH_3) and other nitrogen-containing compounds are converted into harmless nitrogen gas (N_2).
- No dangerous gases are produced such as NO_x and SO_x.
- More than 90 % of the heat is reused by a built-in heat exchanger, offering a compact and energy-friendly process.

The result is water that is virtually free of salts and organics, and which can be disposed of through the sewer system, sent to sea, or reused as process water – an elegant, environment-friendly solution with unsurpassed results. And it all takes place in a continuous, one-step process.

R&D and Production

SCWO results

Wastewater types	Reduction of COD (%) *
Concentrated landfill leachate	99.8
Biologically hardly-degradable detergents	99.7
Solvents from chemical industry	99.9
Phenolic wastewater	99.8
Pharmaceutical production	99.8

* The remaining COD comes from harmless oxidation by-products.

Focused creativity

Good innovation comes from professionalism and creativity. Our interdisciplinary team of mechanical and chemical engineers is steadfast in providing you with a safe and effective system that adds value to your wastewater treatment.

Years of dedicated product development have culminated in an energy-friendly and robust system that is compact, fully-automated, and in compliance with the highest safety and environmental standards.

Aquarden strives to be on the forefront of innovation to bring you the best available techniques and know-how for treating your wastewater.

It all begins in the lab

Wastewater varies greatly in composition. Its pollutants can be a cocktail of medicinal drugs, hormones, industrial chemicals, hormone-disrupting toxins, pesticides, etc. Our skilled chemical staff subjects each waste stream to strict scrutiny and comprehensive examination to ensure an optimized treatment solution that conforms to discharge requirements.

Our results speak for themselves

At Aquarden, we routinely test our systems to document the purification of the wastewater. Analyses conclusively show that the Aquarden SCWO system effectively transforms all hardly-degradable organic compounds into non-toxic substances.

Quality workmanship

Aquarden's SCWO reactors are fabricated from corrosion and heat resistant alloys at our state-of-the-art production facility.

Our production personnel have many years of experience within the fields of metal processing and pressure equipment fabrication. They work in close partnership with our research team to constantly refine our reactor designs with the highest quality and excellence in manufacturing.

Auxiliary systems are assembled from durable, commercially available components, guaranteeing easy maintenance and long operational lifetimes.

Solutions and Service

Specifications

Reactor throughput	**150 L/h ***
COD-reduction	**> 99 %**
Power consumption	**22 kW ****
Heat recovery	**> 90 %**
Max operating temperature	**550 °C**
Operating pressure	**250 bar**
Footprint (pre and post-treatment not included)	**10 m²**
Height	**6 m**

* Total system throughput can be significantly higher by concentrating the feed stream.

** Power consumption may be considerably lower depending on the energy content of the wastewater.

The Aquarden SCWO unit in action. The system makes use of the unique properties of supercritical water oxidation and offers a complete solution to purify tough waste streams.

Adding value to wastewater

Aquarden is focused on providing customers with a system that delivers unsurpassed purification of tough wastewater based on environmentally friendly methods, without compromising the cost-efficiency of the solution.

Through know-how and understanding of specific needs, we provide an all-inclusive solution that helps clients improve their wastewater treatment processes and their triple bottom-line reporting.

Consultancy

Aquarden works in close partnership with clients to design and deliver systems that optimize their treatment processes. Based on thorough analysis of customer specifications and lab tests of the waste streams, Aquarden recommends system dimensions, operating parameters, pre or post-treatment systems, and auxiliary equipment, if any.

System design

Depending on individual requirements, Aquarden delivers either tailor-made solutions or standard units. Systems are scalable and modular and are easily integrated with other treatment systems like filtration, concentration using reverse osmosis, and ion exchange.

All SCWO systems are plug-and-play and feature a continuous, fully-auto-mated process. The units are typically installed on-site at the clients' premises, but off-site treatment may also be ar-ranged.

Service and support

Aquarden offers individual support and service to fit all needs, from ad-hoc support calls to outsourcing of the entire operation. Aquarden never leaves its clients on their own. We believe in long-term relationships based on trust.

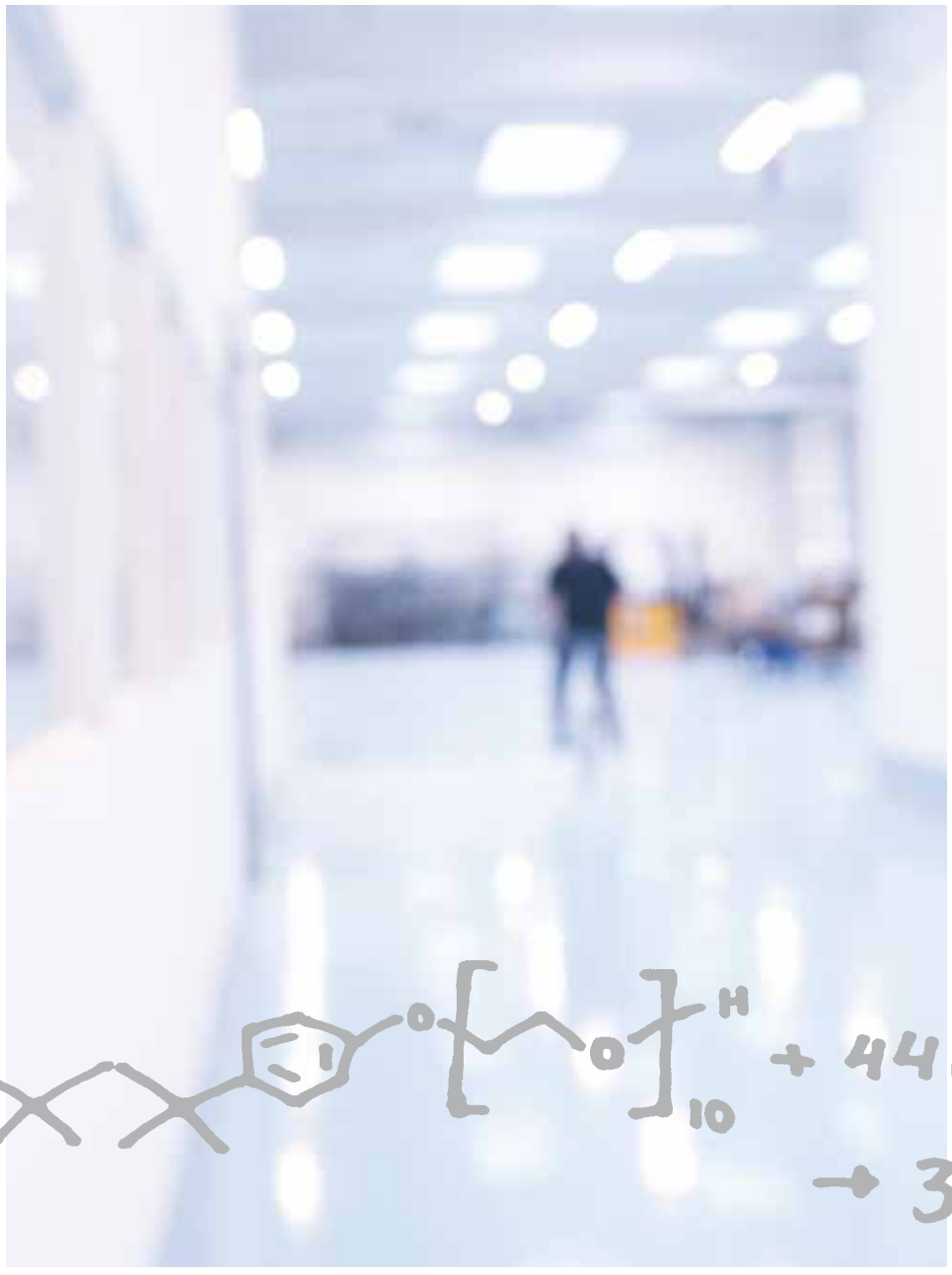
Aquarden Benefits

The Aquarden system includes full automation and constant process overview which reduces operational man-hours.

Pollutants in wastewater streams are completely eliminated in the SCWO process.

Aquarden's solutions offer advantages on several levels.

Not only does effective treatment of wastewater contribute to a cleaner environment, but customers also obtain many tangible operational and economical benefits. This makes Aquarden's system a prudent choice.



Destroys all organics

Exceptional treatment results. Aquarden's technology eliminates hazardous organic compounds completely and efficiently. Ammonia is converted to nitrogen gas and water.

Treats all types of organics. The SCWO process destroys even the most hardly-degradable organics where other advanced oxidation and biological treatment methods are inadequate.

Environment-friendly

No toxic by-products. The system produces only non-hazardous products such as carbon dioxide, water, and nitrogen.

Separates salts and heavy metals. Salts and heavy metals are continuously concentrated and removed. This allows treated water to be disposed of through the sewer system, sent to sea, or reused as process water.

No dangerous emissions. No NO_x, SO_x, or odors are produced.

Operational excellence and safety

Fully-automated and safe. The systems are easy to install and simple to use. Automated procedures ensure the highest user safety and minimum maintenance.

Continuous, one-step process. The process offers continuous, around-the-clock wastewater treatment that rapidly destroys all organics and ammonia while simultaneously separating salts and heavy metals.

Compact modular unit. A small system footprint makes it easy to fit within compact spaces. The modular design easily integrates with other treatment systems.

Cost savings

Energy optimized process. Efficient heat exchange reuses more than 90 % of the energy from the SCWO process, minimizing operating costs.

Short return on investment. Solutions are designed to ensure an attractive total cost of ownership.

No transportation costs. On-site treatment eliminates high transportation costs to external wastewater treatment facilities.

Reduces expensive downtime. Fast, automated start-up and shutdown procedures minimize downtime.

An invitation

We would like to invite everyone who is interested in our technology to come and visit us at our facilities in Skævinge, Denmark.

We are open for a professional dialogue with focus on building long-term partnerships and customer relations.

Welcome to our future.

Aquarden
TECHNOLOGIES

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