

PFAS

Capture & Complete Destruction



Aquarden
TECHNOLOGIES

PFAS

The presence of per- and polyfluoroalkyl substances (PFAS) in our environment is a growing and acute global concern. PFAS are nicknamed 'forever chemicals' as they are extremely carcinogenic and highly persistent in nature. Through their widespread use in household products and industry, they leach into our environment and accumulate in the human body for years with adverse health effects. Several technologies exist to capture PFAS in water. Unfortunately, many conventional methods for PFAS destruction are inadequate – e.g. chemical oxidation, biology, and ozonation. High-temperature incineration plants (>> 1000°C) can destroy PFAS but have a high energy and CO2 footprint. Thus, Aquarden has developed a greener robust solution using PFAS-selective adsorbents and Supercritical Water Oxidation (SCWO).



Aquarden's SCWO solution is a cost-efficient and fully automated method for treating PFAS.

Forever Chemicals: Capture and Destruction

Ion exchange resins and other PFAS-selective adsorbents are highly effective at adsorbing PFAS from water. To capture PFAS, Aquarden has developed a full-scale solution where wastewater is passed through two modular adsorption columns. The first adsorption column is efficient at removing organic material but has a low PFAS selectivity and lets PFAS through. The second adsorption column is PFAS-selective and removes

PFAS to below allowable drinking water limits. Upon saturation with PFAS, the spent adsorbent is replaced with fresh adsorbent, while the PFAS-saturated adsorbent is sent to a SCWO plant for complete destruction. The figure on next page illustrates the entire process.

Main benefits

Fits all sizes: The Aquarden PFAS removal system is completely modular and scalable to fit your needs.

Resin replacement service: When your adsorbents are fully saturated, we will replace your adsorbents. Spent adsorbent is sent for complete destruction to an off-site SCWO system.

On-site SCWO treatment: We provide optional on-site SCWO treatment for applications with very large consumption of PFAS adsorbents.

Simple, continuous and fully automated process: Minimal supervision required.

Complete removal and destruction of PFAS: System is customized to meet your discharge limits.

Total system integrator: We are with you all the way with full service and support.

Scandinavian solution: Registered in Denmark and Norway and active worldwide.

Supercritical Water Oxidation (SCWO)

Supercritical water is a fourth state of water that exists above 374°C and 221 bar and is a fantastic medium for breaking down micropollutants within seconds to their most basic components. Aquarden's modular SCWO system can completely destroy PFAS-saturated

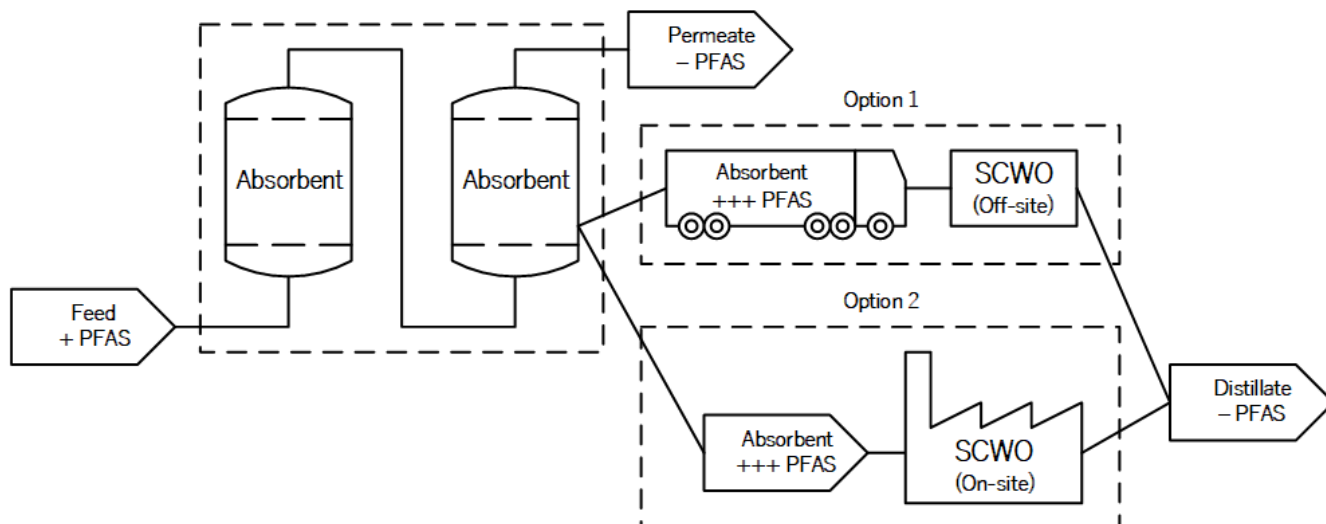


Figure 1: The Aquarden SCWO-adsorption process for PFAS remediation adsorbents or concentrated PFAS streams off-site or on-site, leaving only H₂O, CO₂, N₂ and mineral acids as byproducts. The table on the right illustrates the typical oxidative efficiency of SCWO.

Pre- and Post-Treatment

High organic loads in wastewater can typically weaken an adsorption process. It is therefore very important to ensure good pre-treatment to reduce the organic load in the raw wastewater prior to PFAS adsorption. At Aquarden, our specialists evaluate every case individually to customize the best pre- and post-treatment solutions. For some waters like groundwater, the need for pre-treatment is minimal, whereas for a more complex wastewater like leachate, more pre-treatment steps may be needed. At Aquarden we test these processes from laboratory to pilot scale to ensure an optimal solution with respect to

	Before (µg/l)	After (µg/l)
PFHpA	0.36	<DL
PFOA	0.52	<DL
PFNA	<DL	<DL
PFBS	0.89	0.0081
PFHxS	0.28	0.0096
PFOS	0.28	0.018
PFOSA	0.0069	<DL
PFHxA	0.63	<DL
PFBA	<DL	<DL
PFPeA	0.30	<DL
PFDA	<DL	<DL
FTS 6:2	0.38	<DL
Sum PFAS	3.7	0.035

Results from PFAS contaminated leachate before/after SCWO treatment (<DL = below detection limit).

discharge quality, CAPEX and OPEX. By combining our in-house products with quality products from dependable suppliers we construct and build complete industrial wastewater treatment systems to match your specific challenges.

Specifications

Flow and capacity

Typically, 1-50 m³/hour. No upper limits as the entire system is modular. One standard SCWO unit can destroy 5 m³/day of highly contaminated PFAS wastewater or spent adsorbents.

Footprint

The footprint of the adsorption setup is minimal – a 2,5 m³/h system takes up less than 3 m² and a 15 m³/h system can easily be fitted into an isolated 20' container. Our SCWO system can be fitted into two 40' containers.

Service

By selecting the Aquarden PFAS technologies you ensure constant **removal and destruction** of PFAS. Our dedicated service team can handle the entire process, including plant commissioning, operation and support.

About Aquarden
Provider of total solutions

Aquarden is an expert in sustainable treatment of problematic wastewater and designs solutions for solving the toughest wastewater challenges. We offer tests, consultancy, turnkey systems, and services – all customized to meet your specific requirements. Solutions are integrated into your individual production and wastewater treatment processes.

Our mission is to help you in meeting the highest environmental standards for industrial wastewater treatment by providing green and effective solutions. Our proprietary and prize-winning SCWO system destroys all organic and toxic compounds in wastewater completely and efficiently, and reuses energy and water.



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