WATCHER
WATCH WATER
a Water Company

FILTERSORB
FILTRATION
ADSORPTION
INSTANT PRODUCTS
OXY TREATMENT
SYSTEMS

ULTRARedox

MEMBRANE & ION EXCHANGE MEDIA

INTRODUCING

ADVANCED REDOX PROTECTION FOR MEMBRANE SYSTEMS

ULTRARedox™ is an advanced high-surface-area aluminosilicate media engineered as a **multifunctional redox barrier for sensitive membrane and ion-exchange systems**. It combines redox-active surface chemistry, contaminant interception, scale modification, and depth filtration within a single granular bed. By conditioning incoming water, **ULTRARedox™** helps reduce contaminant loading, control deposits, and support stable operating conditions while maintaining efficient water flow. This integrated approach helps protect **RO, NF, UF, MBR, ceramic membranes, and ion-exchange systems**, supporting improved reliability and consistent operation.

RO | NF | UF | MBR | Ion Exchange | Ceramic Membranes

Surface Area
~2,000 m²/g
Engineered aluminosilicate architecture

Mechanism
Anodic-Cathodic Redox
Heterogeneous redox-active solid/water interface

Pathways
Eight in One Bed
Redox, adsorption, catalysis, precipitation and more

Operation
No Chemical Regenerant
Feed-water backwash restores active redox sites

APPLICATIONS

- Reverse Osmosis (RO) Pretreatment
- Nanofiltration (NF) Systems
- Ultrafiltration (UF) Protection
- MBR Pretreatment
- Ceramic Membrane Protection
- Ion Exchange Pretreatment

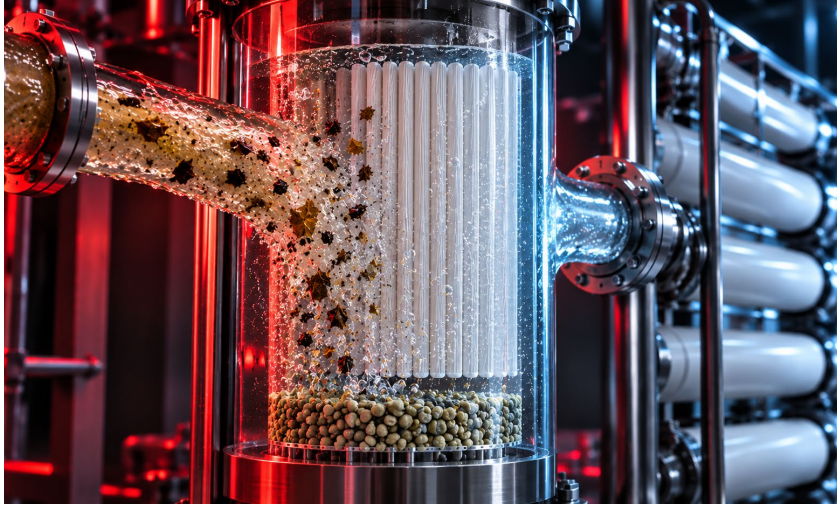
IAPMO R&T WATER QUALITY PLATINUM SEAL
IAPMO RESEARCH AND TESTING

PREMIUM QUALITY
MADE IN GERMANY

ULTRARedox

WATCHER®
WATCH WATER
a Water Company

FILTERSORB
FILTRATION
ADSORPTION
INSTANT PRODUCTS
OXY TREATMENT
SYSTEMS



THE CHALLENGE

WHY MEMBRANES FAIL

Membrane performance is governed by **the chemistry, particles and biology that reach the membrane surface.** **ULTRARedox™** is positioned as a multifunctional protective barrier upstream of sensitive treatment assets.

Challenge	Representative Challenge	Consequence
Scaling	$CaCO_3$, $CaSO_4$, silica supersaturation	Flux decline, pressure rise, cleaning
Biofouling	Cells, EPS and EOM	Biofilm and hydraulic resistance
Metal fouling	Fe/Mn and reactive metals	Deposits and poisoning
Colloids	Sub-micron solids and fines	SDI rise and obstruction
Organics	PFAS, APIs, pesticides	Contaminant transport / adsorption load

Design objective: reduce chemical, particulate and biological loading before it reaches the expensive downstream barrier.

MULTI-BARRIER PRETREATMENT

ONE BED, MULTIPLE PROTECTIVE FUNCTIONS

Engineered high-surface-area aluminosilicate media **combining redox-active surface chemistry, contaminant interception, scale modification and depth filtration** in one granular bed.

WHY SURFACE AREA MATTERS

High specific surface area increases the interface available for **adsorption, surface complexation, catalytic contact and redox-active interactions.**

THE REDOX BARRIER BEFORE THE MEMBRANE

NOT JUST A FILTER, A PROTECTIVE INTERFACE.

MATERIAL ARCHITECTURE

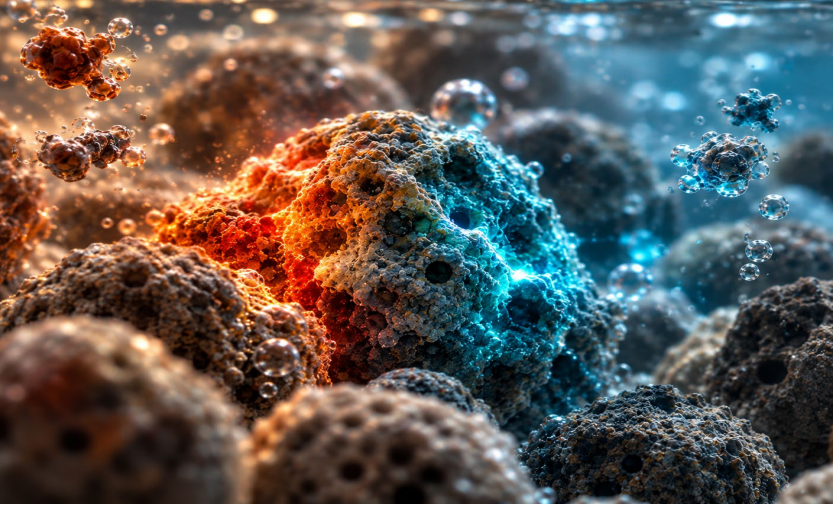
THE ULTRAREDOX™ SOLID-WATER INTERFACE

Engineered aluminosilicate architecture with a stated specific surface area of approximately 2,000 m^2/g.

ULTRARedox™ is based on an engineered clinoptilolite/aluminosilicate matrix. Aluminosilicate frameworks contain interconnected silicon-oxygen and aluminium-oxygen tetrahedral units. Their porous architecture creates a very large interface for water-solid interactions.

Framework Bonding
Si-O-Si | Si-O-Al

Property	Specification
Base matrix	Engineered aluminosilicate matrix
Specific surface area	~2,000 m^2/g
Bulk density	0.78–0.82 g/cm^3
Mohs hardness	7.0
Porosity	>62%
Operating pH	5.5–9.5
Max. operating temperature	85°C



WATCHER
WATCH WATER
a Water Company

FILTERSORB
FILTRATION
ADSORPTION
INSTANT PRODUCTS
OXY TREATMENT
SYSTEMS

CORE SCIENCE

THE ANODIC-CATHODIC REDOX ENGINE

The differentiating concept is a **heterogeneous redox-active solid/water interface**. Electron-transfer reactions can proceed in complementary directions according to contaminant chemistry, electrochemical potential, pH, dissolved oxygen, competing ions and active surface chemistry.

OXIDATION (ANODIC) **REDUCTION (CATHODIC)**

General Redox Reactions

Oxidation: Reductant ⟶ Oxidized species + n e^-

Reduction: Oxidant + n e^- ⟶ Reduced species

Mechanism	Scientific Role
Oxidation	Electron loss at redox-active interfaces
Reduction	Electron gain; oxidation state can alter mobility
Adsorption	Capture at internal and external surfaces
Catalysis	Surface-mediated acceleration of reactions
Complexation	Specific binding to surface/mineral sites
Immobilization	Conversion to less mobile forms
Depth capture	Retention of colloids and fines through the bed
Crystal modification	Influence on nucleation and mineral growth

EIGHT TREATMENT PATHWAYS

MULTI-MECHANISM CONTAMINANT CONTROL

ULTRARedox™ is described as creating strong anodic and cathodic reaction environments across an enormous porous surface, without implying that the granular bed is a conventional wired electrochemical cell.

Redox Transformation	Adsorption / Surface Capture
Surface Complexation	Catalytic Reaction
Precipitation / Co-precipitation	Depth Capture
Crystal Modification	Immobilization

DIFFICULT ORGANICS

PFAS, PHARMACEUTICALS & PESTICIDES

Performance claims are based on the available ULTRARedox™ technical data and validated test results.

For PFOA, PFOS, PFHxS and GenX, the source states catalytic C-F bond cleavage plus surface capture with an effluent target of non-detect. For APIs, endocrine disruptors and atrazine, it states Advanced Oxidation Reactions plus adsorption with a non-detect target.

Target Class	Stated Mechanism	Target
PFOA / PFOS / PFHxS / GenX	Catalytic C-F bond cleavage + surface capture	Non-detect
APIs / endocrine disruptors / atrazine	Advanced Oxidation Reactions + adsorption	Non-detect

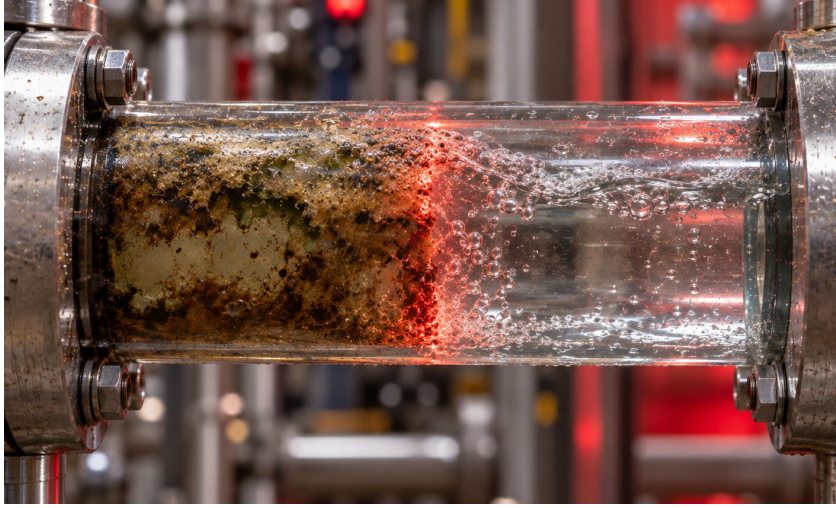
Multi-Barrier Protection in

ONE MEDIA BED

Capture vs. transformation: adsorption transfers a contaminant to a solid phase; C-F bond cleavage describes chemical transformation. Adsorption captures contaminants on the solid surface, while redox and catalytic pathways may chemically transform selected contaminants under suitable operating conditions.

WATCHER®
WATCH WATER
a Water Company

- FILTERSORB
- FILTRATION
- ADSORPTION
- INSTANT PRODUCTS
- OXY TREATMENT
- SYSTEMS



INORGANIC CONTAMINANTS

HEAVY METALS & PHOSPHATE CHEMISTRY

Oxidation state, solubility, complexation and surface affinity control contaminant mobility.

The source reports As(III)/As(V), Pb, Hg, Cr(VI) and Cd treatment through redox reduction and hydroxide co-precipitation, with a target below 0.001 mg/L.

General Redox Concept

$M(n+) + x\ e^- \rightarrow$ lower oxidation-state species

For orthophosphates and organophosphates, the source identifies specific catalytic mineral complexation with a target below 0.01 mg/L.

General Surface Concept

$M\text{-}OH + phosphate \rightleftharpoons M\text{-}phosphate + H_2O / OH^-$

Speciation matters: These equations explain general aqueous chemistry; they do not assert that every listed contaminant follows one identical pathway.

SCALE CHEMISTRY

CONTROL THE CRYSTALLIZATION ENVIRONMENT

ULTRARedox™ is positioned to alter supersaturation dynamics of $CaCO_3$, $CaSO_4$ and silica.

Carbonate Equilibrium

$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^- \rightleftharpoons 2H^+ + CO_3^{2-}$

$Ca^{2+} + CO_3^{2-} \rightleftharpoons CaCO_3(s)$

Calcium carbonate scaling depends on calcium activity, alkalinity, pH, temperature, ionic strength, supersaturation, nucleation and growth kinetics. The source states that **ULTRARedox™** transforms hard scale-forming calcite into non-adherent aragonite microcrystals.

ENGINEERING POSITION

ULTRARedox™ operates through a scale-modification mechanism rather than conventional hardness removal. $CaCO_3$, $CaSO_4$ and SiO_2 have different fouling chemistries.

BIOLOGICAL & CORROSION CONTROL

BIOFOULING, EPS & METAL DEPOSITION

Protect downstream surfaces before a mature foulant layer becomes established.

The source describes an active catalytic redox surface that disintegrates bacterial cellular membranes, neutralizes extracellular polymeric substances (EPS), and helps reduce downstream biofilm formation without chemical biocide dosing.

EPS is the hydrated polymeric matrix that supports attachment, nutrient retention and mature biofilm development.

Iron Redox

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

Iron and manganese fouling is redox- and pH-dependent. The source states that **ULTRARedox™** stabilizes ORP, passivates metallic boundary layers and helps reduce downstream deposition of Fe/Mn oxidation products.

TWO PROTECTION FRONTS

Biological protection targets cells/EPS; corrosion and metal-fouling control targets the chemistry that produces reactive or particulate deposits.

WATCHER® WATCH WATER a Water Company

FILTERSORB
FILTRATION
ADSORPTION
INSTANT PRODUCTS
OXY TREATMENT
SYSTEMS

HYDRAULIC ENGINEERING

FROM CHEMISTRY TO A PRESSURE VESSEL

Chemistry and hydraulics must work together.

Parameter	Design Value
DIN Grade I	0.6–1.6 mm - RO/NF/direct DW
DIN Grade II	1.6–2.4 mm - SWRO/BWRO/MBR
DIN Grade III	2.0–4.0 mm - high-turbidity / roughing
Minimum Bed Depth	80 cm
Optimum Bed Depth	100–120 cm
Freeboard	35–40%
Service Flow Rate	20–30 BV/h
Backwash Rate	25–35 m/h
Backwash Duration	8–12 min
Pressure Drop	<0.35 bar / 100 cm bed at 25 BV/h, 20°C

NO CHEMICAL REGENERANT

The source states that periodic feed-water backwashing expands the bed, scours captured colloids and cleans active redox sites for continuous operational cycles.

ONE BED.

MULTIPLE MECHANISMS

STRONGER PROTECTION BEFORE THE

MEMBRANE

THE CONDITIONING ZONE

MANAGING WATER VARIABILITY BEFORE IT REACHES THE MEMBRANE

Real feed water is rarely constant. Changes in source water, seasonal conditions, suspended solids, dissolved metals, organic loading, ionic strength and biological activity can continuously alter the chemistry entering a treatment system.

ULTRARedox™ can be positioned as an engineered conditioning zone between raw-water pretreatment and the sensitive downstream separation process.

Instead of relying on a single treatment mechanism, the granular bed provides a large reactive interface where several surface interactions can occur simultaneously. This creates an intermediate treatment stage in which incoming water is conditioned before reaching RO, NF, UF, MBR, ceramic membranes or ion-exchange media.

CONDITION THE WATER.

PROTECT WHAT COMES NEXT.

WHY A CONDITIONING ZONE MATTERS

Sensitive downstream technologies perform best when the feed reaching them is as stable and manageable as possible. **ULTRARedox™** provides an additional barrier between changing raw-water conditions and the final treatment asset.

THE OBJECTIVE IS TO:

Intercept

Contaminants and particles before they reach critical downstream surfaces.

Transform

Reactive species where suitable redox and catalytic pathways are available.

Condition

The water through multiple simultaneous solid–water interactions.

Protect

The downstream process from unnecessary contaminant and fouling exposure.

MORE THAN FILTRATION

ULTRARedox™ should therefore be viewed not simply as another granular filter, but as a multifunctional water-conditioning stage engineered to prepare the feed water for the treatment technology that follows.

SYSTEM INTEGRATION

ONE PROTECTIVE BARRIER BEFORE SENSITIVE ASSETS

Versatile pretreatment for RO, NF, UF, MBR, ceramic membranes and ion exchange.

The source positions **ULTRARedox™** to protect downstream assets against scaling, biofouling, metal deposition, colloidal fouling and complex organic contaminant transport.

THE ULTRARedox™ PRINCIPLE

A multifunctional solid-water interface where redox transformation, adsorption, catalytic reaction, complexation, precipitation/immobilization, depth filtration and scale modification can operate within one engineered granular media bed.

EVIDENCE ARCHITECTURE

VALIDATED PERFORMANCE SHOULD BE VISIBLE

The strongest technical claim is one placed beside its measured test conditions.

Performance claims should be interpreted together with the corresponding water chemistry, operating conditions and analytical test methods. Each major claim should be accompanied by the supporting laboratory report details.

Evidence Field	Recommended Detail
Laboratory	Name and accreditation, where permitted
Water matrix	Real or prepared challenge water
Influent	Initial contaminant concentration
Effluent	Measured value and detection limit
Hydraulics	Flow, BV/h, bed depth, media volume
Exposure	Total bed volumes or duration
Method	Analytical method / standard
Outcome	Removal, transformation or protection endpoint

CLAIM ▸ CONDITION ▸ RESULT

This structure keeps powerful validated claims powerful while giving engineers the conditions needed to interpret them.

ADVANCED REDOX MEMBRANE PROTECTION

Standard Packaging

Packaging	Weight of product	Quantity/pallet	Gross Wt./pallet
Bag (30 L)	25 kg	40	1025 kg
Bulk Bag (1200 L)	1000 kg	1	1025 kg

★ *Other packaging can be considered on request*

Watch-Water® GmbH
Fahrlachstraße 14
68165 Mannheim, Germany
Tel. +49 621 87951-0
Fax +49 621 87951-99
info@watchwater.de