

COOLING WATER SYSTEMS

Optimizing Cooling Towers with DZ 9450 ROS

A single-chemical, ORP-controlled treatment that generates reactive oxygen species (ROS) to control biofilm, algae, scale and corrosion — lowering operating cost while improving heat-transfer efficiency and reducing Legionella risk.



DZ 9450 protects industrial cooling towers where warm, aerated water invites biological growth, scale and corrosion.

3,125×

MORE GERMICIDAL
THAN CHLORINE

<10 sec

MICROBIAL KILL AT
TARGET ORP

20%+

ELECTRICITY SAVINGS CITED BY A
CALIFORNIA ELECTRIC UTILITY

— The problem in every cooling tower

Cooling towers combine warmth, moisture, sunlight and dissolved minerals — ideal conditions for biological fouling, scale and corrosion. Biological activity is easy to detect: a slimy film develops inside pipes, on basins and fill, and on heat-exchange surfaces. Manufacturers and professional bodies such as ASHRAE agree that a minimal fouling factor of just **0.001** can cut efficiency by as much as **10%**.

The worst offender is biofilm. Sessile microorganisms secrete a sticky extra-polymeric substance (EPS) that traps suspended solids and insoluble mineral salts. A biofilm on a heat-transfer surface is **300% worse than calcium-carbonate scale**, and it simultaneously drives scaling and corrosion by shielding the colony from conventional biocides and dispersants — providing a home for anaerobic bacteria that cause localized pitting and general corrosion. The same aquatic systems also let *Legionella pneumophila* thrive within amoebae, a recognized public-health risk in central air-conditioning for offices, hotels and hospitals.

HOW IT WORKS

An advanced oxidation process — in a bottle

DZ 9450 is a mineral oxychloride: minerals chelated with oxygen in liquid form, purposely designed to be weakly bound. On contact with inorganics, microorganisms and organic matter it readily releases oxygen atoms that aggressively oxidize the target — simulating an advanced oxidation process (AOP) without an ozone generator.

The reactive oxygen species — led by the hydroxyl radical — dissolve the EPS matrix that shields biofilm, then attack the DNA of the exposed cells. Because the attack is on the DNA itself, microorganisms cannot adapt, so DZ 9450 works as a **single-chemical program** in place of a conventional dual-chemical treatment.

Effectiveness is measured and controlled by oxidation-reduction potential (ORP). Studies by the World Health Organization and the Ozone Institute show that raising ORP above **+650 mV** eliminates harmful microorganisms in **under 10 seconds**. In cooling service, dosing is simply held at a target of **>+700 mV** with an ORP meter — no complex titration, and far less chemical than a chlorine program.

The by-products are oxygen and water. A protective residual of mineral monoxides remains active against bacterial recontamination, and the treated water buffers alkaline, further reducing acid corrosion.

OXIDATION POTENTIAL OF COMMON OXIDANTS

REAGENT	FORMULA	VOLTS
Fluorine	F ₂	3.06
Mineral Oxychloride	M _x O _y Cl _z	2.8–2.9
Hydroxyl Radical	OH•	2.80
Oxygen Ion	O ⁻	2.42
Ozone	O ₃	2.07
Hydrogen Peroxide	H ₂ O ₂	1.78
Perhydroxyl Radical	HO ₂	1.70
Chlorine Dioxide	ClO ₂	1.57
Hypochlorous Acid	HOCl	1.49
Chlorine Gas	Cl ₂	1.36
Oxygen (Molecule)	O ₂	1.23
Hypochlorite Ion	OCl ⁻	0.94
Sodium Hypochlorite	NaOCl	0.94
Hydroperoxide Anion	HO ₂ ⁻	-0.88
Superoxide Radical	O ₂ ⁻	-2.40

— Disinfection efficacy vs. ORP

ORP LEVEL (mV)	COLIFORM COUNT (PER 100 mL)	RESULT
200	300	Untreated / high risk
300	36	Partial control
400	3	Near-complete
600	0	Complete elimination

Coliform count in 100 mL of water as a function of ORP. DZ 9450 holds ORP well above the +650 mV disinfection threshold.

THE TAKEAWAY

One ORP-controlled reagent replaces a dual-chemical program — oxidizing biofilm, algae and organics on contact while a mineral-monoxide residual guards against regrowth.

WATER MANAGEMENT

Three jobs, one reagent

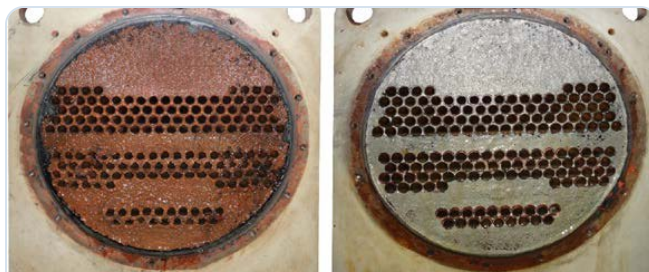
Every cooling-water program has two goals: improve heat-transfer efficiency and keep operating cost down. DZ 9450 delivers both by controlling biology, scale and corrosion at the same time.

1 Control biological activity

DZ 9450 eliminates slime and organic deposits through complete oxidation — rupturing cell walls and oxidizing the organic residue, then oxidizing the existing deposits in the same pass. Viable microorganisms, algae and the biofilm that harbors *Legionella* are removed at the source rather than merely suppressed.

2 Prevent & remove scale

Scale robs efficiency and accelerates under-deposit corrosion. DZ 9450 prevents buildup and removes existing deposits by oxidizing the biological “glue” that binds mineral salts to metal surfaces — restoring clean heat-transfer area.



CONDENSER TUBE-SHEET — BEFORE VS. AFTER DZ 9450

3 Inhibit corrosion

With biological and mineral deposits gone, the potential for under-deposit corrosion falls automatically. The treated water buffers alkaline, reducing acid attack, and DZ 9450 rapidly oxidizes the outermost metal into a hard protective layer of ferroso-ferric oxide (magnetite) — including on copper heat exchangers.



UNDER-DEPOSIT CORROSION IS HALTED ONCE BIOFILM IS REMOVED.



Cooling-tower fill: fouled (left) vs. restored (right) after DZ 9450 treatment.

TWO GOALS, MET AT ONCE

Cleaner heat-transfer surfaces mean higher efficiency and lower operating cost — biological control, scale prevention and corrosion protection from a single, easy-to-monitor reagent.

FINANCIAL BENEFITS

Lower cost than a chlorine program

It takes about **12 times** the amount of chlorine to equal the same oxidizing effectiveness as DZ 9450, and DZ 9450 delivers ozone-class performance at roughly **1% of the capital cost and 10% of the operating cost** of an ozone system. Studies by a California electric utility, NASA, the Jet Propulsion Laboratory and a major technology company confirm ROS as a viable alternative to multi-chemical treatment, with electricity savings of 20% or more.

— DZ 9450 vs. conventional chlorine

ATTRIBUTE	DZ 9450 (ROS)	CHLORINE
Relative germicidal power	3,125×	1× (baseline)
Oxidizer dose for equal effect	1×	12×
Oxidation potential	2.8–2.9 V	1.36 V (Cl ₂)
By-products	Oxygen + water	THMs, HAAs, chlorite
Shelf stability	Up to 6 months	~30 days at 100%
Program type	Single chemical	Dual chemical

By-products of DZ 9450 are oxygen and water; in the presence of bromide, halogen-substituted DBPs are not formed.

— Where the savings come from

- 1 Reducing make-up water by permitting more cycles between blowdowns.
- 2 Eliminating the cost of ordering, shipping, handling, storing and disposing of a stable of regular chemicals — and the discharge liabilities and record-keeping that go with them.
- 3 Cutting power consumption by keeping chiller heat-transfer efficiency high through cleaner condenser tubes.

REACTIVITY (DOSE RATIO)

TARGET	DZ 9450 DOSE
Inorganics	<1.0 mg/L per mg/L
Pathogens	1.0 per 1,000–10,000
Organics	1.0–8.0 mg/L per mg/L
Operating pH 6.5–9.5. By-products are protective mineral monoxides that resist recontamination.	

BOTTOM LINE

Improve heat transfer • reduce scale and corrosion • eliminate biofilm and algae • lower Legionella risk • simple to use and monitor.

NSF/ANSI Std 60 Certified

California Water Board Approved

EPA FIFRA Registered

U.S. Clean Water Act Compliant

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