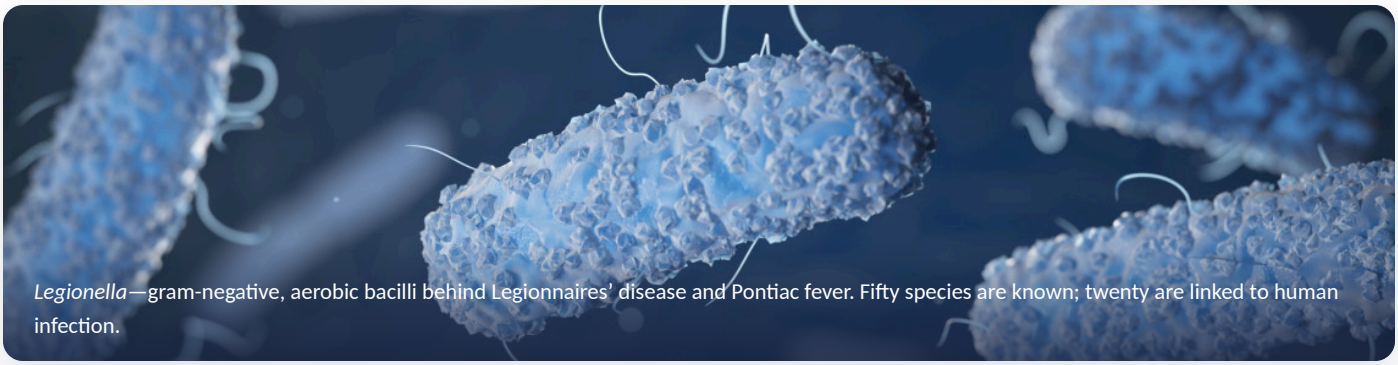
PUBLIC HEALTH • WATER MANAGEMENT

Legionella Prevention & Control

A practical guide to what *Legionella* is, why it evades conventional disinfection, and how a water-management program built on JC 9465 mineral oxychloride ROS and ORP control removes it—and keeps it from coming back.



Legionella—gram-negative, aerobic bacilli behind Legionnaires' disease and Pontiac fever. Fifty species are known; twenty are linked to human infection.

50
SPECIES IDENTIFIED — 20 LINKED TO HUMAN INFECTION

68–122°F
RANGE WHERE LEGIONELLA REPRODUCES (OPTIMAL 95–115°F)

+650 mV
ORP AT WHICH LEGIONELLA WAS ELIMINATED INSTANTLY IN LAB TESTING

Legionellosis is the family of infections caused by *Legionella* bacteria—from Pontiac fever, a mild flu-like illness, to Legionnaires' disease, a severe and often lethal pneumonia. Nearly all human cases are caused by *Legionella pneumophila*.

First identified after a pneumonia outbreak at the 1976 American Legion convention in Philadelphia, *Legionella* is now a recognized public-health hazard in the large, complex water systems it colonizes. Because the bacteria are relatively resistant to standard disinfection and hide within biofilm, controlling them takes more than routine chlorination—it takes a managed program built around a treatment that reaches the biofilm and holds a measurable protective residual.

What Legionella Is

Legionella are natural inhabitants of water and are found in rivers, lakes and streams. They are gram-negative, aerobic, unencapsulated bacilli; of the roughly fifty species identified, twenty are known to be associated with human infection, and the majority of cases are caused by *L. pneumophila*. There are two forms of legionellosis: Pontiac fever, marked by flu-like symptoms, and the more severe, often lethal pneumonia known as Legionnaires' disease.

Where It Grows & How It Spreads

The major source of *Legionella* is the water-distribution systems of large buildings and cooling towers. Other sources include misting machines, humidifiers, whirlpool spas, fountains and hot springs. Large numbers have been found in the sediment at the bottom of institutional hot-water tanks, where temperatures often fall within the optimal growth range.

Infection occurs when contaminated water is aerosolized and inhaled, when it is aspirated, or through the use of respiratory-therapy equipment. Low—even non-detectable—levels of the organism can colonize a water source and grow to high concentrations under the right conditions.

CONDITIONS THAT FAVOR GROWTH
Poor water flow & stagnation
Warm water, 68–122°F (optimal 95–115°F)
Nutrients from algae, flavobacteria & *Pseudomonas*
Biofilm & slime that shield the colony
Amoeba & protozoa that harbor the bacteria
Sediment in institutional hot-water tanks (43–55°C)

Harder to Kill Than the Indicators We Test For

Water quality is traditionally judged by the disinfection of coliform bacteria—yet *Legionella* is markedly more resistant to chlorine than those indicators. At residual levels typical of public distribution systems, coliforms are eliminated in under a minute while legionellae persist for tens of minutes, and their resistance grows as conditions become less than optimal (higher pH, lower temperature).

ISOLATE (SOURCE)	1 MIN	5 MIN	10 MIN	30 MIN	60 MIN
L. pneumophila (river)	65%	19%	13%	4%	<1%
L. pneumophila (hot-water tank)	56%	19%	20%	17%	6%
L. micdadei (hot-water tank)	31%	9%	6%	4%	3%
E. coli (indicator)	**<1%**	—	—	—	—

Percent surviving at 0.1 mg/L free chlorine, 21°C, pH 7.6 (Kuchta et al., Applied and Environmental Microbiology, 1983). A 99% kill of L. pneumophila took about 40 minutes; coliform indicators were gone in under one minute.

Why Conventional Treatments Fall Short

Legionella resists standard disinfection because it grows inside biofilms and slime that are difficult to penetrate, and is further protected by symbiotic relationships with other microorganisms. It is not eradicated by the conventional chlorination used to purify domestic water.

Every common alternative carries a trade-off. Chlorine-based chemicals—except chlorine dioxide—do not remove biofilm or control recolonization; chlorine dioxide reacts slowly and needs long contact time. Ozone lasts only minutes and cannot protect a distribution system; UV leaves no measurable residual—both require a chlorine residual as well. Copper/silver ionization loses reactivity away from its electrodes, is unreliable in fast-moving water, can be neutralized by chlorine, and leaves metal precipitate to filter out.

These approaches can also introduce their own problems: corrosion and pitting of piping, disinfection by-products that pose a health risk, gas leaks, taste and odor issues, and—critically—a failure to hold a residual that prevents recolonization.

The strength of an oxidizing biocide is measured by its electrochemical potential. The higher the value, the faster and more complete the disinfection—and among oxygen-based reagents, JC 9465 ranks at the very top.

OXIDATION POTENTIAL OF COMMON OXIDANTS

REAGENT	FORMULA	VOLTS
Fluorine	F_2	3.06
Mineral Oxychloride	$M_xO_yCl_t$	2.8–2.9
Hydroxyl Radical	OH•	2.80
Oxygen Ion	O^-	2.42
Ozone	O_3	2.07
Hydrogen Peroxide	H_2O_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

Water-Management Best Practices

Absent a treatment that eradicates *Legionella*, control has traditionally meant enforcing a **water-management plan**—a program to maintain and protect the water system, identify areas of risk for bacterial growth, and designate points for routine testing. The goal is to reduce the risk of *Legionella* growing within the system and, above all, to reduce the risk of a Legionnaires' disease outbreak.

FROM REDUCING RISK TO REMOVING IT

A management plan can only *reduce* the chance of an outbreak. Paired with JC 9465 and ORP control, the same program can move from risk mitigation to a zero-risk treatment protocol—eliminating *Legionella* and preventing its regrowth.

The Jenfitch Solution: JC 9465 Mineral Oxychloride ROS

JC 9465 is an advanced-oxidation formula of oxygen-chelated minerals stabilized in a water-based solution. It generates reactive oxygen species that oxidize microorganisms on contact—disrupting their chemistry so they cannot survive.

Unlike earlier advanced-oxidation processes, JC 9465 stabilizes the oxidizing reagent together with its catalyst, holding that reactivity in a steady state for a long shelf life without loss of potency. Because it acts in nanoseconds, *Legionella* has no time to sense a chemical attack and retreat. It destroys biofilm on every surface in contact with the water, wipes out the amoeba and protozoa that shelter the bacteria, and removes the algae and other microorganisms that feed them—then holds the longest residual protection on the market to prevent regrowth in stagnant water.

Controlled & Verified by ORP

Performance is monitored with a simple oxidation-reduction potential (ORP) meter—the industry-standard measure of a water's ability to remove contaminants. The higher the ORP, the more residual protection is available and the faster pathogens are removed.

PATHOGEN / INDICATOR	ORP < 485 MV	550–620 MV	> 665 MV
E. coli O157:H7	>300 s	<60 s	<10 s
Salmonella spp.	>300 s	>300 s	<20 s
Listeria monocytogenes	>300 s	>300 s	<30 s
Thermotolerant coliform	>48 h	>48 h	<30 s

Survival time at increasing ORP. An ORP of 600 mV is considered disinfected water; the WHO 1971 Drinking Water Guidelines set 650 mV as the recommended level for potable water. At +650 mV, a nationally recognized laboratory found Legionella was eliminated instantly.

CERTIFIED & GREEN

NSF/ANSI 60 certified for drinking water, EPA FIFRA registered (Est. No. 92945-1), USDA Organic certified, GRAS for direct food contact, and compliant with the EPA Green Chemistry program—with no toxic by-products.

NSF/ANSI 60 | EPA FIFRA Registered | USDA Organic | FDA GRAS | EPA Green Chemistry

Jenfitch, Inc. is the exclusive distributor of JC 9465. To discuss a Legionella prevention program for your system, contact us — **charles@jenfitch.com** • **www.jenfitch.com** • **(925) 289-3559** • 712 Bancroft Rd. #805, Walnut Creek, California 94598.