PUBLIC HEALTH • WATER SAFETY

Breaking the Chain of Legionellosis

A potentially fatal disease is spreading through the water systems around us. Jenfitch cuts the causative chain at its weakest link—destroying the biofilm where *Legionella* hides, with the mineral oxychloride chemistry of JC 9465.

Legionella pneumophila—the waterborne bacterium behind Legionnaires' disease and Pontiac Fever.

450%
RISE IN U.S. LEGIONNAIRES' CASES SINCE 2000

~90%
OF *LEGIONELLA* LIVE INSIDE BIOFILM, NOT THE WATER STREAM

6-log
REDUCTION IN UNDER 10 SECONDS AT ORP > +700 MV

What Is Legionellosis?

Legionellosis is the family of infections caused by *Legionella* bacteria. It ranges from Pontiac Fever—a mild, flu-like illness—to Legionnaires' disease, a potentially fatal pneumonia that frequently requires hospitalization.

The disease first drew public attention in 1976, when 221 attendees of an American Legion convention in Philadelphia fell ill and 34 died. The CDC identified the responsible bacterium in 1977 and named it *Legionella*. Nearly all human infections are caused by *L. pneumophila*. According to the World Health Organization, the overall fatality rate in Europe is about 12 percent—yet U.S. cases have grown nearly 450 percent since 2000.

The most common route of exposure is inhaling contaminated, aerosolized water droplets smaller than five microns. Showerheads and faucets, hot tubs, cooling towers, HVAC systems, and fountains all generate these aerosols. Those most at risk are people over 50, current or former smokers, and anyone with existing lung disease or a compromised immune system.

Cooling towers, HVAC and building plumbing generate warm, aerosolized water—the conditions *Legionella* thrives in.

Where the Risk Lives

Legionella is common throughout the environment in water and moist soil, but in nature it rarely reaches infectious levels. The danger begins when small amounts enter the complex water systems of large buildings, then multiply. It prefers warm, stagnant water—above 20°C (77°F) and below 50°C (122°F), with an optimum of 37°C (98.6°F), the temperature of the human body and of most hot tubs. Facilities with intermittent flow—hotels, hospitals, cruise ships, schools and campsites—are especially susceptible.

Why Biofilm Is the Weak Link

Microorganisms adhere to natural and man-made surfaces and colonize them as **biofilm**—a complex ecosystem of bacteria, algae and grazing protozoa that shields its inhabitants from temperature extremes and biocides. Areas of slow flow and stagnation encourage it to form, and about **90 percent of the *Legionella* in a water system lives within the biofilm** rather than in the water stream.

Legionella grown in biofilm is markedly more resistant than that grown in the liquid phase. Research at the Montana State University Center for Biofilm Engineering has found that as biofilms collect sediment and scale they become brittle and break off in fragments; when inhaled, these fragments are harder for the body to clear than single bacteria.

Biofilm also harbors amoebae. *Legionella* can infect an amoeba, feeding on its internal materials while gaining protection, then replicate until the host cell bursts and spreads the infection further. As a 2013 article in *Virulence* notes, amoeba can form protective cysts under unfavorable conditions, and bacteria grown inside them show changes in “biochemistry, physiology, and virulence potential,” including greater antibiotic and chemical resistance.

THE WEAKEST LINK

Because roughly 90% of *Legionella*—and its most resistant, amoeba-hardened forms—lives inside biofilm, controlling biofilm formation breaks the causative chain of Legionellosis.

The Breakthrough: JC 9465

To cause infection, *Legionella* must first multiply to sufficient numbers. Jenfitch controls that multiplication with **JC 9465**, a mineral oxychloride chemistry that mimics nature's ability to generate a very high concentration of reactive oxygen species (ROS)—hydroxyl radical ions and singlet oxygen ions.

The strength of an oxidizing biocide is measured by its electrochemical potential. Ozone measures about 2.07 volts and sodium hypochlorite just 0.94 volts, while JC 9465 reaches **2.7–2.8 volts**—more energy, and therefore faster disinfection. Its ROS react faster with microorganisms than chlorine can, succeeding in applications where chlorine alone has failed.

Jenfitch uses oxidation-reduction potential (ORP) to control biological growth. A study by Special Pathogen Laboratory confirmed that holding ORP above **+700 mV** achieves a 6-log reduction of *Legionella* in under 10 seconds—eliminating legionellosis in most systems in less than four hours.

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

Higher ORP, Fewer Survivors

In laboratory testing, raising the oxidation-reduction potential of the water steadily collapses the surviving bacterial population—until, above the disinfection threshold, no colony-forming units remain.

ORP LEVEL (MV)	CFU PER 100 ML OF WATER
+200	300
+300	36
+400	3
+600	**0 — water disinfection**
+800	**0 — water sterilization**

Special Pathogen Laboratory (PA): holding ORP above +700 mV achieved a 6-log reduction of Legionella in under 10 seconds.

From cooling water and plumbing to food, utilities and oil & gas—one microbial-control program, many systems.

One Solution, Many Systems

Biofilm prevention and removal belong in every general microbial-control program. Stopping the multiplication of *Legionella* does the same for other waterborne pathogens—reducing risks from organisms such as *Naegleria fowleri*, the "brain-eating amoeba," and *Salmonella*, which causes some 1.2 million gastrointestinal illnesses in the U.S. each year.

JC 9465 has been proven highly effective as a single oxidant in applications where chlorine alone has failed—including biofilm control, cooling water, pulp and paper, food and beverage, utilities, and oil and gas.

Jenfitch is one of the world's leading water-treatment companies, with a presence in Canada, Mexico, Australia, Korea, and across California, Texas and Florida. Our team brings hundreds of years of combined industrial water-treatment experience and a deep understanding of the complex, dynamic systems where *Legionella* grows.

THE BOTTOM LINE

By holding ORP above +700 mV, JC 9465 destroys biofilm and inactivates *Legionella*—a 6-log kill in under 10 seconds, clearing most systems in under four hours and breaking the causative chain of Legionellosis.

NSF Approved | EPA Registered Biocide | USDA Organic Registered | Proven Where Chlorine Failed

Talk to Us

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