

Designing a Multi-barrier Approach to Address Water Quality and Disease Prevention



PRESENTED BY:

Chris Ebener

Senior Engineer, LiquiTech

Healthcare Acquired Infections

10% of all
hospitalizations
result in an HAI



1,700,000
patients per
year acquire an
HAI



99,000 people
die annually
from an HAI



Average cost to
treat an HAI
\$45,000

\$33,000,000,000

***“Perhaps the most overlooked, important,
and controllable source of nosocomial
infections is hospital water”***

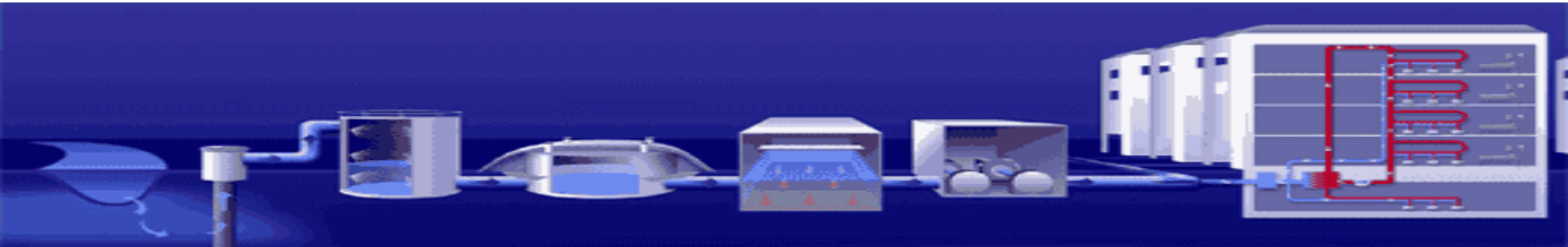
-American Medical Association



Where do waterborne pathogens come from?

- Naturally Occurring
- The Municipality does not claim to disinfect to the end user
- There is no such thing as ZERO
- Lines from municipality to facility may not be maintained

Low Flow + Warm Water + Biofilm = Optimal breeding ground for bacteria to flourish



Regulatory Concerns

DBP Regulation



Decreased Chlorine Levels



Chloramine Adoption

Disinfectant	Units	Inactivation		
		2-log	3-log	4-log
Chlorine ¹	mg · min/L	3	4	6
Chloramine ²	mg · min/L	643	1,067	1,491
Chlorine Dioxide ³	mg · min/L	4.2	12.8	25.1
Ozone	mg · min/L	0.5	0.8	1.0

CT values were obtained from AWWA, 1991.

¹ Values are based on a temperature of 10°C, pH range of 6 to 9, and a free chlorine residual of 0.2 to 0.5 mg/L.

² Values are based on a temperature of 10°C and a pH of 8.

³ Values are based on a temperature of 10°C and a pH range of 6 to 9.

Infrastructure Concerns

- Aging Infrastructure
- Sediment disturbance
- Increasing pH which affects disinfection residuals
- Corrosion inhibitor use increasing microbiological activity
- Green initiatives are increasing water age and velocity

pH	HOCL	OCL-
7.0	80%	20%
7.2	70%	30%
7.4	60%	40%
7.6	50%	50%
7.8	40%	60%
8.0	30%	70%



Common Waterborne Pathogens

Pseudomonas

- CDC estimates over 51,000 HAI's per year
- Classified serious threat in CDC Antibiotic Resistance Report

Mycobacterium

- Estimates of 3,500-17,500 cases per year
- Extremely chlorine resistant

Cryptosporidium

- 30% of US citizens will contract Cryptosporidiosis
- Extremely chlorine resistant

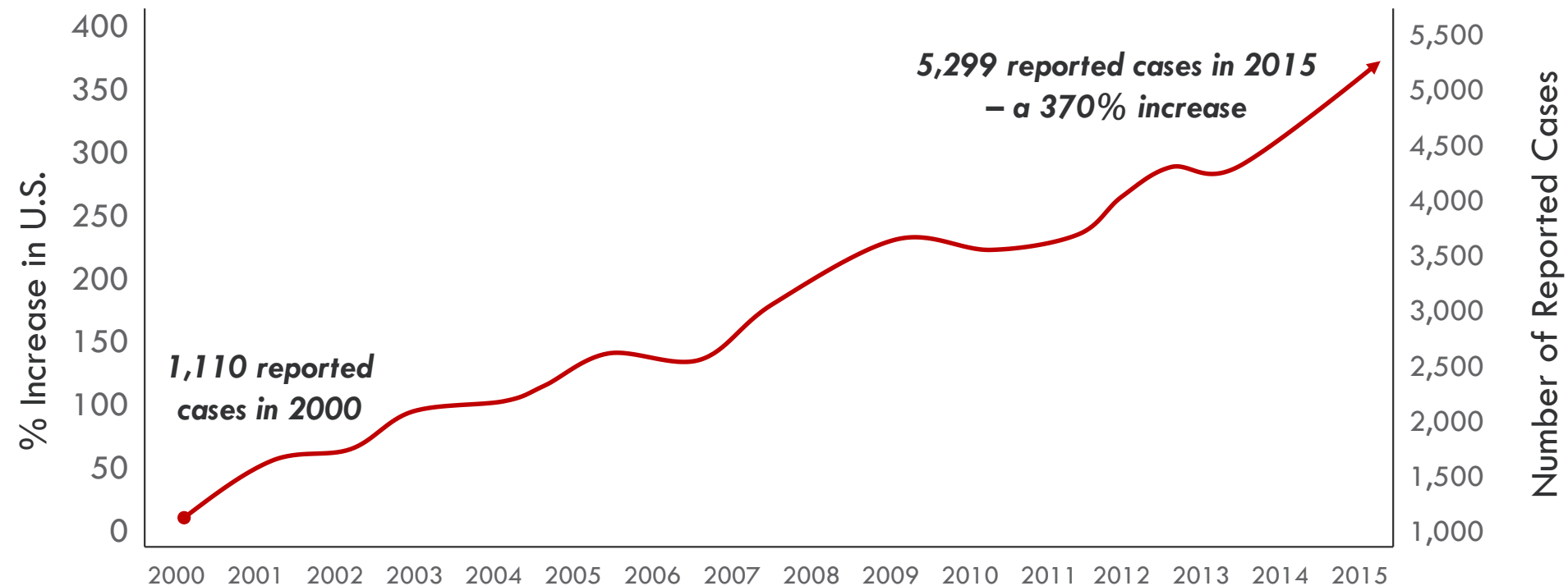
Giardia

- 10,000+ cases per year
- Extremely chlorine resistant

Legionella

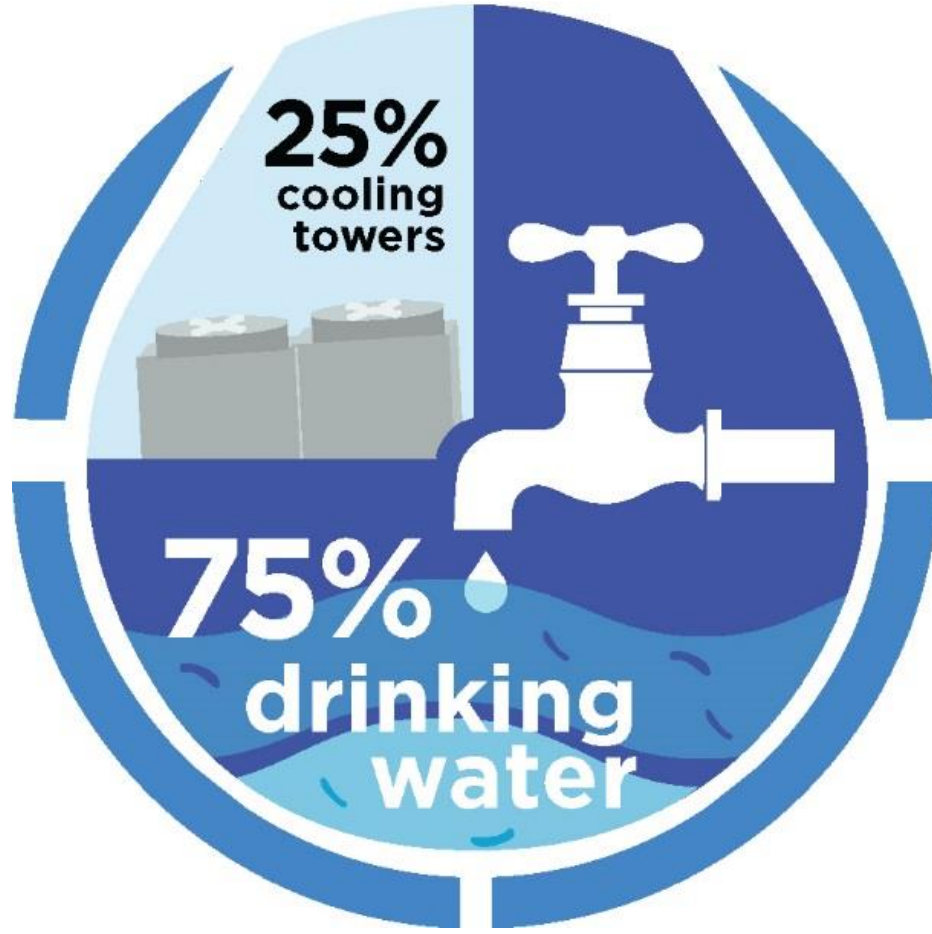
CDC - Legionnaires' Disease Increase

More than 40,500 cases reported over the past 15 years



Reference: CDC Weekly MMWR 2000-2015

Legionella Outbreak Sources



Drinking/Potable water is the main source of *legionella*

- Shower Heads
- Faucets
- Ice Machines
- Fountains
- Hot tubs
- Decorative fountains

Legionella can live & proliferate in a facility's water system at a wide range of temperatures

151 °F (60 °C)

- *Legionella* die in solution after 2 minutes

131 °F (55 °C)

- *Legionella* die after 5 – 6 hours

122 - 131 °F (50 - 55 °C)

- *Legionella* do not multiply

68 - 122 °F (20 - 50 °C)

- Ideal growth range for *legionella*

Below 68 °F (20 °C)

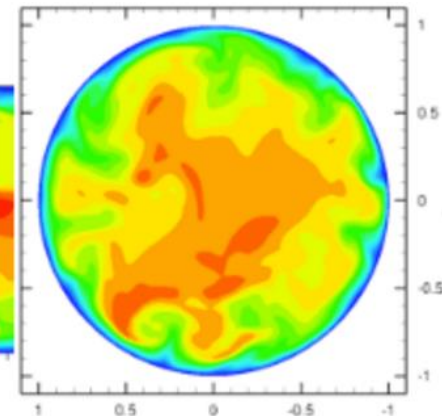
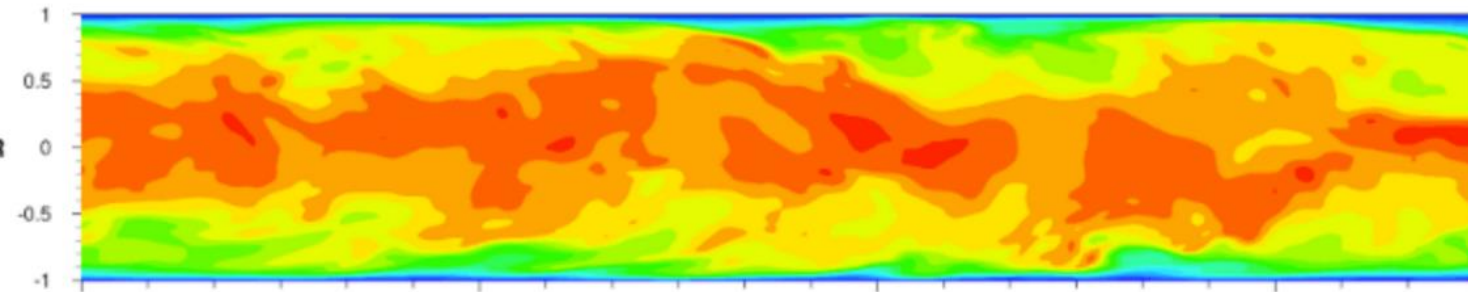
- *Legionella* survive, but are dormant

Distal sites become breeding ground for bacteria



Mechanics of High Temperature Regimen

- Impossible to maintain constant temperature throughout whole infrastructure due to stratification and heat loss
- Can not deliver water at scalding temperatures so location of water mixing becomes point of contamination and stagnation
- No residual protection
- Energy and maintenance intensive
- High capital cost on implementation



ASHRAE Standard 188 – Approved June 26, 2015

Legionellosis: Risk Management for Building Water Systems

Proactive approach to prevent Legionellosis
associated with all building water systems

A blue-outlined arrow pointing downwards from the first box to the second box.

Establishes a legal imperative to address *legionella*

A blue-outlined arrow pointing downwards from the second box to the third box.

Requires a multi-disciplinary approach

ASHRAE Standard 188 – Approved June 26, 2015

Legionellosis: Risk Management for Building Water Systems

Water Management Program

- Facilities will be required to develop a written document for their water management program.

Building Code Implications

- ASHRAE 188 is written in code ready normative language. It has been proposed for adoption into the International Plumbing Code & International Mechanical Code.

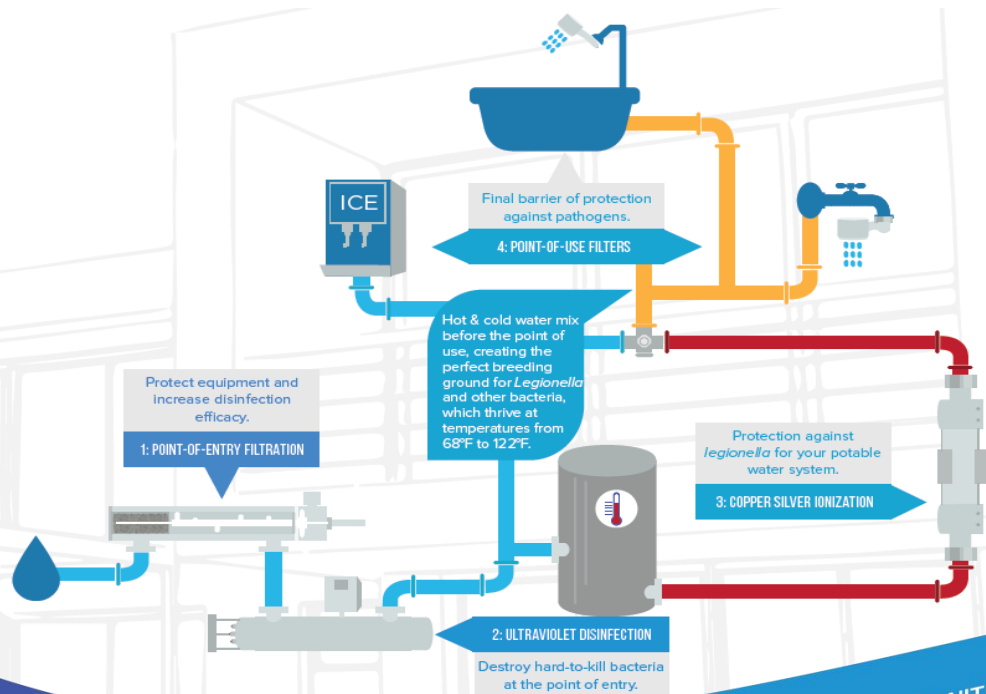
Litigation

- A legal imperative to address *legionella* in building water systems is now established. 188 will likely become the primary document which the standard of care is argued.

New York State Department of Health Regulations

- Incorporates the majority of ASHRAE 188
- Requires *legionella* Testing
 - ▣ Potable Required for Healthcare Facilities
 - ▣ All Cooling Towers
 - ▣ Requires action in the event of positivity
- Clients will be seeking assistance

Multi Barrier Approach



- Specialized mix of technology and service
- Protect your facility from point of entry to point of use
- Analytical approach to water management

WATER MANAGEMENT PLANS

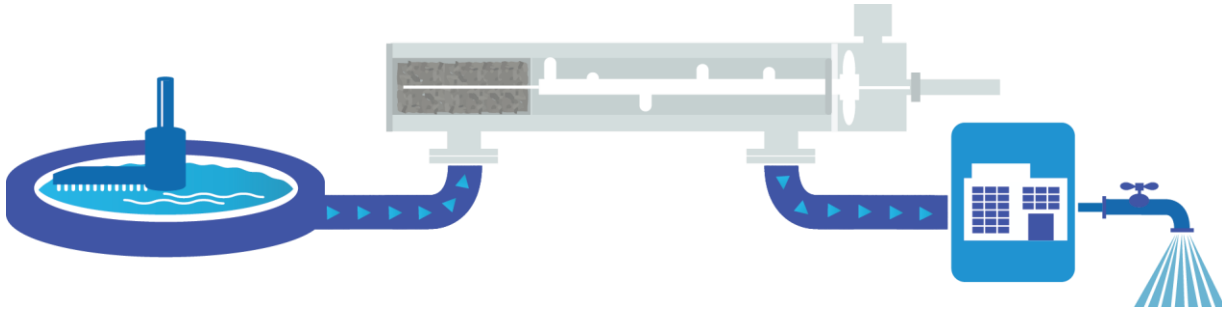
TESTING & VALIDATION

REAL TIME MONITORING

MAINTENANCE SERVICES

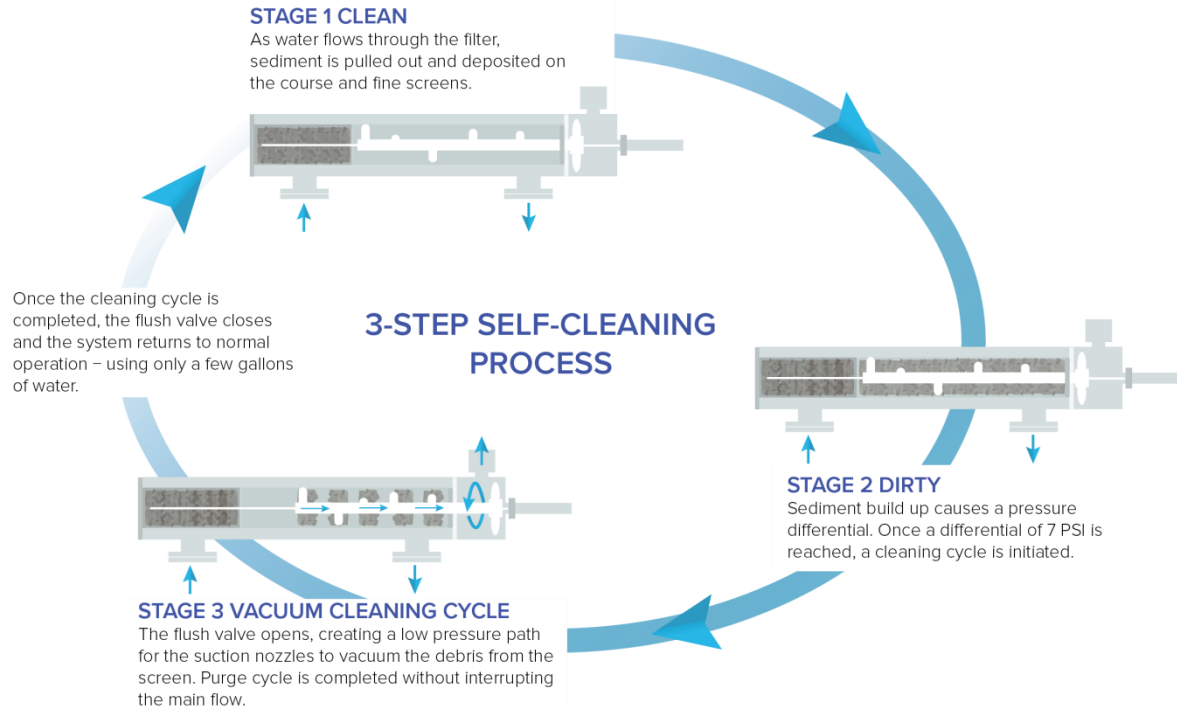
EMERGENCY REMEDIATION

Sanitary Point of Entry Filtration

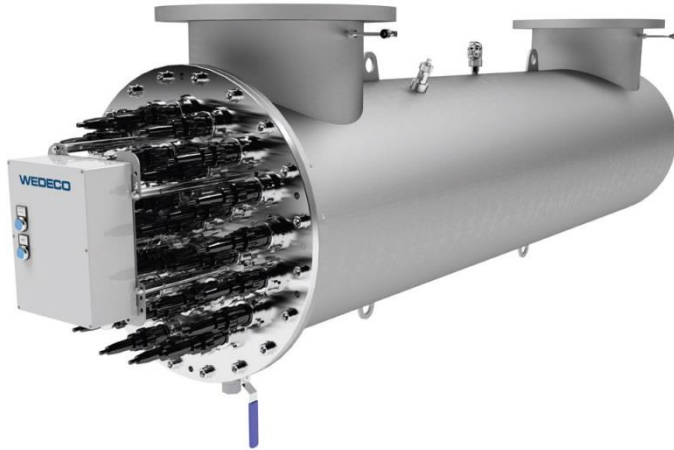


- Reduces sediment and corrosion particulate
- Low operation costs – no consumables required
- Continuous flow – no service interruption during backwash
- Eliminates build-up of nutrients and incubation of bacteria/biofilm

Sanitary POE Filtration

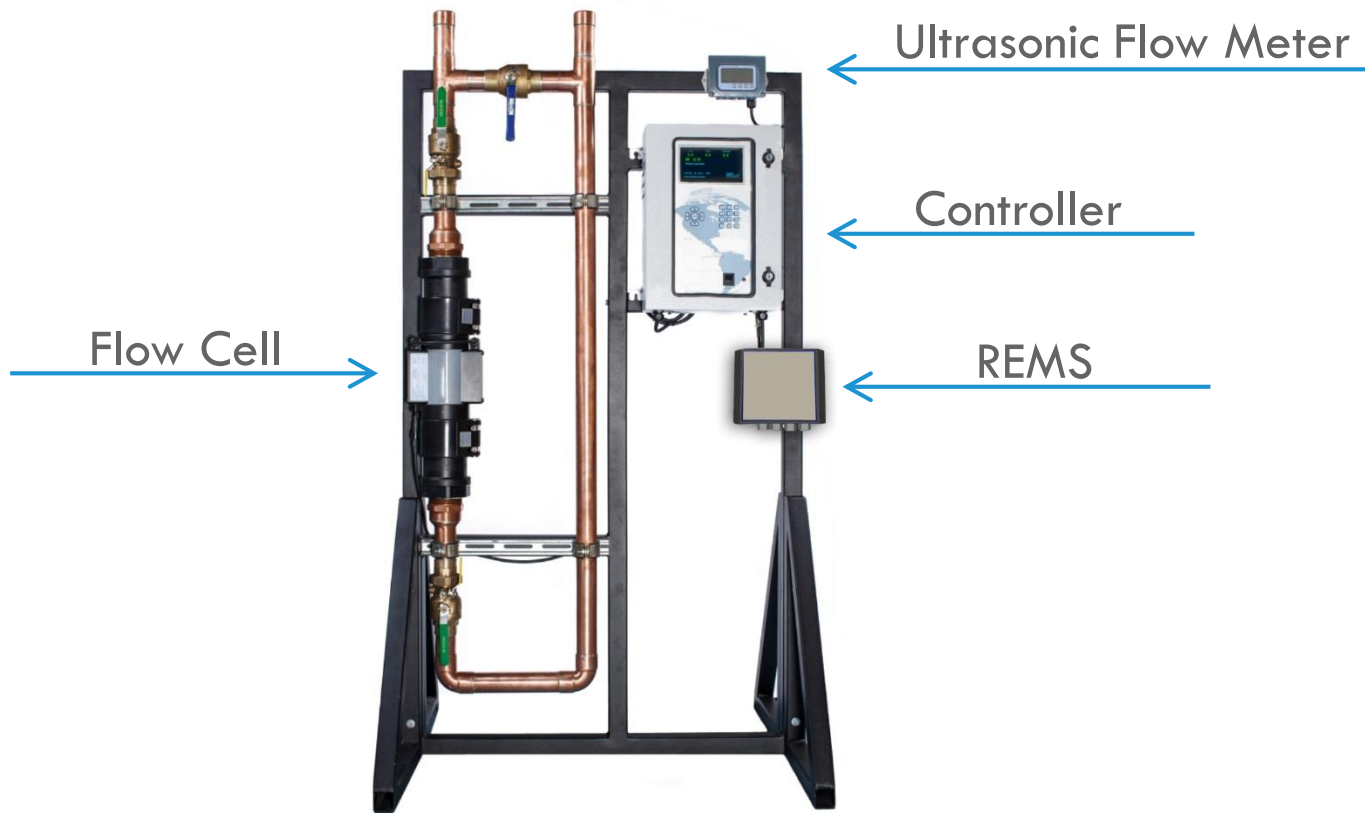


Ultra Violet Disinfection

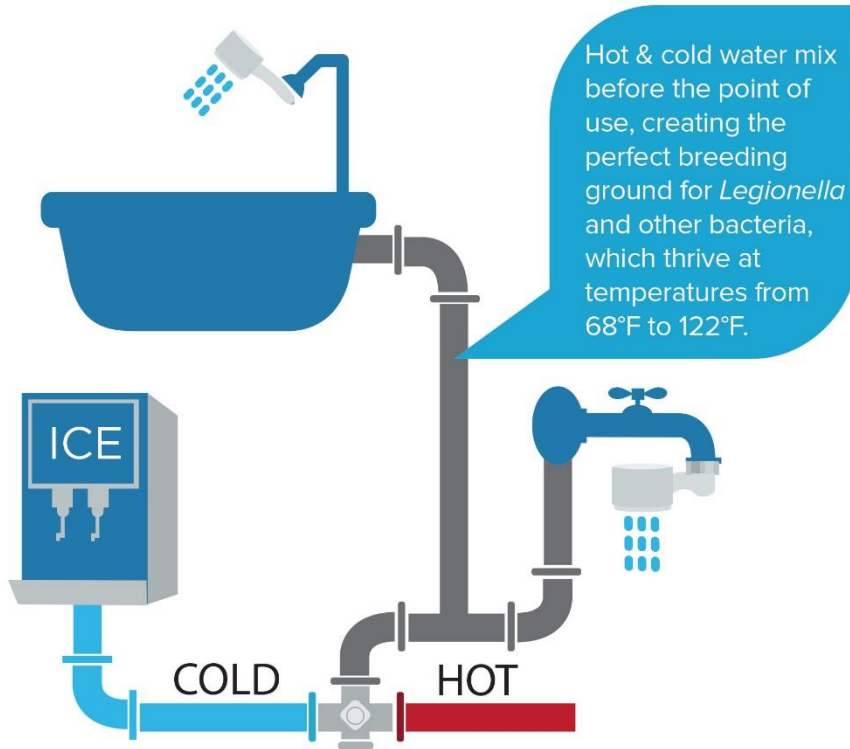


- First line of defense against harmful bacteria in your incoming water
- Inactivates broadest spectrum of microorganisms
- Energy efficient & requires minimal maintenance
- Not a standalone option – works best as part of a multi barrier solution

Copper Silver Ionization



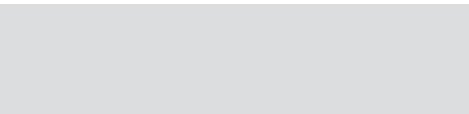
Point of Use Filters



- Instant protection against *legionella* and other waterborne pathogens
- Final barrier at the point of use for at risk populations
- Rapidly deployable in emergency situations
- Shower & Sink:
 - 70-day use
- Ice Machine
 - 90-day use

Waterborne Pathogens:

Achieve Systemic Protection with Copper Silver Ionization



Best Practices of Secondary Disinfection

Sustainability

- Systemic, long term solution for your facility that is also environmentally friendly

Consider Your Environment

- No detrimental effects to the immediate plumbing environment and the individuals it serves (patients, guests, employees, etc.)

Avoid Hazards

- No detrimental effects to the immediate plumbing environment and the individuals it serves (patients, guests, employees, etc.)

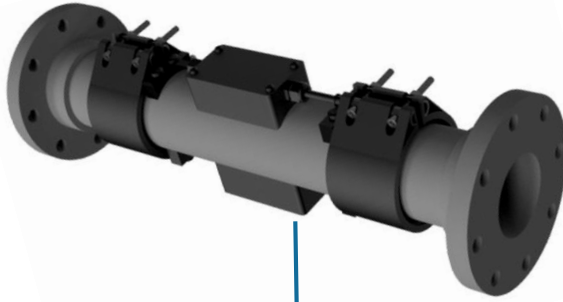
Select Vetted Technologies

- 30 year proven track record, EPA Registered, NSF Approved, ETL/UL Certified

Ionization System Components



Controller



Flow Cell



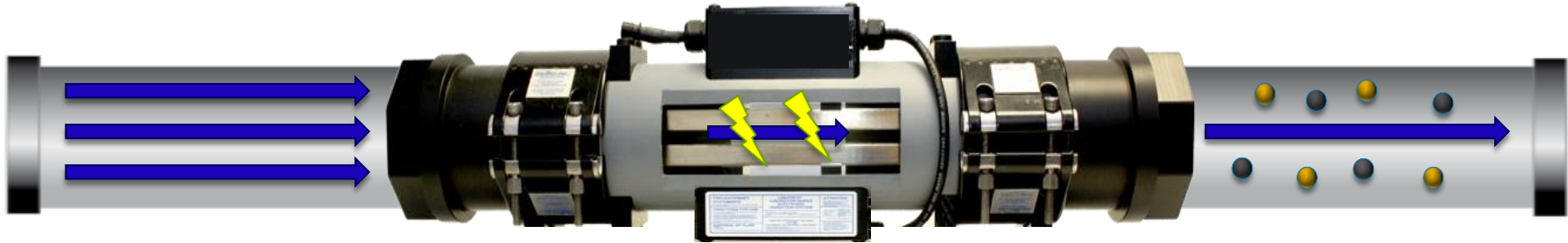
Flow Meter



REMS

Copper Silver Ionization: How It Works

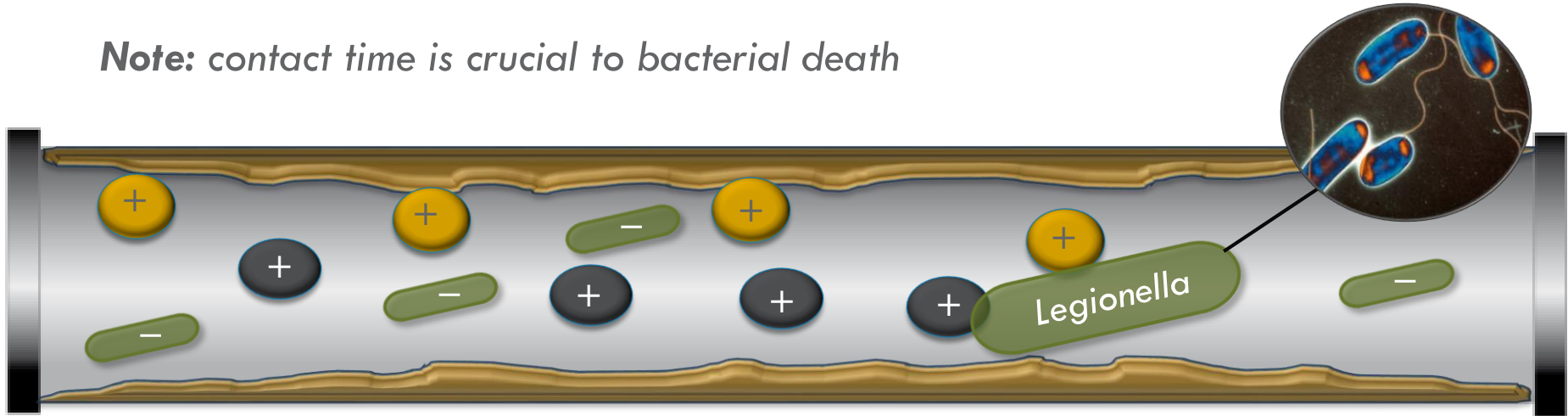
1. Water passes through the flow cell chamber
2. A direct current is applied across the electrodes, creating positively charged copper silver ions
3. The ions seek out bacteria throughout the entire plumbing system, providing on-going disinfection



Science & Technology of Copper Silver Ionization

4. The positively charged copper and silver ions are attracted to the negatively charged bacteria
5. Copper weakens the bacteria cell wall
6. Silver causes cell lysis (death)

Note: *contact time is crucial to bacterial death*



Validation: Target System Output Levels



Critical System Maintenance

Weekly

- Targeted distal site flushing

Monthly

- Exchange flow cells
- Clean electrodes
- Copper silver lab testing/validation

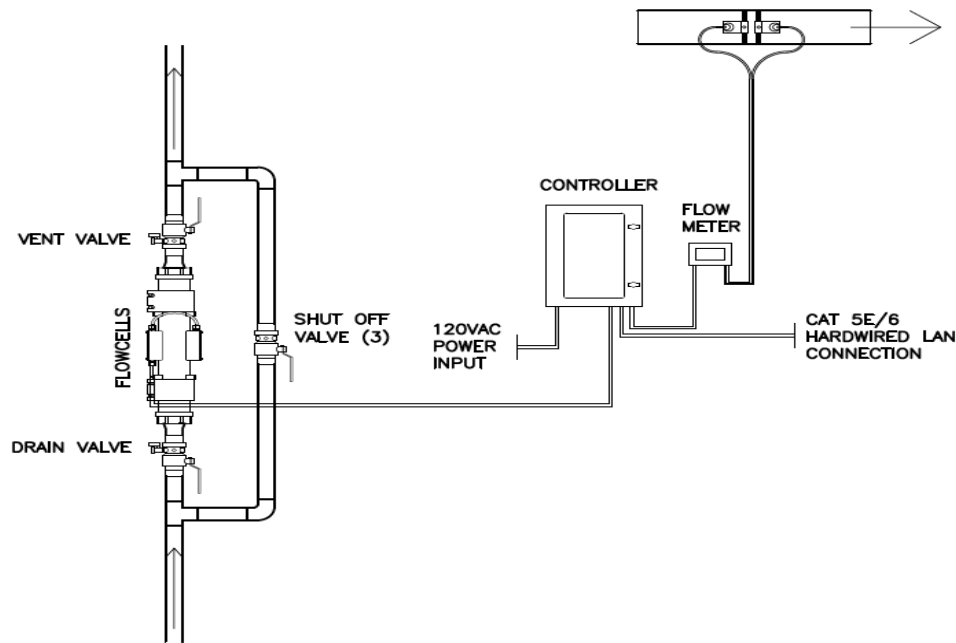
Quarterly

- *Legionella* lab testing/validation

Annually

- Flow cell evaluation by LiquiTech to determine if recalibration or electrode replacement is needed

Single Flow Cell Hot Water Installation



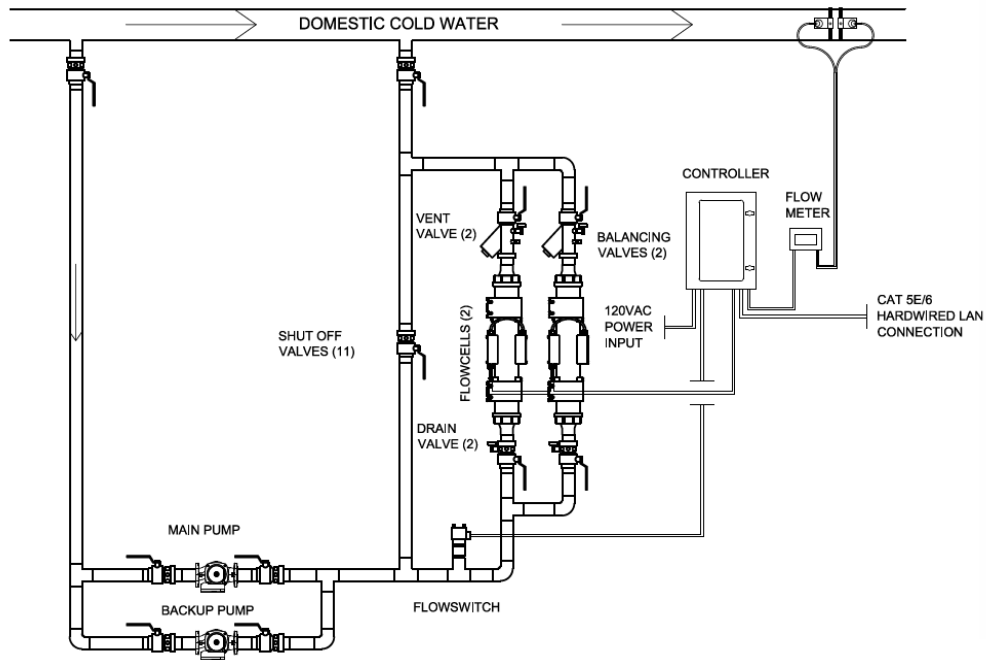
THE FLOW METER TRANSDUCERS WILL BE INSTALLED ON THE COLD WATER MAKE-UP TO THE INSTANTANEOUS HEATERS AND THE MIXING VALVE (IF USED)

THE FLOWCELL WILL BE INSTALLED IN THE HOT WATER RECIRCULATION LOOP PRIOR TO THE HOT WATER HEATERS.

FLOW THROUGH FLOW CELL IS NOT TO EXCEED 30 GPM. CONTACT LIQUITECH IF EXPECTED RATE EXCEEDS 30 GPM.



Point of Entry Installation



PUMPS CAPABLE OF SUSTAINING 15-25
GPM THROUGH THE FLOWCELLS



Water Safety is Fundamental

- Often overlooked, a lack of water safety takes more lives than fire in the US
- Proactive water disinfection is an essential asset protection program
- Proactive disinfection strategies will reduce liability exposure
- Protection of your most valuable assets – clients, patients, and brand



Protect your facilities with
Patient Quality Water

Questions?



Chris Ebener

Senior Engineer | **LiquiTech**
innovation in water security™

Phone: (630) 693-0500

Email: cebener@liquitech.net