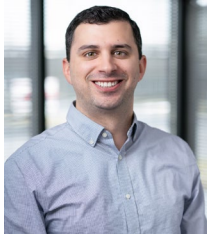


APIC VIRTUAL SYMPOSIUM · JUNE 2026

# Hidden Reservoirs: Inhibiting Transmission and Proliferation of Waterborne MDROs

Presented by LiquiTech | Water Management Specialists

# Today's Presenters



**Director –  
Water  
Safety  
LiquiTech**

## David Pierre

- ASSE 12080 Certified Legionella Water Safety and Management Specialist
- APIC Continuing Education Instructor
- ASHRAE SSPC Committee 188 Member
- ASPE Legionella Task Group Member

A peer-reviewed author of studies in the *American Journal of Infection Control*, the *Annals of Clinical Microbiology* and others, David has conducted hundreds of waterborne pathogen risk assessments and developed 300+ water management programs for hospitals and other large occupied buildings.



**Infection  
Preventionist -  
Riverside Doctors'  
Hospital**

## Heather Gutierrez

- MSI
- BSN
- RN
- CIC
- CHOP B

Heather serves as an infection preventionist for Riverside Health System in Williamsburg, VA. Her team's efforts contributed to a significant reduction in waterborne pathogen positivity, documented in the poster she presented at the APIC 2025 Annual Conference.



**Vice-President –  
Technical  
Solutions  
LiquiTech**

## Jack Murphy

- ASSE 12080 Certified Legionella Specialist
- APIC Continuing Education Instructor

An experienced water treatment leader, Jack specializes in Legionella risk mitigation and the application of innovative water system treatment programs for hospitals and health systems.

**LiquiTech**

3000+ sites

500+ clients

30+ years experience

## WHAT YOU WILL LEARN TODAY

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- The evidence linking sinks, drains and plumbing to MDRO transmission
- How waterborne pathogens persist and spread via these environments
- Essential requirements to minimize such risks
- How one hospital effectively reduced waterborne bacterial positivity

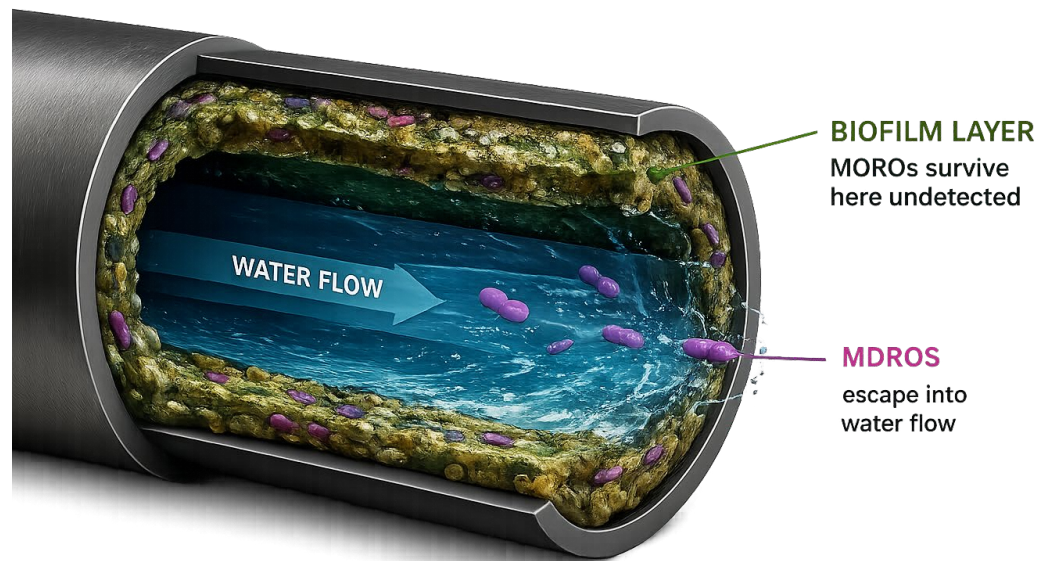
PART ONE

# The Hidden MDRO Reservoir

01

# What Grows Inside Hospital Pipes

Biofilm creates a living matrix inside every pipe — shielded from disinfectants, invisible to inspection, and impossible to remove with surface cleaning.



**1 meter**

splash radius of contaminated droplets from a colonized sink

**100%**

of hospital sinks have some biofilm

**≥1 MDRO**

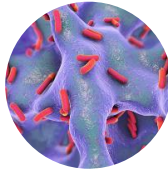
in 70% of ICU sink drains\*

# Common Pathogens Hiding in Your Pipes

All identified by whole-genome sequencing in hospital plumbing biofilm

## Pseudomonas aeruginosa

Most frequently linked



## CRE / Klebsiella

ICU outbreak driver



## Candida auris

Colonizes drain surfaces



## Legionella spp.

Same biofilm reservoir



## Acinetobacter

Wet & dry persistence



## E. coli (ESBL)

WGS-confirmed sinks → pts



PART TWO

# Transmission Mechanics

02

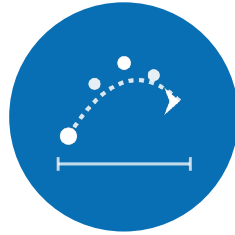
# How a Handwash Becomes a HAI



Water hits  
biofilm in drain



Splash creates  
aerosolized droplets



Droplets travel  
>1 meter from sink



Land on hands,  
equipment, surfaces



Contact with  
vulnerable patient

**120 cm**

**MAX SPLASH DISTANCE**  
detected for *Pseudomonas aeruginosa*

*"Contaminated droplets were detected on countertops, soap dispensers, and clinician hands."*

# The 1-Meter Risk Zone

Contaminated droplets reach surfaces — and clinicians — up to 1.2m from the drain

**≤30 cm**

Sink basin, faucet

**EXTREME**

**30–60 cm**

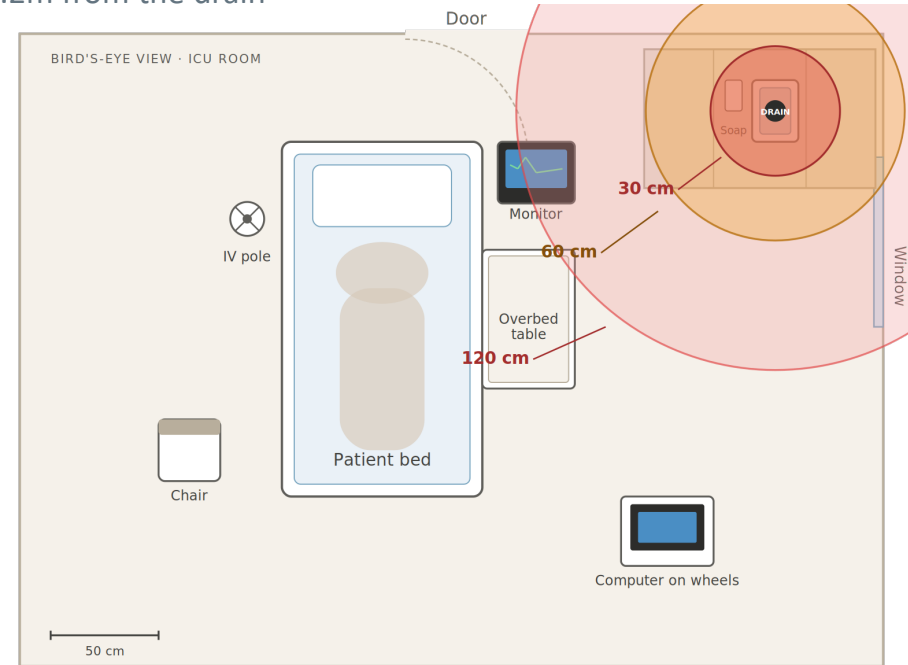
Counter, soap, monitor

**HIGH**

**60–120 cm**

Overbed table, bed rail, IV pole, clinician

**SIGNIFICANT**



PART THREE

# The Science

03

# The Evidence Is Clear

WGS-confirmed sink-to-patient transmission link is no longer circumstantial

2014

Univ. of Virginia

CRE *Klebsiella*

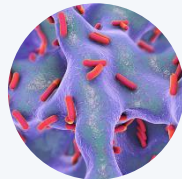


Sink removal stopped outbreak entirely

2017

Univ. of Pittsburgh

*Pseudomonas*



Bacteria traveled >1m via splash

2018

Oxford Univ.

*E. coli* / *Klebsiella*



WGS matched sinks to patient isolates

2020

Multi-center

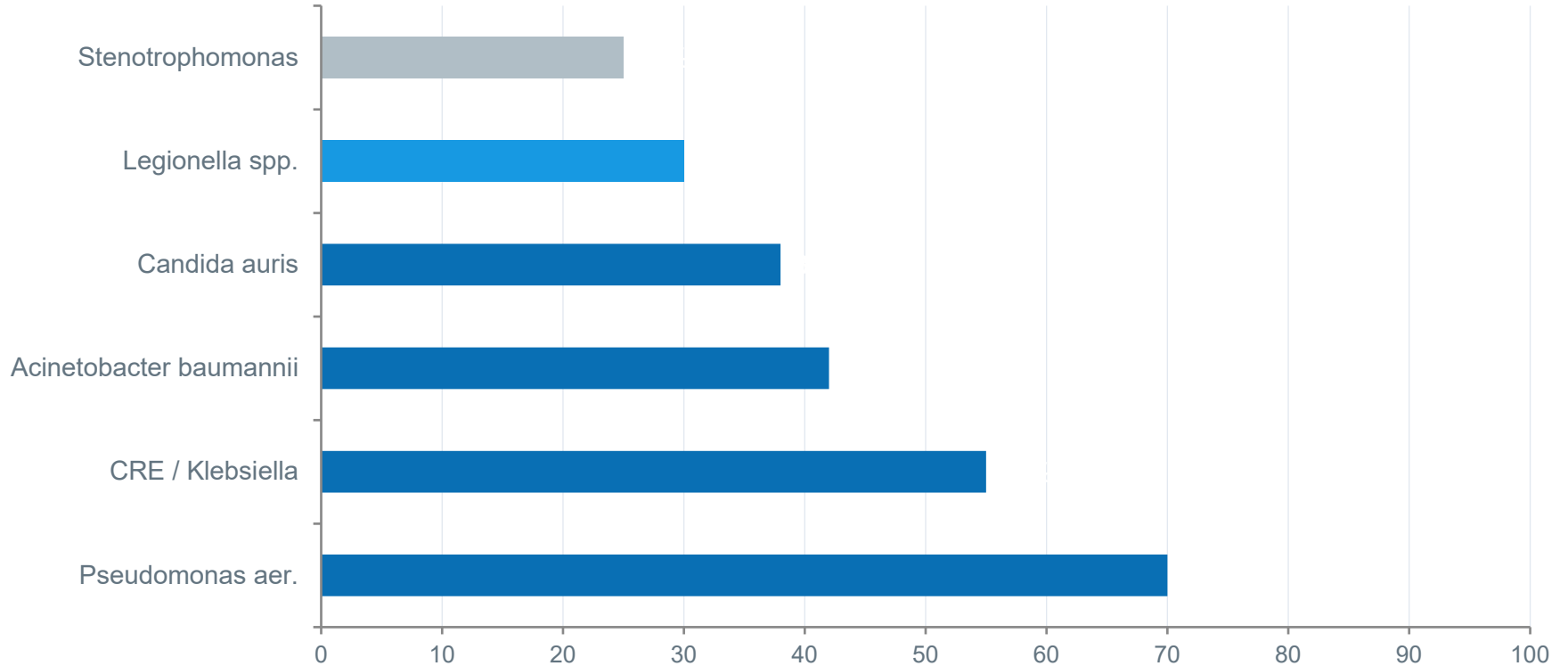
*Candida auris*



Drain colonization preceded ward outbreaks

# ICU Drain Positivity by Organism

% of ICU sink drains testing positive — multi-site surveillance



PART FOUR

# Why Standard Methods Fail

04

# The Vicious Cycle of Recurrence

Surface cleaning targets what's visible

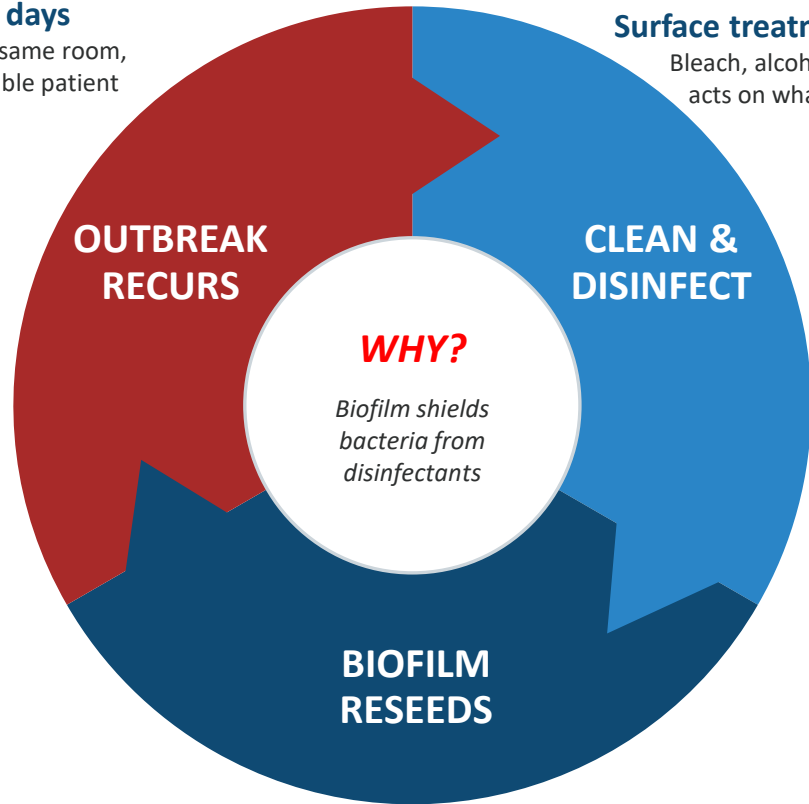
But MDRO reservoirs hide inside sinks, drains and pipes

## Patients re-exposed within days

Same MDRO, same room, same vulnerable patient

## Surface treatment applied

Bleach, alcohol, quats — acts on what's visible



## Upstream pipe repopulates reservoir

Hidden biofilm reseeds the sink, drain or pipe in hours

# 3 Reasons Traditional Approaches Fall Short

01

## Can't Reach It

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### Biofilm

lives in P-traps & horizontal runs

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Disinfectants applied to visible surfaces never reach the protected biofilm layers deep inside drainpipes.

02

## Can't Kill Through It

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### Chemical

residuals degrade before depth

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Oxidant-based chemicals lose efficacy at higher temps and in stagnant water — exactly where biofilm thrives.

03

## It Just Comes Back

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### Upstream

pipe reseeds the drain in days

---

Even after aggressive disinfection, organisms migrate back from untreated upstream sections — restarting the cycle.

PART FIVE

# The Path Forward

05

# 5 Criteria for an Effective Solution

Ask your water treatment vendor these questions

## 1 Define Efficacy

*"What does 'effective' mean?"*

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The 30% positivity benchmark reflects the limits of oxidant chemistry — not what's actually achievable. Demand higher.

## 2 Target Non-Detect

*"Can you achieve non-detect for Legionella?"*

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Non-detect is achievable. If a vendor says otherwise, ask why.

## 3 Address Sediment

*"Does it filter as well as disinfect?"*

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Sediment acts as food and shelter for bacteria — filtration must be part of the treatment, not an afterthought.

## 4 Minimize Corrosion

*"What does it do to equipment?"*

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Oxidant chemicals corrode autoclaves, endoscope processors, and dialysis machines. Get the data.

## 5 Avoid Chemical Risk

*"Does it require hazmat handling?"*

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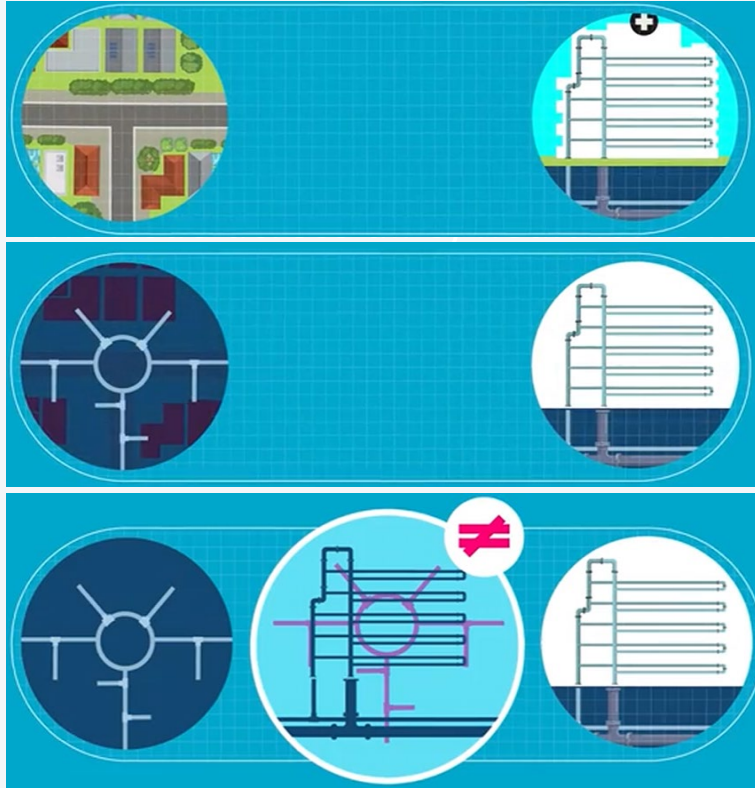
If yes — hazmat suit, blast-proof storage, special ventilation — proven non-oxidant alternatives exist.

# What 'Better' Looks Like

METRIC	INDUSTRY 'STANDARD'	ACTUALLY ACHIEVABLE
Definition of water management success	Compliance	Performance
Waterborne Pathogens Targeted	Legionella	Broad Spectrum
Pathogen detection at point of use	Detectable	Non-detect
Sediment in treatment zone	Present	Filtered out
Mechanism for bacterial control	Single	Multiple, Independent
Hazardous chemical handling required	Yes	No

# **LiquiTech Multi-Barrier – Water Treatment Designed for Hospitals**

# The Problem: Municipal Water Is Not Designed for Healthcare



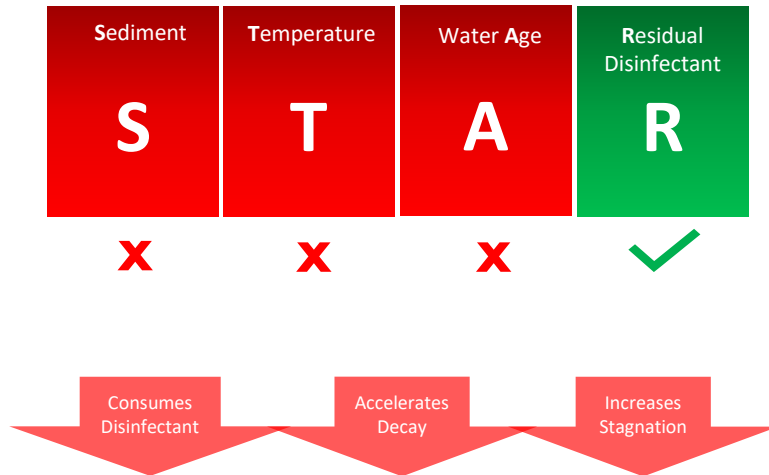
## WHY IT MATTERS

- Hospitals draw from infrastructure built for residential use
- But municipal water systems were not designed for healthcare
- Water that enters the building clean, but is transformed inside by distance, heat, sediment, and stagnation
- Pathogen amplification risk starts the moment water crosses the facility threshold.

# Why Treatment Approaches Produce Different Outcomes

Legionella Control Depends on Managing All Four STAR Variables – Not Just Disinfectant Strength

## Oxidant-Based Programs



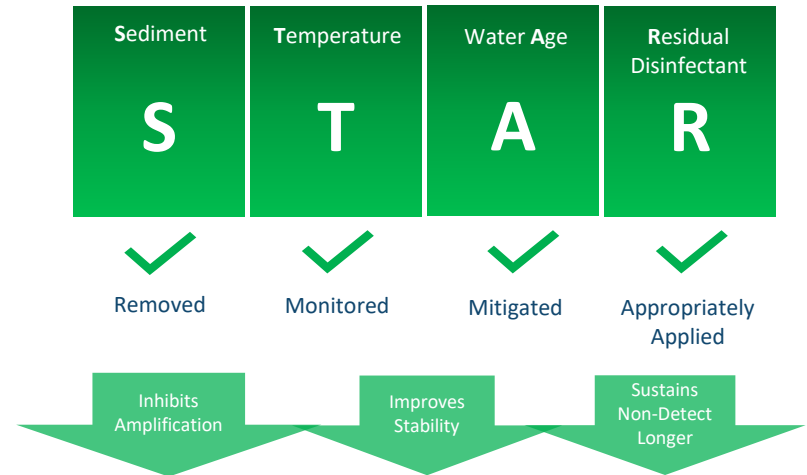
### Reactive Control

Higher Risk of Recurrence

Performance depends on factors it can't control

Higher dose ≠ proportionate impact

## LiquiTech Multi-Barrier



### Structural Control

Higher Probability of Sustained Non-Detect



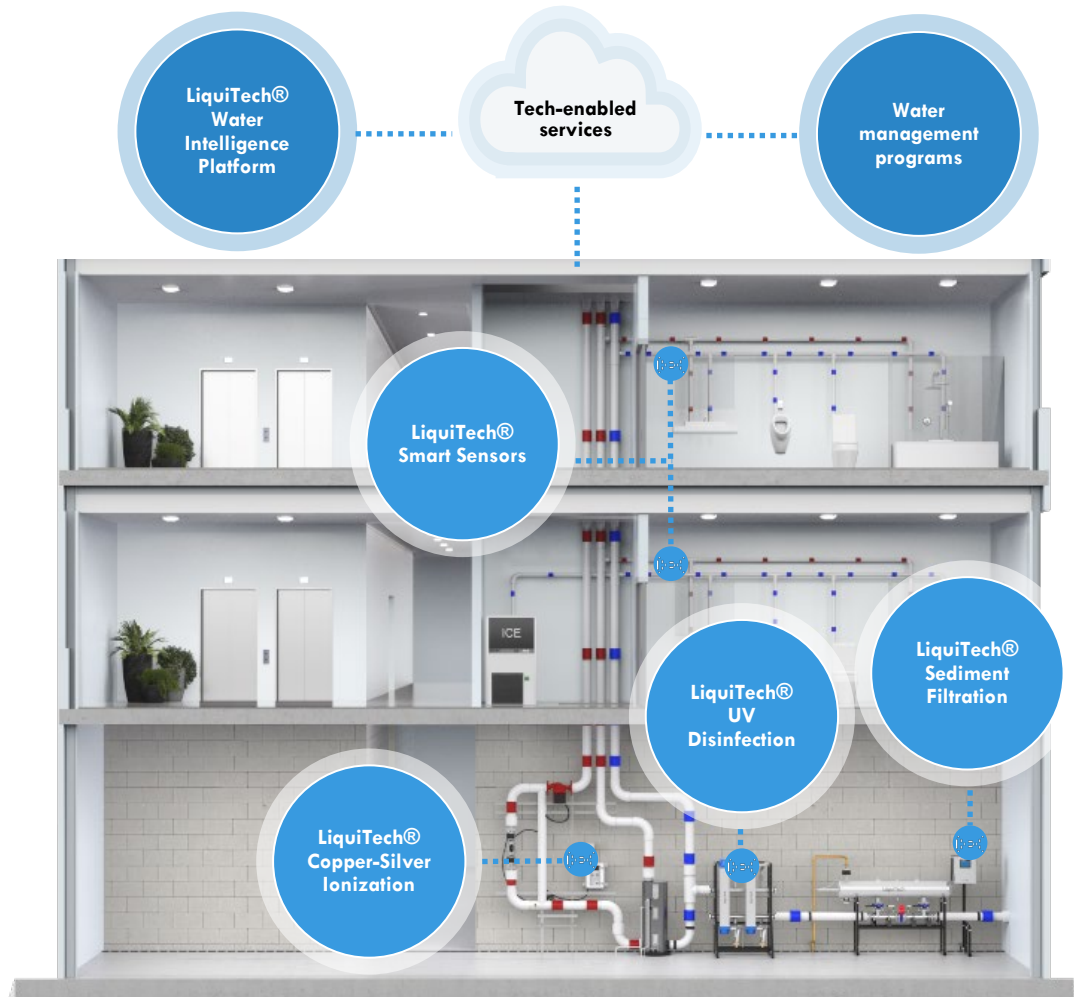
# Compliance-Based vs Performance-Based Programs

Compliance-Based Goal = Meet Standards, Performance-Based Goal = Achieve Control

	Compliance-Based	Performance-Based
Model	Detect and respond	Prevent and stabilize
Focus	Documentation Sampling Response thresholds Regulatory defensibility	Controlling sediment Stabilizing water Reducing water age Applying resilient residual
Compliant	Yes	Yes
Stabilizes system drivers	No	Yes
Controls amplification drivers	No	Yes
Detects or prevents problems	Detects	Prevents
Performance depend on sampling frequency	Yes	No
Performance depends on operational consistency	Yes	No
Performance depends on disinfectant response	Yes	No
Retrospective or Prospective	Retrospective	Prospective
Outcome	Can achieve compliance while still experiencing recurrence	Sustained control becomes structural

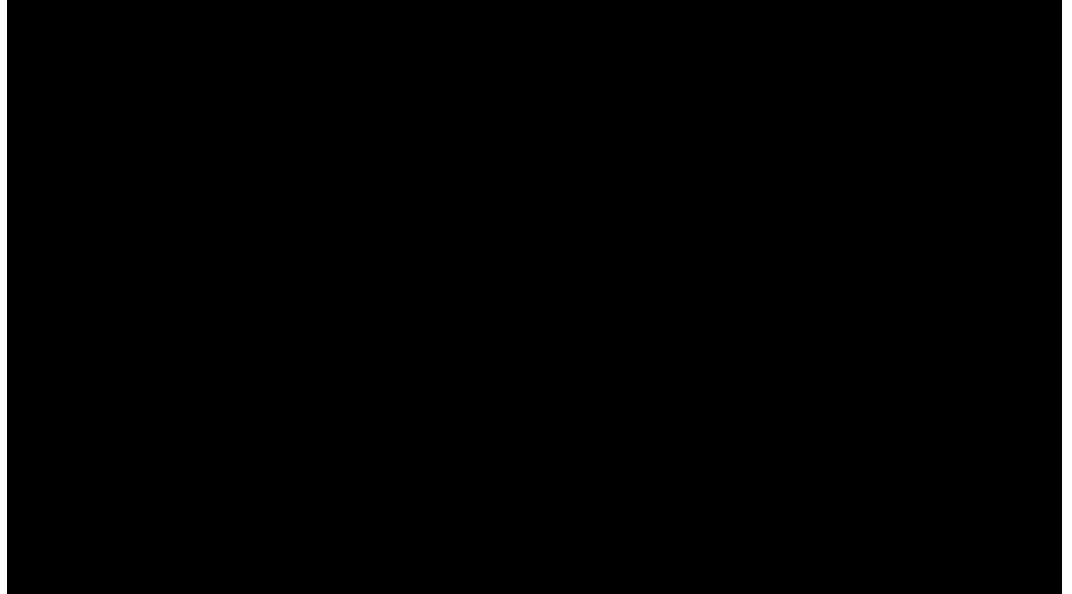
# Principles of a Multi-Barrier Approach

- Designed specifically for use in complex building water systems
- Built to address the root conditions that allow waterborne pathogens to persist and amplify
- Combines multiple independent mechanisms to
  - attack organisms
  - remove microbial support conditions
  - reduce recolonization potential
- Delivers real time monitoring and actionable intelligence to reduce labor drive outcomes



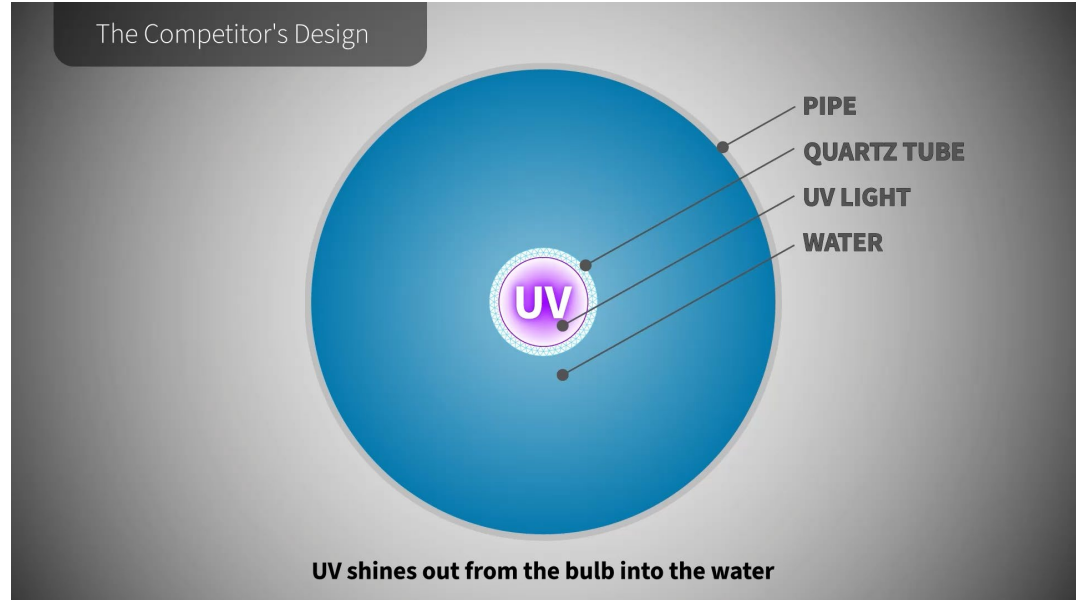
# LiquiTech Sediment Filtration

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- Eliminates up to 97% of sediment at the point of entry
- Self-cleaning filters remove corrosive material + food and shelter for bacteria

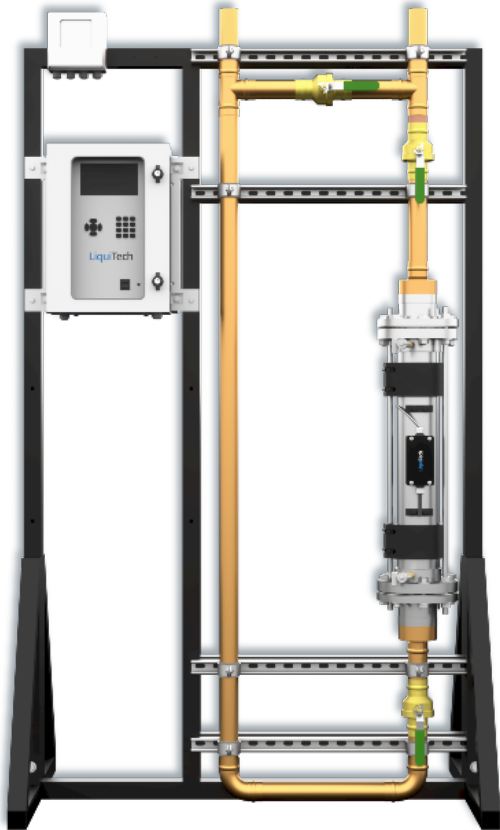
# LiquiTech UV Disinfection



- Initial bacteria kill at point of entry
- 100% exposure to UV light can kill 99.9999% of bacteria that contribute to waterborne pathogens

# LiquiTech Copper-Silver Ionization

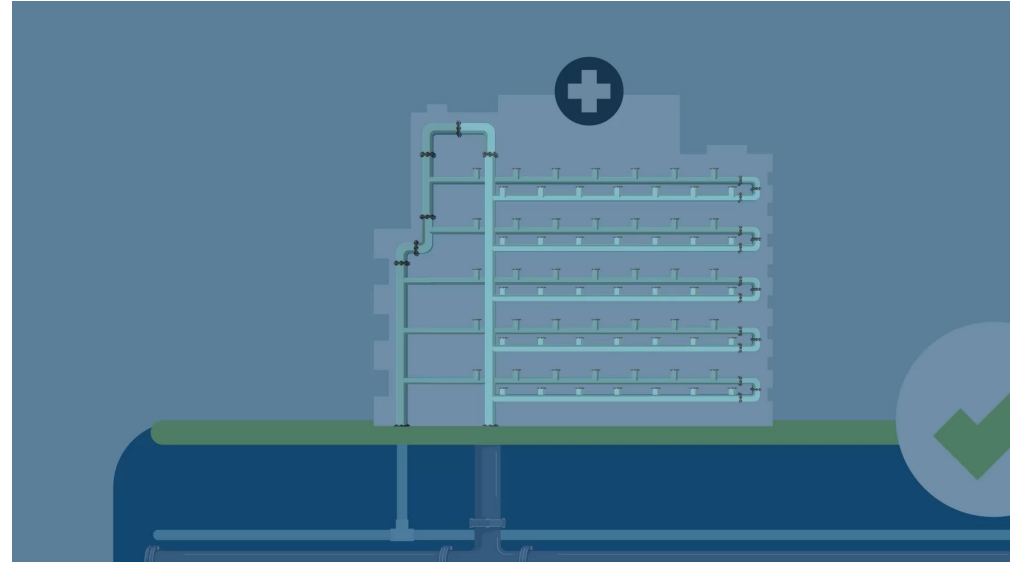
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- Non-toxic, ongoing bacterial kill
- Reduced corrosion of pipes and equipment vs oxidant chemicals

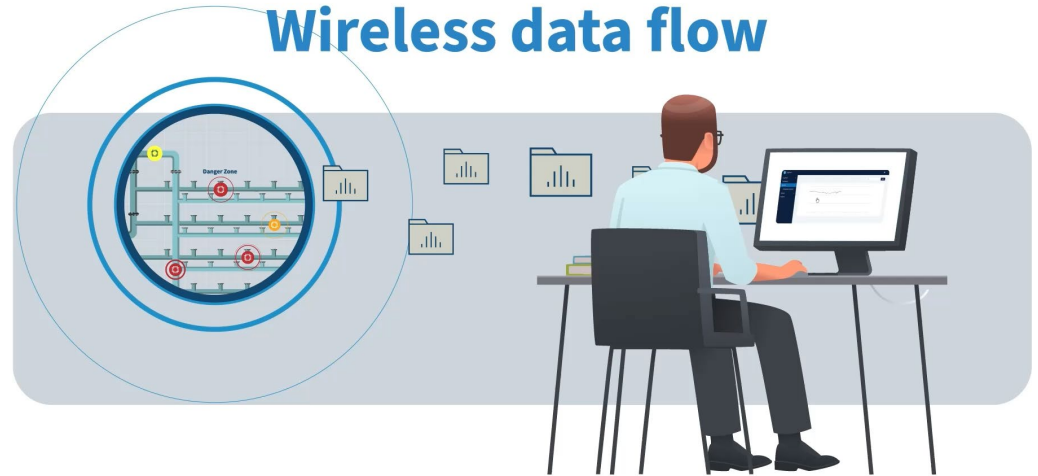
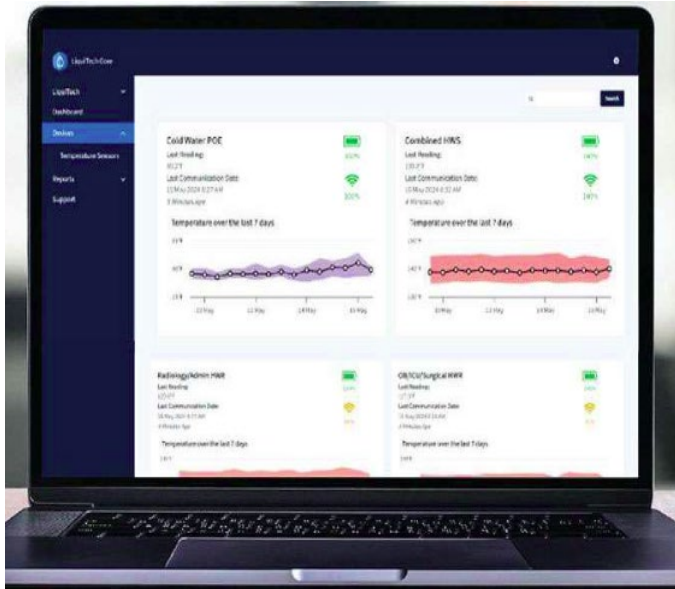
# LiquiTech Smart Sensors

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- Real-time monitoring
- Location specific ranges based on site-specific observations

# LiquiTech Water Intelligence Platform



- User-friendly dashboard display
- Actionable insights on flow rate, source water quality, energy usage, temperature, equipment failures and more

# Proven the Most Effective for Cost and Outcomes

Observed effectiveness  
of LiquiTech's solution at  
client sites

Hundreds of health systems  
nationwide rely on LiquiTech

**100%**

of LiquiTech multi-  
barrier sites achieved  
legionella non-detect

**20%**

1 in 5 HAIs are caused  
by waterborne  
pathogens

**100%**

of Legionella  
infections are caused  
by waterborne  
pathogens

**-97%**

reduction in sediment  
levels observed with  
LiquiTech sediment  
filtration

**\$2M**

spent by one site on unsuccessful  
chlorine-based remediation before  
achieving 100% legionella non-  
detect with LiquiTech

**\$3M**

average wrongful  
death lawsuit  
settlement for  
Legionnaire's Disease

# Case Study – Riverside Doctors' Hospital

# Riverside Doctors' Hospital

- 40-bed nonprofit acute care hospital
  - Riverside Health System
- Williamsburg, VA
- DNV Certified Primary Stroke Center
- DNV Advanced Hip and Knee Certified
- Geriatric ED–accredited
  - first in Virginia
- Leapfrog “A” safety grade
- Modern, patient-centered campus on 25+ acres



# Background

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## Implementation of Copper Silver Ionization to Control Legionella in a Community Hospital Water System

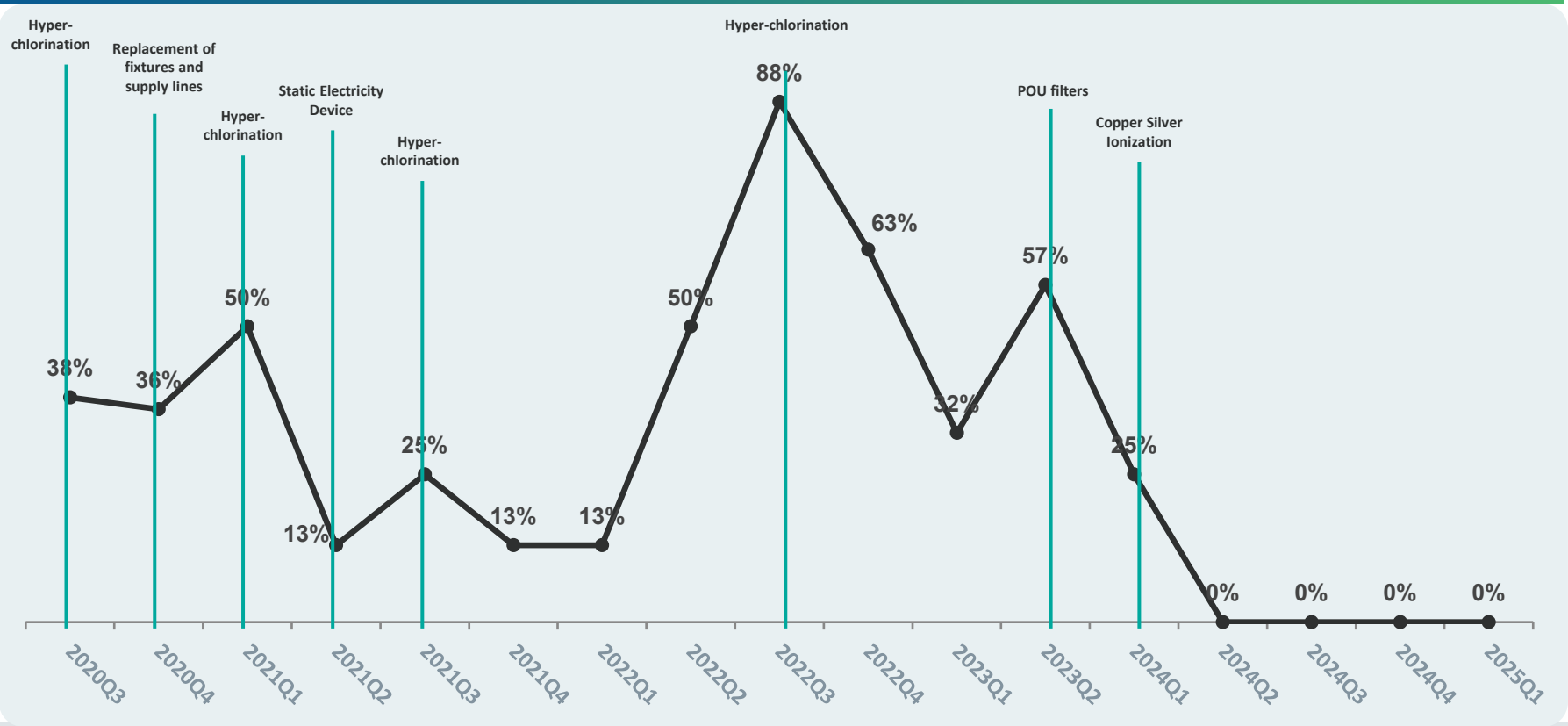
### Overview

- Legionella is a waterborne bacterium capable of causing Legionnaires' disease through aerosolization from showerheads, faucets, cooling towers, and decorative fountains
- Multiple mitigation strategies were attempted at this community hospital beginning in 2019, including flushing, hyper-chlorination, AM radio wave devices, friction/static electricity devices
- Legionella persisted at 13–88% positivity

### Problem Statement

- Proactive surveillance detected low-level Legionella in hospital water systems from 2019 onward
- Despite repeated reactive interventions, percent positivity remained variable and persistently elevated
- A more effective, sustainable solution was needed to achieve consistent Legionella control

# Results – Percent Positivity – Timeline of Events



# Methods

Multidisciplinary approach, staged technology deployment, and systematic monitoring

## Trigger & Decision

Q2 2023 revealed the highest Legionella concentrations recorded, prompting closure of a patient room and formation of a multidisciplinary team (IP, administration, quality, facilities, water management vendor)

Literature review led to selection of copper silver ionization as the preferred technology

## Technology Deployed

Copper silver ionization system installed on the coldwater system — October 2023

Sediment filtration system installed in a staged process alongside the ionization system

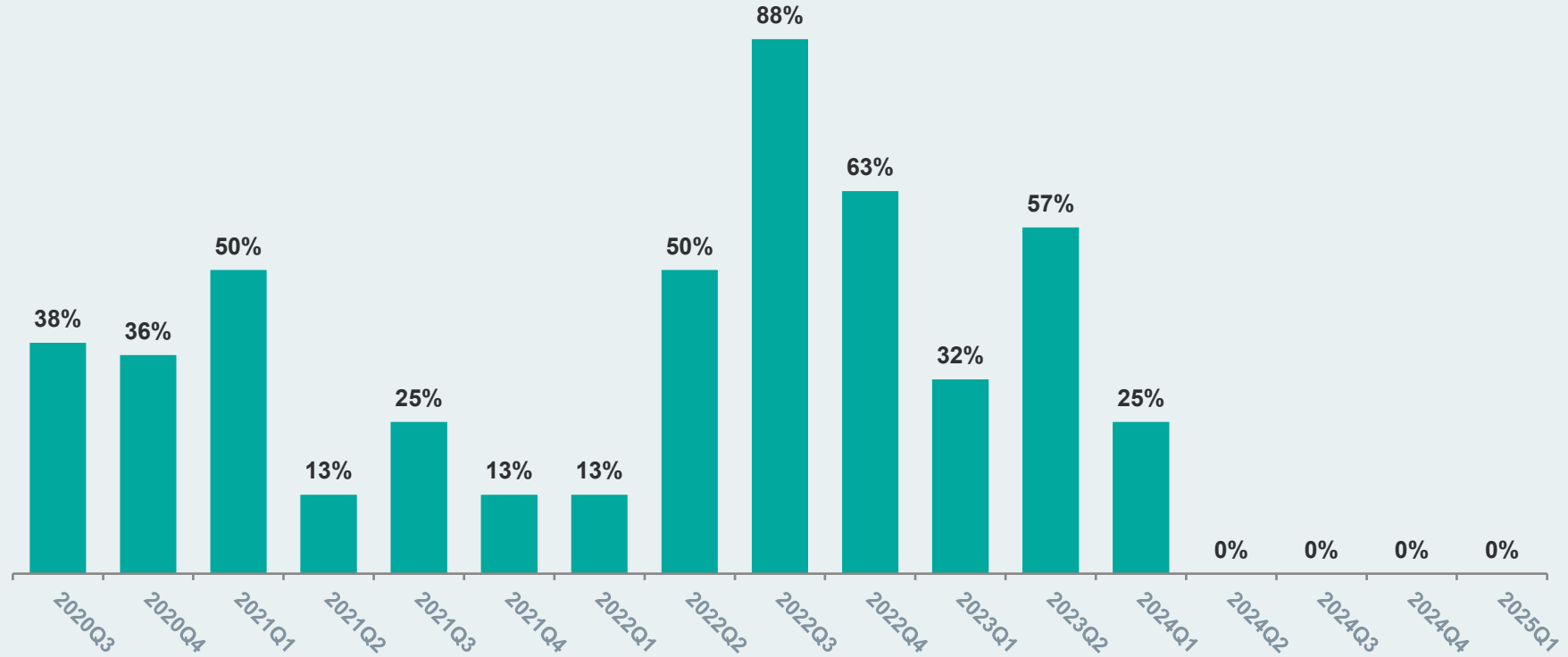
## Sampling Protocol

Copper silver ionization system commissioned — January 2024

Quarterly testing conducted: 8 samples per quarter from two randomly selected locations (hot and cold water)

Pre- and post-intervention percent positivity compared to evaluate effectiveness

# Results – Percent Positivity



# Conclusion

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## Copper silver ionization and sediment filtration delivered sustained Legionella control


- Copper silver ionization combined with sediment filtration demonstrated promising and sustained results — achieving Legionella non-detect across all samples since Q2 2024
- Continued sampling is recommended to confirm long-term effectiveness and monitor for any recurrence
- Legionella can persist in facility plumbing systems despite implementation of multiple conventional mitigation strategies

### Reference

- U.S. Centers For Disease Control and Prevention. (2024, March 15). Public health strategies for Legionella control. <https://www.cdc.gov/control-legionella/php/public-healthstrategy/index.html>.
- United States Environmental Protection Agency. (2016, September). Technologies for Legionella Control in Premise Plumbing Systems: Scientific Literature Review. <https://www.epa.gov/sites/default/files/2016-09/documents/placeholder.pdf>.

### Acknowledgements

- Water management vendor and the quality, facilities, and hospital administration team for their support and collaboration on implementation of the copper silver ionization and sediment filtration system



# Your Water System Is Either a Risk or a Resource.

LiquiTech partners with infection prevention teams to address MDROs at the source  
the source — treating the full plumbing system, not just the visible surface.

# What Are Your First Steps?

*Water is an unseen risk -- and an overlooked opportunity. Here's your action agenda.*



## Assess

- 1) Meet with your Facilities team
- 2) Plan and execute a facility-specific water risk assessment
- 3) Identify your STAR variable gaps (not just what's in your current water management plan)



## Define

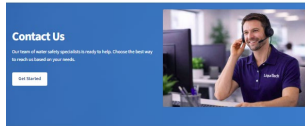
- 4) Set outcome-based targets.
- 5) Define CFU thresholds.
- 6) Develop and deploy process to document corrective action protocols.



## Quantify

- 7) Illustrate clinical and financial impact potential to leadership
- 8) Implement or upgrade your building-level water management solution to one that addresses all four drivers of water instability.

# Reach Out



Choose your contact path

<b>Emergency Remediation</b> Immediate response to significant distress or immediate safety concerns	<b>Sales &amp; Solutions</b> Get help with existing equipment or explore available technology solutions	<b>Technical Support</b> Get help with existing equipment or system troubleshooting
<a href="#">Contact Us Now</a>	<a href="#">Request Consultation</a>	<a href="#">Get Support</a>

General Inquiries

Name:

Business:

City/State:

Phone:

Website:

How can we help?

[Submit](#)

[www.liquitech.com](http://www.liquitech.com)

# Download

### Choosing the Right Water Treatment Solution

Traditional water treatment isn't designed for high-moisture or saline systems, and it's not the best for your facility.

### 5 Questions Hospitals and Health Systems Should Ask

- 1. Clarify Performance Standards – Don't Settle for Generalities**  
How do you define "effective" disinfection? How have you measured your disinfection? Can you show us proof of the effectiveness of your disinfection process? How do you measure the effectiveness of your disinfection process? How do you measure the effectiveness of your disinfection process?
- 2. Don't Set Your Goals Too Low**  
Can you get your new disinfection technology to meet the same standards as your existing disinfection technology? How do you measure the effectiveness of your disinfection process? How do you measure the effectiveness of your disinfection process?
- 3. Sediment – Understand and Address its Impact**  
Sediment is a common problem in hospitals and health systems. It can cause equipment to fail and can be a health hazard. How do you measure the effectiveness of your disinfection process? How do you measure the effectiveness of your disinfection process?
- 4. Corrosion – Clarify How Much You Can Expect**  
Is your disinfection technology causing corrosion? How do you measure the effectiveness of your disinfection process? How do you measure the effectiveness of your disinfection process?

*Healthcare Leaders – Key Questions Guide for Water Treatment*

[www.liquitech.com/news](http://www.liquitech.com/news)

# Join Us



Upcoming events

- APIC 2026 - Nashville, TN, June 15-17
- ASHE 2026 - Minneapolis, MN, Aug 2-5

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# Thank You

Questions & Discussion

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