

Healthcare Facility Management Society of New Jersey

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***AN INTEGRATED
SOLUTION TO
MITIGATING
WATERBORNE
HOSPITAL ACQUIRED
INFECTIONS
(HAIs)***





**DELIVERING
OUR PROMISE** | AS ONE
TEAM

***AN INTEGRATED SOLUTION TO
MITIGATING WATERBORNE
HOSPITAL
ACQUIRED INFECTIONS
(HAIs)***



Discussion Topics

- What Is The Impact of HAIs?
- Approaches To Mitigate Waterborne Pathogens?
- What Guidelines / Standards Exist?
- What Would Execution Look Like?
- What Are Remediation Strategies?
- Awareness To A Path Forward?



Ecolab / Nalco Experience & Support Resources

A Network of Experts to Support Your Site Operations With A Dedicated Division Focused On Global Water Safety

INDUSTRY
EXPERTISE

EXPANDED
CAPABILITIES

HOLISTIC
APPROACH

INCREASED
REACH

21,500 FIELD ASSOCIATES

on the front lines directly serving you

\$160 MILLION

in global R&D
investment
in 2010

5,500 patents

1300 R&D employees

at more than 20 Technology Centers around the world

2012 Revenue: \$14 billion

Field associates with
8+ years experience

Field associates with
10+ years experience

40%

60%

NALCO
An Ecolab Company

Nalco's Global Water Safety Capabilities



Environmental Hygiene Services Resume

Nalco's Environmental Hygiene Services Team has worked with customers on Water Safety planning for 15+ years

30+ Certified HACCP managers

Over 1,000 HACCP plans written and implemented worldwide including over 250 in hospitals

Local service delivered that follows global practice standards

Demonstrated secondary disinfection expertise

Responsible for disinfecting 1 billion+ gallons of potable water annually

Nalco Legionella lab is a charter member of CDC-ELITE proficiency program

Six (6) Industrial Staff Microbiologists



What do Facility Managers and Infection Preventionists have in common?

Not Enough Hours In The Day!

They Each Have Their Own Perspective

Anything?

They Each Have Their Own Priorities

They Each Can Impact Reducing Waterborne HAIs

But it takes a team effort!

HAIs have a
direct impact on
patient health,
satisfaction
and...



Waterborne pathogens
are a clinical relevant cause of
Hospital Acquired Infections
(HAIs)

since water is a
vector of infection.

What Most Common Waterborne Pathogens Impact HAIs?



PSEUDOMONAS



a common cause of pneumonia, severe wound and skin infections in hospital patients

‘**1,400** deaths occur annually in the US as a result of health care – associated pneumonia caused by waterborne *Pseudomonas aeruginosa* alone (Anaissie et al)’.

LEGIONELLA



the cause of a severe form of bacterial pneumonia

‘In one national survey of 192 hospitals , each hospital had at least one case of nosocomial Legionnaires’ disease, and **16%** reported more than 5 cases.’*

‘From the NISS data Cohen et al estimated that **950** cases fatal nosocomially acquired legionellosis occurred in the US annually.’

* Fiore AE, A survey of methods used to detect nosocomial legionellosis among participants in the National Infections Surveillance System, 1999

The human and financial burden due to waterborne pathogens from building water systems is staggering.

Impact of HAIs



CMS' Exclusions On HAI Reimbursement?
(Centers for Medicare & Medicaid Services)



1 in every 20 hospitalized patients
become ill with an HAI

Overall annual direct
medical costs of HAI to
U.S. hospitals ranges from:
\$28.4 to \$45 billion



\$30,000 - \$50,000
average cost
to treat an inpatient HAI



Over **1.7 million** HAIs
in U.S. hospitals (2002)

CDC has reported that **10.4%**
(170,000) of HAI's are related
to ***Pseudomonas***



Studies published between 1998 & 2005 indicate that between **9.7% and 68.1%** of random ICU water samples were **positive** for *Pseudomonas aeruginosa* and between **14.2% and 50%** of patient infections with this organism were due to genotypes found in ICU water



Pseudomonas aeruginosa is the **fourth most** commonly isolated nosocomial pathogen (**#1 Waterborne**)



Studies have shown up to **50% (85,000)** of hospital acquired infections by *Pseudomonas* may be derived from the water distribution system^{2,3,4}



~1,400 deaths occur each year as a result of waterborne nosocomial pneumonias attributable to *Pseudomonas aeruginosa* alone

CDC estimates that **8,000-18,000** cases of **Legionnaires' disease** occur each year



23% of LD cases are acquired in hospitals (1,840-4,140) according to CDC

\$321 million/year in medical costs to treat Legionnaires' disease



\$33,000 average cost to treat an inpatient HAI of legionellosis



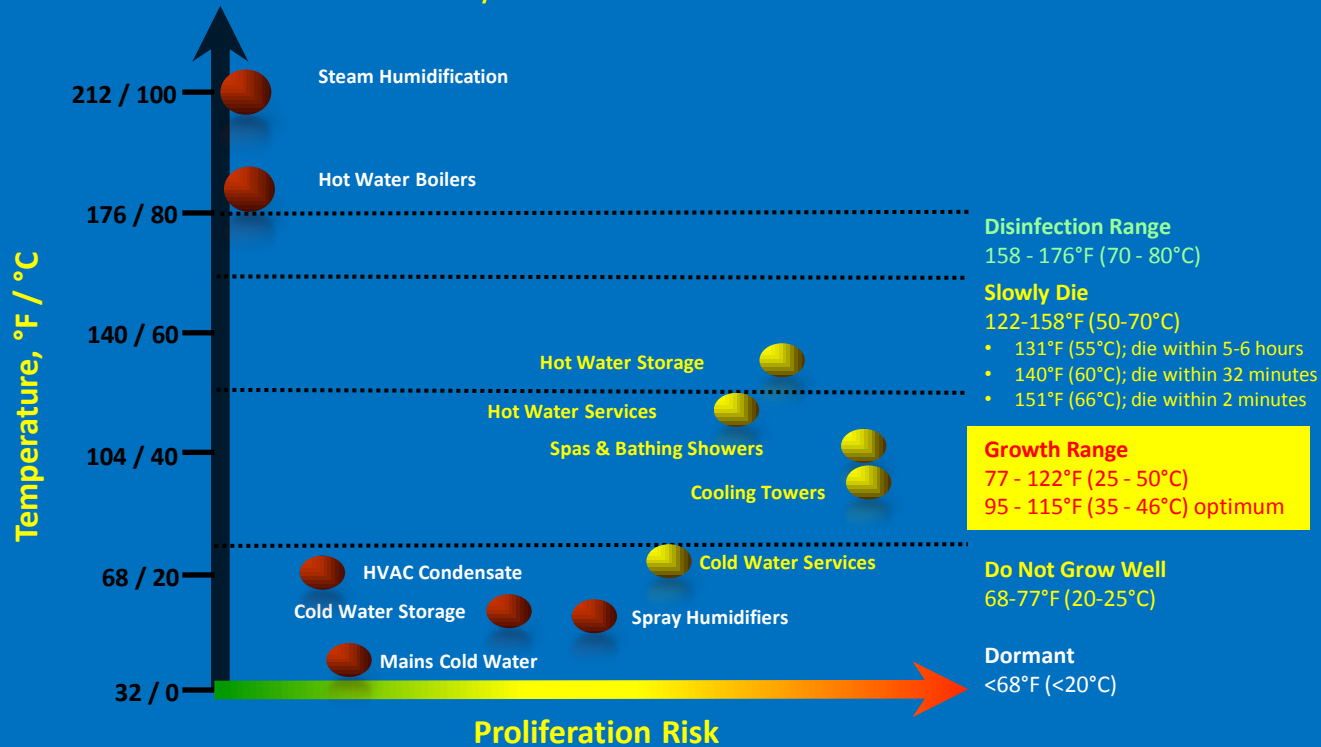
LD fatality is **40%** if acquired in a hospital = 736-1,656 deaths (>4,000 deaths overall annually)

Water is essential...

And yet, **water can cause unintended human harm** if not properly engineered, managed and monitored.

Utility & Domestic Services

Temperature vs. Proliferation Risk



**waterborne pathogens are
lurking in pipes...**

Biofilms are the enemy!

Which is where pathogens live.

Stenotrophomonas

Acinetobacter

Mycobacter

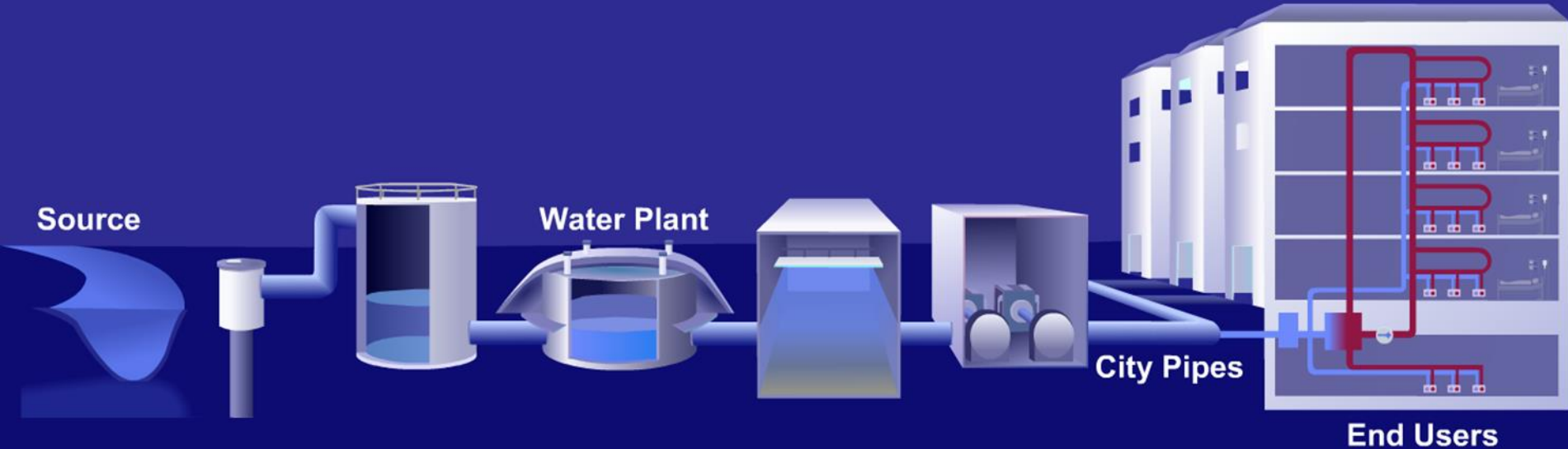
Pseudomonas

Legionella

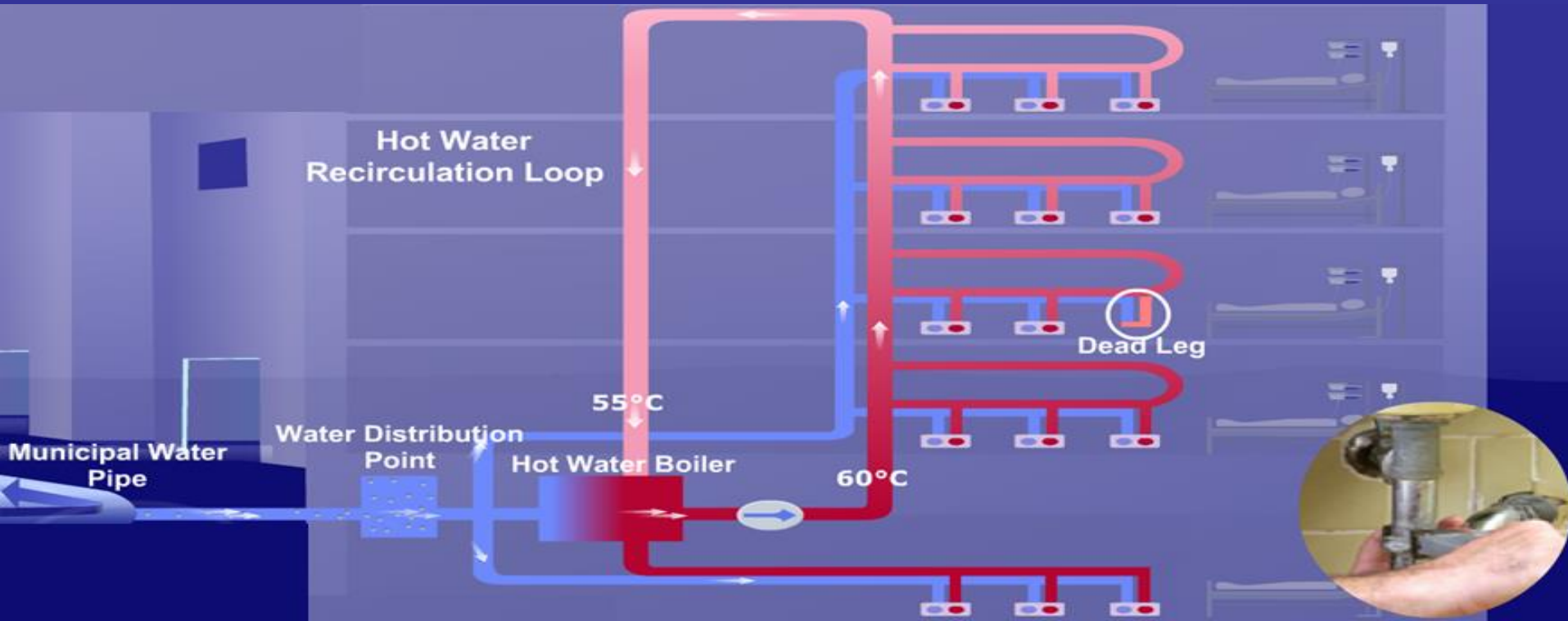


How can this be?

Complex water systems break, pipes leak, and biofilms grow.



SYSTEM CONDITIONS Complexity, age, poor temperature controls, lack of residual disinfectant, and water stagnation can provide conditions that allow formation of biofilms.



Legionella Ecology – When good water goes bad

- Disease was first recognized in 1976 during a Legionnaires' convention in Philadelphia
 - More than 200 people sickened, 34 died following a stay at the Bellevue-Stratford hotel in Center City Philadelphia
- Key factors required for the bacteria to grow and infect employees
 - Municipal water can be contaminated with the bacterium
 - Bacterium enters buildings water system, finds a niche
 - Scale, biofilm, warm temperatures, plumbing dead legs
 - Organisms can survive, thrive and grow in niche
 - Plumbed water therefore serves as the reservoir
 - Vectors for legionella infection are aerosols, mists, sprays
 - Cooling towers and evaporative condensers, showers, fountains, whirlpools, spas, hot tubs, faucets, water baths



Waterborne Microorganisms

Primary Clinical Significance



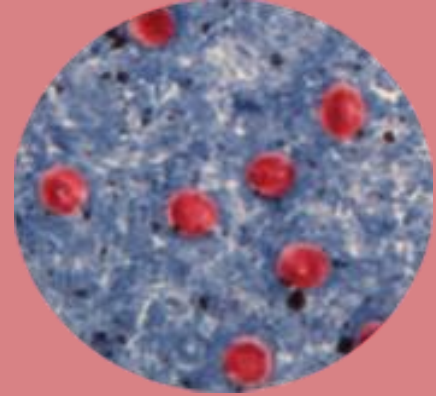
Bacteria

- ▶ *Pseudomonas aeruginosa*
- ▶ *Legionella pneumophila*
- ▶ *Acinetobacter* spp.
- ▶ Non-tuberculous or Atypical *Mycobacterium*



Fungi

- ▶ *Aspergillus fumigatus*
- ▶ *Fusarium solani*



Parasites

- ▶ *Cryptosporidium parvum*
- ▶ *Giardia lamblia*
- ▶ *Acanthamoeba* spp.

Sources of Waterborne Pathogen Exposure



**Aerosols
from
showers
and faucets**



**Direct
contact
with water
streams**

**Opportunities for waterborne
microbes to enter into the
healthcare environment**



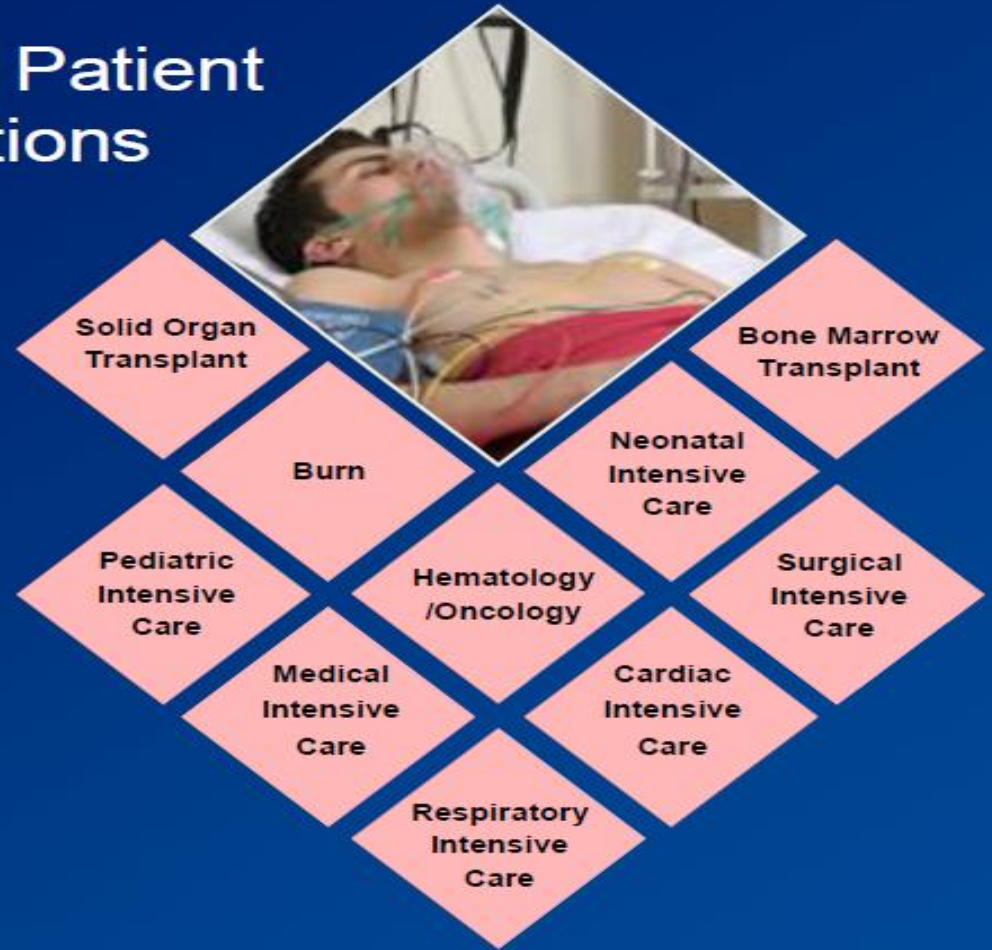
**Ice from ice
machines**

**Improperly
reprocessed
medical
devices**

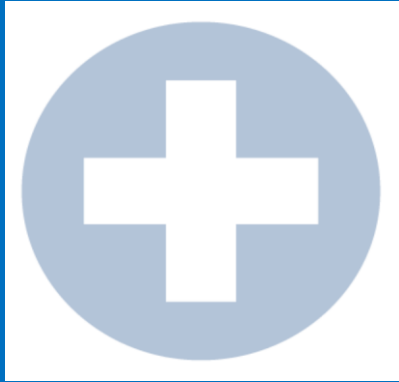


*Where
are the
greatest
AT-RISK
areas?*

At-Risk Patient Populations



Pseudomonas aeruginosa



The cause of 10-20% of all HAIs in ICUs¹

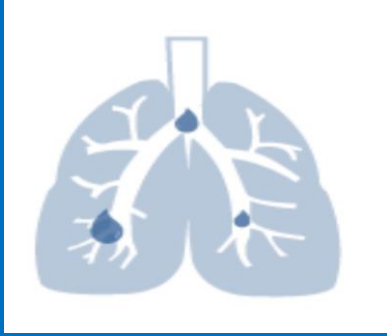
Transmission Pathway

Droplets of contaminated tap water or contaminated hands of nursing staff can inadvertently come into contact with patient entry portals such as catheters, drains and tracheal tubes.

- This pathogen is a **major waterborne cause** of severe infections including pneumonia, sepsis, and wound and skin infections¹.
- Studies have shown up to **50%** of hospital acquired infections by this pathogen may be derived from the water distribution system^{2,3,4}.
- A study found **14%** of ICU health care workers hands were positive for *Pseudomonas* when washed with contaminated tap water and **12%** were positive when last contact was with a *Pseudomonas* positive patient⁵.



Legionella pneumophila



**23% of all cases
are reported as HAIs⁹**

- This **waterborne pathogen** causes a severe lung infection a form of pneumonia known as Legionnaires' disease or legionellosis. A person can develop this disease by inhaling contaminated water mists or droplets.
- *This pathogen is perhaps the best-known for colonizing biofilms that can be found in centralized water storage tanks as well as peripheral water outlets such as showers and faucets^{6,7,8}.*

Ice Machines



Showers



Cooling Towers



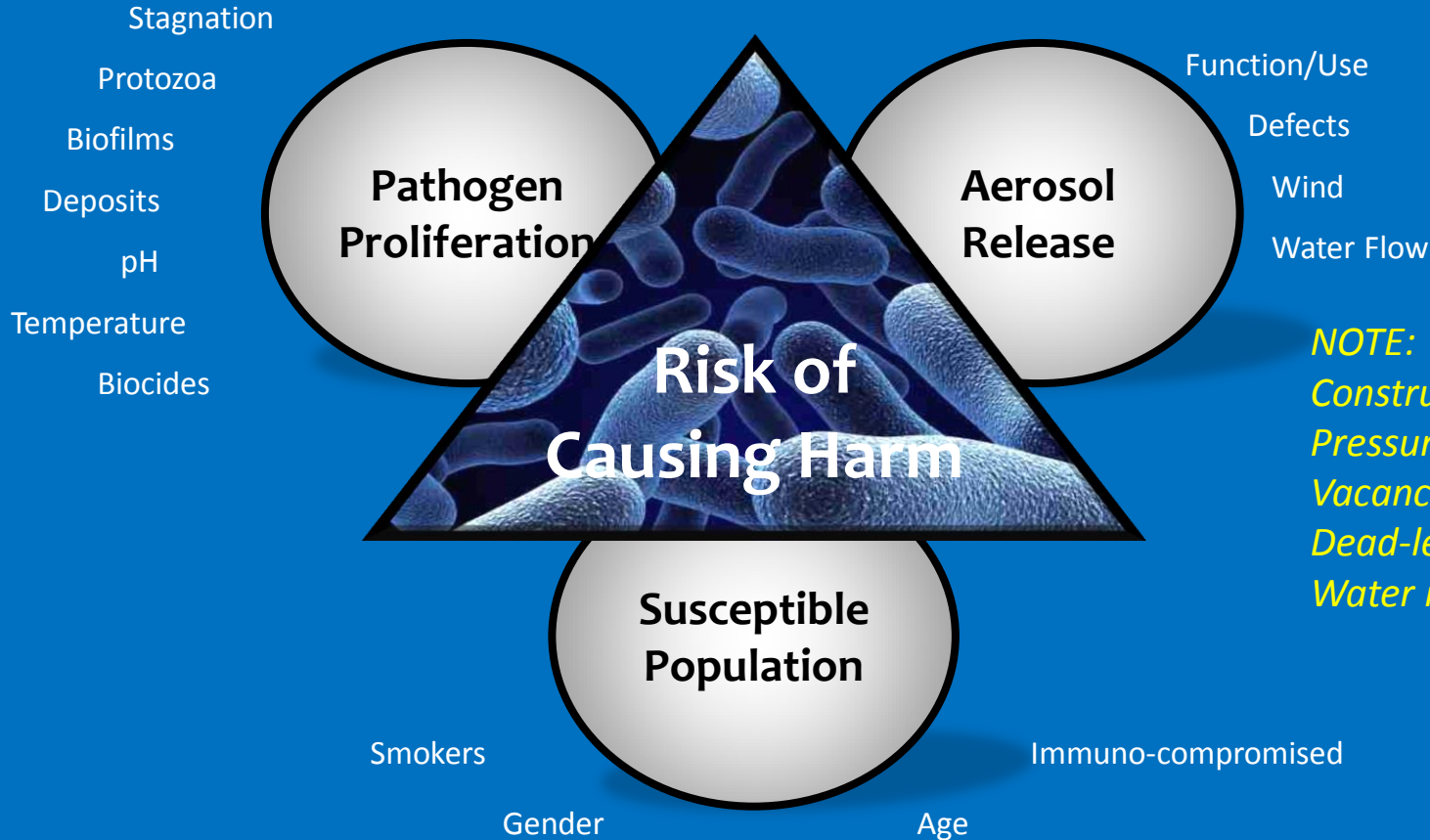
Water Features



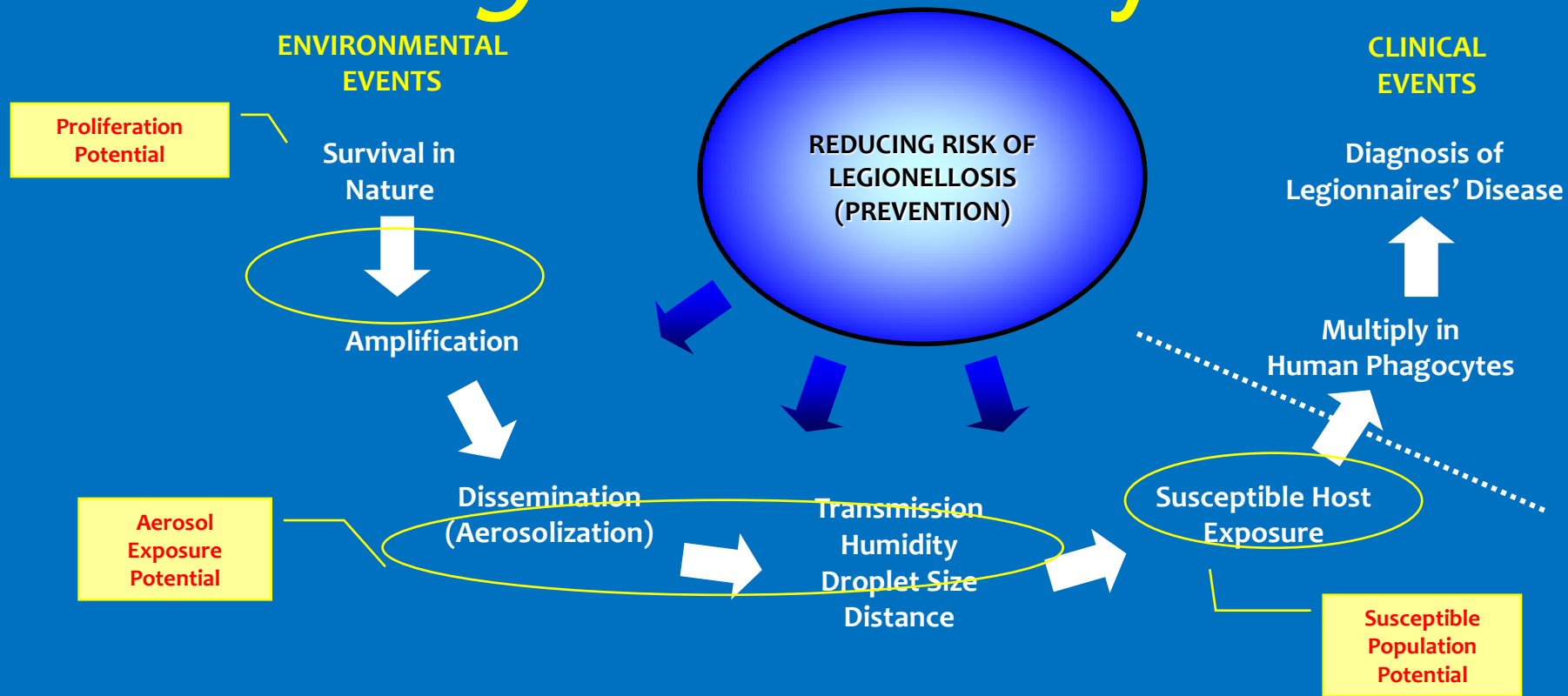
Jacuzzi/Spas



Conditions that increase risk of causing harm...



Legionella Life Cycle



CDC Recommends:

“The source of Legionella should be identified and decontaminated or removed”.

The Joint Commission, EC.02.05.01

The [organization] manages risks associated with its utility systems.

- *Establish and maintain a utility systems management program to promote a safe, controlled and comfortable environment that... reduces the potential for hospital-acquired illness to be transmitted through the utility systems.*
- *Healthcare Facility identifies and implements processes to minimize pathogenic biological agents in cooling towers, domestic hot/cold water systems and aerosolizing water systems.*

**Already
Many
Standards
&
Guidelines**



Local Guidelines: Allegheny County, PA, Maryland, New York, Texas, Virginia

**VHA DIRECTIVE 2008-010
PREVENTION OF LEGIONELLA
DISEASE**

INDUSTRY AVAILABLE SERVICES IN AN INTEGRATED APPROACH TO HELP YOU

*With a
focus on
waterborne
pathogens*



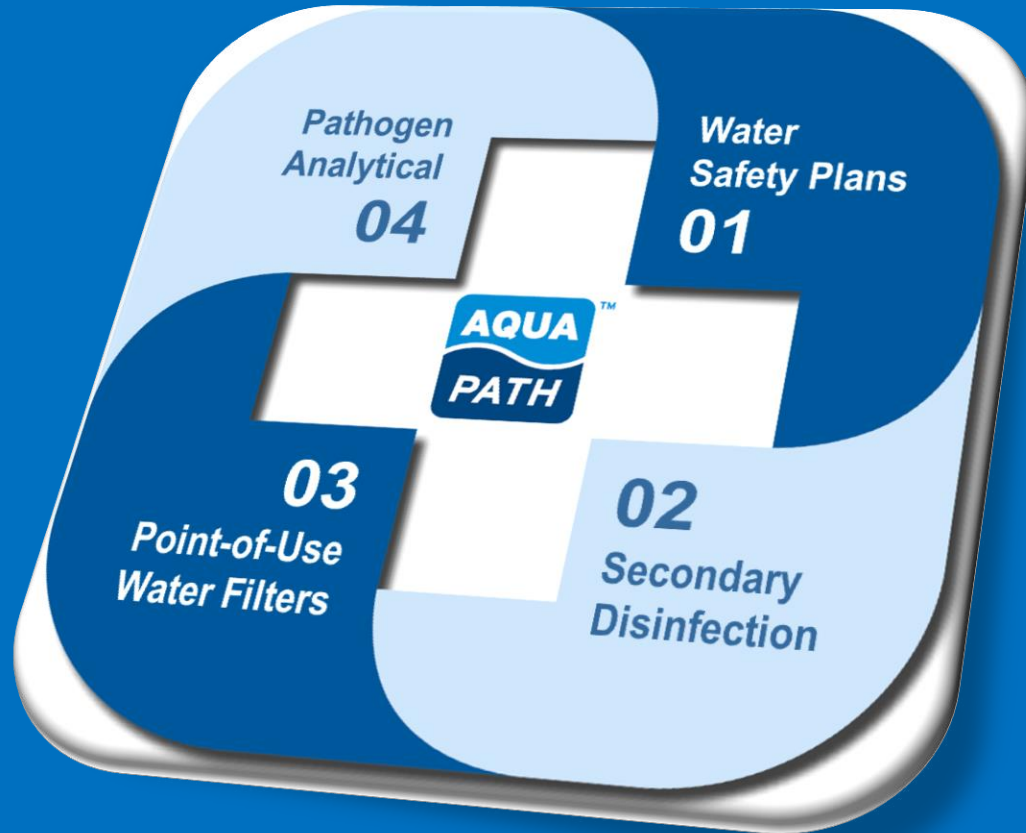
INDUSTRY AVAILABLE SERVICES IN AN INTEGRATED APPROACH TO HELP YOU

*With a
focus on
waterborne
pathogens*

Potential Qualification Criteria

- Water Safety **Experience**
- **Knowledge** of Waterborne Pathogen Risk Mitigation
- **Technology** to Make it Effective
- **“Boots on the Ground”** to Assist

The AQUAPATH™ Program



01 Water Safety Plans

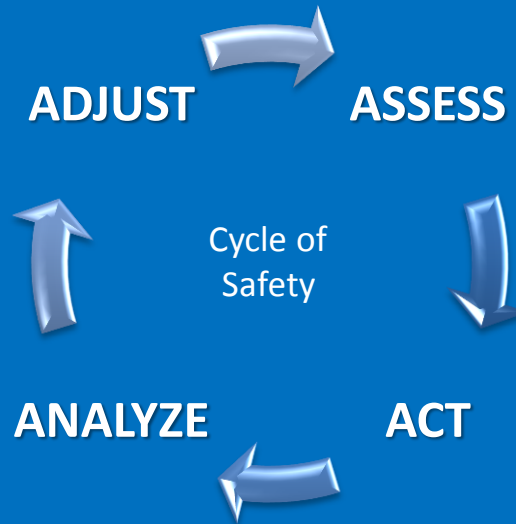
Expert Risk Management

» Pathogen Water Safety Plans

» Web-based Data Monitoring & Management

» Consulting & Support

- *Hazard Analysis*
- *Process Flow Diagrams*
- *Plan Design & Implementation*
- *Awareness Training*
- *Verification & Validation*



**Your Partner in
Water Safety**



**DELIVERING
SAFE WATER**

Execution and setting the cycle...

Client/Nalco



Consultation
Establishing
Policy

Nalco



Education
Training

Client/Nalco



Site Survey
Survey
Analysis
Prioritize Risk

Client/Nalco



Hazard
Assessment
Define
Management
Plan
Define
Contingencies
Monitoring
Controls
Legionella
Testing

Client/Nalco



Verification
Validation
Review
Evaluate
Adjust

Best Practices: Cooling Tower

Strategy	Purpose	Reference
System Operation	Goal is to operate in a manner that keeps the system treated and limits stagnant conditions. Startup/Shutdown; Intermittent operation; New system startup	ASHRAE 12, 188P CTI
Inspection & Maintenance	Goal is to maintain mechanical design intent to limit aerosol release, to maintain balanced water flows and to eliminate dead zones.	ASHRAE 12, 188P CTI OSHA
Design & Siting	Be aware of design features (sumps, drift eliminators, location of tower) that can increase risk if not properly managed.	ASHRAE 12, 188P CTI OSHA
Scale & Corrosion Control	A comprehensive scale and corrosion program is necessary to limit scale and corrosion formation to within specified critical limits.	ASHRAE 12, 188P CTI
Biocide Control	A comprehensive biocide program applied to within critical limits is necessary to maintain microbial control. Biocides must be applied in a manner that demonstrates control.	ASHRAE 12, 188P CTI OSHA
Clean & Disinfect (C&D)	Goal is to prevent accumulation of slimes and sludge which can allow microbial proliferation and increase <i>Legionella</i> risk. Twice annual C&D; Off-line and On-line	ASHRAE 12, 188P CTI OSHA
Legionella Monitoring	Recommended to verify control of the hazard. <i>* Typically recommended for investigative or post remedial verification purposes.</i>	ASHRAE 12 CTI OSHA*
Aerobic Bacteria Monitoring	Monitoring is essential to verify biocide program is sufficient to control microbial growth.	CTI

Best Practices: Domestic Water Services

Strategy	Purpose	Reference
New Construction/ Renovation	Goal is to be aware of design features (cross connections, need for piping insulation, dead-legs, low flow zones, water hammer arrestors, etc.) or stagnant conditions that can increase risk if not properly managed.	ASHRAE 12, 188P OSHA
New Systems, Startup/Shutdown	Goal is to define practice to manage the water system to limit stagnation, implement practices to flush systems after lengthy shutdown or interruption of water service, and requirements for clean and disinfection before commissioning new systems.	ASHRAE 12, 188P
System Maintenance	Goal is to define practice (Clean and disinfect, flushing, repair, etc.) for system maintenance of hot and cold water tanks, ice machines, water filters, shower heads and hoses, faucets, etc.	ASHRAE 12, 188P
Water Temperature	Water temperature recommendations for legionellae control are: <ul style="list-style-type: none"> • Maintain water heater outlet temperatures at or above 140°F (60°C); • Maintain the hot water temperature at coldest point in the water heater, the storage tank, or the distribution system at or above 124°F (51°C); • Maintain the cold water temperature in any part of system at or below 77°F (25°C). 	ASHRAE 12, 188P OSHA
Water Disinfection	Where water disinfection or treatment is performed, a defined program must be followed to assure it meets EPA requirements for potable water applications.	ASHRAE 12, 188P OSHA
Emergency Disinfection	Goal is to define practice to be followed if there are suspected legionellosis health problems associated with the use of potable water in a building system.	ASHRAE 12, 188P OSHA
Legionella Monitoring	Recommended to verify control of the hazard. <i>* Typically recommended for investigative or post remedial verification purposes.</i>	ASHRAE 12 OSHA*

02 Secondary Disinfection

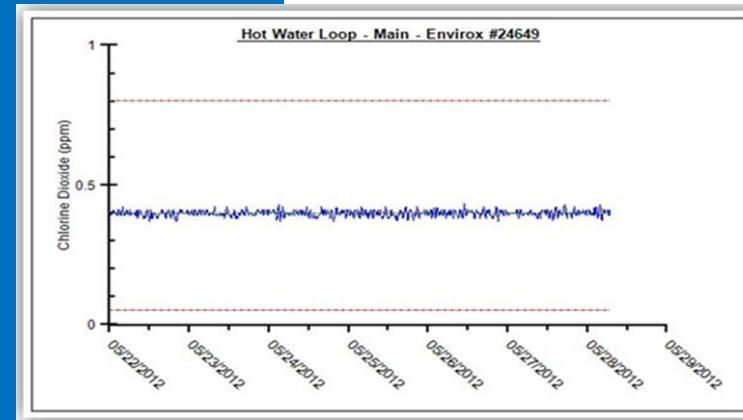
A Continuous Treatment Strategy

- » Evaluation of alternatives: Pros & Cons
- » Hot and cold potable water treatment
- » NSF-61 certified equipment
- » NSF-60 certified chemistry
- » Water treated per EPA regulations
- » Nalco 360 24/7 monitoring of disinfectant residuals
- » 360 automation of system alarms

Envirox



Chlorine Dioxide (ClO_2)



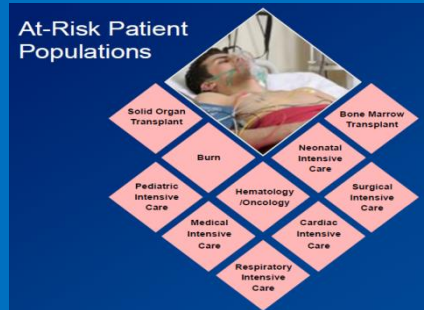
Summary of Disinfection Choices

	ENVIROX Chlorine Dioxide	Chloramine	Chlorine	Copper- Silver	Ozone	UV-Light	Thermal Disinfect
Effective against legionellae	YES	YES	YES	YES	YES	YES	YES
Effective against most bacteria	YES	YES	YES	YES	YES	YES	NO
Effective against biofilm	YES	YES	NO	NO	YES	NO	NO
No Legionella resistance	YES	NO	NO	NO	YES	YES	YES
Protects whole system	YES	YES	YES	YES	YES	NO	NO
Not affected by pH	YES	NO	NO	NO	YES	YES	YES
Not affected by water hardness	YES	YES	YES	NO	YES	YES	YES
Easy to monitor	YES	YES	YES	NO	NO	NO	YES
Low corrosion rates	YES	YES / NO	NO	NO	NO	YES	YES
No Trihalometanes (THM's)	YES	NO	NO	YES	NO	YES	YES
Low disinfection by-products (DBP)	YES	YES	NO	YES	NO	YES	YES

03 Point-of-Use Water Filters

A Point Control Strategy

- » *An absolute barrier for waterborne pathogens*
- » *“Sterilizing Grade Filtered Water”*
- » *For high risk patient areas*
(BMT, ICU, NICU, BURN, ONCOLOGY, ETC.)
- » *For immediate response to an outbreak or incident*



QPoint™ Faucet
Water Filter (62-Day)



Aquasafe™ Faucet
Water Filter (31-Day)

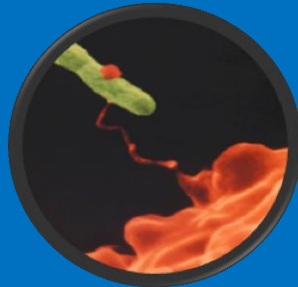
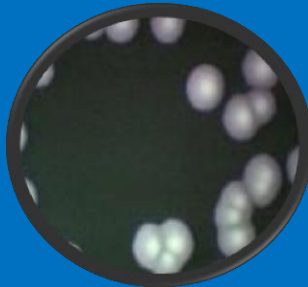


Aquasafe™ Shower
Water Filter (31-Day)

04 Pathogen Analytical

Validation of the Control Strategy

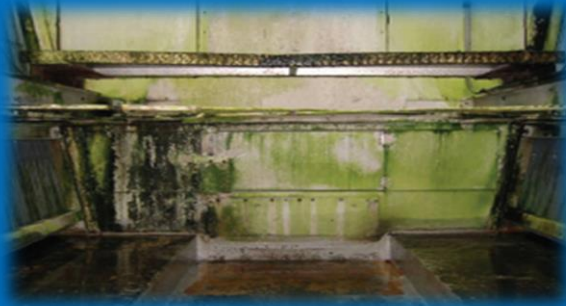
- » *Legionella* Culture Test per ISO 11731
- » A Certified CDC-ELITE Proficient Lab
- » Interpretation & Consulting
- » Testing Plans



Remediation Strategies

» Cleaning & Disinfection Services

- Cooling Water Systems
- Potable Hot & Cold Water Systems
- Decorative Fountains
- Ice Machines



BEFORE



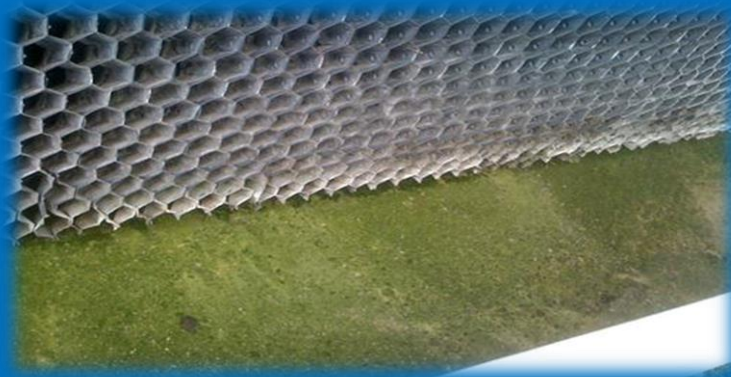
DURING



AFTER

Do I have issues with deposits or scale?

46



Do I operate systems near people or entry points?



Supplemental Controls

Validation Studies/Endorsements

ENVIROX

“A 17-month evaluation of a chlorine dioxide water treatment system to control Legionella species in John-Hopkins hospital water supply concluded: “Our results indicate that operation of a chlorine dioxide system effectively removed Legionella from the hospital water supply. Our results indicate that chlorine dioxide may hold promise as a solution to the problem of Legionella contamination of hospital water supplies”.

POU Filters

Trautman: *“Point-of-use filtration is a simple, successful, and highly cost-effective strategy to lower endemic Pseudomonas aeruginosa infections in a surgical ICU”.*

The 2007 WHO publication recommends:

“Legionella and the prevention of Legionellosis point-of-use filters are recommended for high risk areas such as transplant units and ICUs when Legionella free water (0 CFU/1000 mL) is not achievable”.

Nalco EHS Water Hygiene Services Capabilities

RISK MANAGEMENT

- **Legionella Water Safety Plans**
- **Waterborne Pathogen Water Safety Plans**
- **Web-based Data Monitoring & Management**
- **Consulting and Support :**
 - Hazard Analysis
 - Plan Design & Implementation
 - Awareness Training
 - Verification & Validation



PATHOGEN ANALYTICAL

- **Legionella culture testing per ISO11731**
- **Certified CDC-ELITE proficient for Legionella**
- **Interpretation & Consulting**
- **Testing Plans**
- **Legionella Analytical Guide**



REMEDIATION

- **Cleaning & Disinfection Services:**
 - Cooling Water Systems
 - Potable Hot & Cold Water Storage Systems
 - Potable Water Distribution Systems
 - Decorative Fountains
 - Firewater Tanks

Emergency Remediation Protocols

SUPPLEMENTAL CONTROL

- **Secondary Disinfection:**
 - ENVIROX Chlorine Dioxide & E-Chlorine Systems
 - NSF60/61 Approved
 - EPA Regulatory Guidance per SDWA
- **Point-of-Use Water Filters:**
 - Absolute barrier for waterborne pathogens
 - Validated up to 31-Days or 62-Days per ASTM F838-05 for 0.2 µm sterilizing grade filters

Your Partner in
Water Safety



Financial Impact:

Direct Hospital Cost:

- **\$30,000 – \$50,000 Per HAI**
 - *This will be increasing significantly*
 - *Lack of CMS reimbursement impact*

Regulatory Fines:

- Anticipate this being more prevalent in the future

Litigation:

- 2006 LD Outbreak resulted in a \$5.2 MM settlement
- Most LD cases are settled between \$1-3MM/fatality

Impact on Moral:

- Recruiting & Retention

Damage To Brand:

- Site/Organization-Specific & Critical

*According to the November 2006 report from the Pennsylvania Health Care Cost Containment Council (PH4C), the average charge for patient cases with an HAI was \$185,260, compared to \$31,389 for cases without a hospital acquired infection. For patient cases with an HAI, the average number of days in the hospital was **20.6** days, compared to **4.5** for cases without an HAI¹²*

*Savings for prevention of LD in Medicare beneficiaries alone would be estimated to be over **\$30MM per year** and substantially higher than that for other healthcare-associated conditions*

Risk Reduction Strategies ...do this



- Learn more
- Do a Water Safety Plan (WSP)
 - Perform a Risk Hazard Assessment
 - Develop a written Risk Management Plan with defined control goals and contingencies
- Keep it moving
- Keep cooling systems properly treated
- Use “*Best Practices*” for microbiological control
 - Follow a contingency plan for system upsets or when control goals are not met
 - Keep it clean
- Monitor and inspect the systems routinely
- Document and retain records



An Awareness To The Path Forward:



HAIs Are Reported To The CDC & State Department of Health (level of detail varies by state reporting requirements)

BETTER INSIGHT

- Do you know if there can be an improvement at your facility?

BETTER ACTION

- Do you believe this is worth further discussion at your facility?

BETTER RESULTS

- How and who do you suggest should be involved in those discussions?



**DELIVERING
SAFE WATER**