MANAGING LEGIONELLA IN WATER SYSTEMS
Mistakes & Misconceptions

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Research Associate Professor
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EXPERIENCE IS THE NAME EVERYONE GIVES THEIR MISTAKES.

-OSCAR WILDE-
Objectives

• Describe circumstances & conditions that have been linked to outbreaks of Legionnaires’ disease.

• Approaches to prevention:
  - Describe elements of ASHRAE Standard 188-2015
  - Understand the “gaps” in ASHRAE 188
1980: Research Begins in Pittsburgh

• Over 30 years studying Legionnaires’ disease
  ▪ I’m a Legionellologist

• My mission: Use What I’ve learned to help you and your clients
How?
A Microbiologist with a Minor in Plumbing!
The New England Journal of Medicine
Established in 1812 as The NEW ENGLAND JOURNAL OF MEDICINE AND SURGERY

UBIQUITOUSNESS OF LEGIONELLA PNEUMOPHILA IN THE WATER SUPPLY OF A HOSPITAL WITH ENDEMIC LEGIONNAIRES’ DISEASE

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and Robert Wadowsky, M.S.
Paradigm Shift: Not Cooling Towers

- NOT a common source for sporadic and hospital-acquired cases
- More commonly associated with large community outbreaks
THE CHALLENGE OF LEGIONNAIRES’ DISEASE
Consider This…

Legionellosis cases have increased substantially – over 200% in last 10 years
Increasing Cases 1998 - 2014

Incidence of Legionellosis-United States, 1998-2014

© Special Pathogens Laboratory
Why Increase in Reported Cases?

• Increase in diagnostic testing = more cases identified

• Environmental factors?
Wet Weather
& Legionnaires’ Disease?

Rain, flooding likely led to spike in Legionnaires' disease
Reports of Legionnaires' disease follow heavy rains.

By Tim Darragh, Of The Morning Call
11:42 P.M. EDT, OCTOBER 17, 2011

All that rainfall in September may have left more than wet basements here and flood-wrecked communities in northeast Pennsylvania.

It also appears it was at least partly responsible for a record spike in Legionnaires' disease, a water-borne bacterial pneumonia that can be fatal to some people.
Cases Linked to Water Systems

- Warm water distribution in:
  - Hospitals
  - Nursing homes
  - Rehabilitation centers
  - Office buildings
  - Apartment buildings
  - Hotels
  - Residential homes

- Other water systems:
  - Spas and hot tubs
  - Decorative fountains
  - Humidifiers
  - Cooling towers
Centers for Disease Control and Prevention Statistics

- 77% >50 years
- 62% male
- Hospitalizations occurred in 98%
  - ICU admission in 39%
  - Death in 10%–30%
Susceptible Hosts

- Elderly
- Smokers
- Immunocompromised
  - Transplant patients
  - High-dose steroids for lung disease
  - Diabetes
  - Cancer
- Approx. 25% cases no known risk factors
Who’s At Risk?

• Many building occupants would be in one or more of these risk groups.

• Some Health Departments investigate single cases, some only multiple cases.
Legionnaires’ Disease

• 2 – 5% of all hospitalized pneumonia cases = 30,000+ annually

• Most cases in people with health conditions that increase risk
  ▪ 25% in otherwise healthy people
  ▪ Mortality 10-30% (highest for hospital-acquired cases)
  ▪ Early treatment with effective antibiotics reduces mortality
2015: Cases Linked to Drinking Water

Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water — United States, 2011–2012

Karlyn D. Beer, PhD1,2; Julia W. Gargano, PhD2; Virginia A. Roberts, MSPH2; Vincent R. Hill, PhD2; Laurel E. Garrison, MPH3; Preeta K. Kutty, MD3; Elizabeth D. Hilborn, DVM4; Timothy J. Wade, PhD4; Kathleen E. Fullerton, MPH2; Jonathan S. Yoder, MPH, MSW2

Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water — United States, 2011–2012
Centers for Disease Control and Prevention (CDC) reported:

• Legionella accounted for 66% of reported drinking water–associated outbreaks.

• Legionella in building plumbing systems lead to drinking water–associated outbreaks.

www.cdc.gov/mmwr/preview/mmwrhtml/mm6431a2.htm?s_cid=mm6431a2_w
Can we blame the Michigan Legionnaires’ disease outbreak on the Flint water crisis?
Flint Legionnaires’ Disease Outbreak

Spike in Legionnaires’ Disease in Genesee County

The State of Michigan reported a spike in cases of Legionnaires’ disease in Genesee County from June 2014 to October 2015 — a total of 88. There were 10 reported fatalities associated with this increase.

Cases of Legionnaires’ Disease in Genesee County, by Month

LEGIONNAIRES’ DISEASE: Pneumonia-like Disease Caused by Bacteria

Legionnaires’ disease is caused by the Legionella bacterium, which is usually found in water. The disease is associated with man-made water environments including hot tubs, large plumbing systems and cooling towers. Many infections go undiagnosed or unreported because symptoms are similar to pneumonia.

History
The disease got its name after an outbreak at the 1976 Philadelphia convention of the American Legion.

Symptoms
Symptoms include fever, chills and cough.

Exposure and Transfer
Infection occurs when a person breathes in water vapor containing the bacteria; it does not transfer between people.

Incubation Period
2 to 10 days after exposure.

Percent Who Become Ill When Exposed to Source
Less than 5%.

Outcome
Need for hospitalization is common. Fatality rate is 5-30%.

Sources:
Michigan Department of Health and Human Services, U.S. Centers for Disease Control and Prevention, Emory University, U.S. National Institutes of Health

Kristi Tanner and Martha Thierry
Detroit Free Press
Tribune News Service

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Legionellosis in the U.S.

Outbreaks continue to occur (building warm water systems, cooling towers, fountains)
Legionnaires' Cases in Quebec City

TOTAL=180

A 13th death from legionnaires' disease in Quebec City

THE CANADIAN PRESS Thursday, September 13, 2012 4:1 PM

QUEBEC - A 13th person has died from legionnaires' disease in Quebec City, while authorities are confident that the outbreak has been brought under control.
Legionnaires' death toll rises to 10 in western Illinois

QUINCY, Ill. – At least 10 people in western Illinois have now died from Legionnaires' disease, after a state veterans home reported two new fatalities among its residents.

An outbreak first identified in late August after an initial case was detected several weeks earlier has sickened 53 residents at the Quincy home, nine of whom died. Four others in Quincy have been diagnosed with the illness, one of whom died. Officials say those cases aren't connected to the larger outbreak.
Legionnaires’ outbreak linked to water

The hot water system sickened 11 patients at Miami Valley Hospital.

By Ben Sutherly
Staff Writer

DAYTON — Insufficient heating of the hot-water system in Miami Valley Hospital’s new 12-story addition was the primary reason for the largest outbreak of Legionnaires’ disease in Ohio since 2004, according to the hospital.

The outbreak of Legionnaires’ disease at the hospital in February and March highlights an unintended result of plumbing codes that could put vulnerable populations like hospital patients at risk.
Hospital Construction

• New $135M 12-story cardiac care patient tower

• 11 cases & 1 death shortly after opening

• 74% of distal outlets positive for Legionella within 1 month of opening
Outbreak in Germany

- Warstein, Germany
  - 165 cases, 12 ICU, 2 deaths caused by *Legionella pneumophila*, serogroup 1
  - Outbreak strain found in 2 cooling towers + other sources – including wastewater from a brewery!
  - Public safety alerts
"Whether or not the Warsteiner brewery is found to be the breeding ground for the Legionella bacteria, officials have been making it clear that … the beer is completely safe to drink."
What Ben Franklin said

DRINKING WATER
“With wine comes wisdom, with beer comes freedom, with water comes bacteria Legionella.”
2015: Summer of Legionella
South Bronx Outbreak

- 130 cases, 12 deaths
- Declared over August 20, 2015

Legionnaires’ disease outbreak in the South Bronx officially over: NYC health commissioner

“I’m happy to announce that the outbreak is over,” Health Commissioner Mary Bassett told a Manhattan news conference.

The South Bronx outbreak of Legionnaires’ disease that killed a dozen New Yorkers and sickened another 127 is officially history.
2015: Summer of Legionella

July 7, 2015
Start of New York City Outbreak

Emergency regulations passed
August 20, 2015
Outbreak Linked to Hotel Cooling Tower
Register a Cooling Tower and Submit Reports

New statewide regulations require registration and periodic reporting of testing, inspection, and certification of cooling towers.
New Regulations

- Cooling towers must be registered
- Legionella testing every 90 days
- Inspection
- Certification
- Maintenance program

Department of Health

EMERGENCY RULE MAKING

Protection Against Legionella
I.D. No. HLT-35-15-00005-E
Filing No. 696
Filing Date: 2015-08-17
Effective Date: 2015-08-17

PURSUANT TO THE PROVISIONS OF THE State Administrative Procedure Act, NOTICE is hereby given of the following action:

Action taken: Addition of Part 4 to Title 10 NYCRR.

Statutory authority: Public Health Law, section 225(5)(a)

Finding of necessity for emergency rule: Preservation of public health, public safety and general welfare.

Specific reasons underlying the finding of necessity: Improper maintenance of cooling towers can contribute to the growth and dissemination of Legionella bacteria, the causative agent of legionellosis. Legionellosis causes cough, shortness of breath, high fever, muscle aches, headaches and can result in pneumonia. Hospitalization is often required, and between 5-30% of cases are fatal. People at highest risk are those 50 years of age or older, current or former smokers, those with chronic lung diseases, those with weakened immune systems from diseases like cancer, diabetes, or kidney failure, and those who take drugs to suppress the immune system during chemotherapy or after an organ transplant. The number of cases of legionellosis reported in New York State between 2005-2014 increased 323% when compared to those reported in the previous ten year period.
Unprecedented Response

“Our new emergency regulations will make sure that building owners live up to their responsibilities and provide health officials with critical information to counter the spread of Legionella bacteria.” - Governor Cuomo
I Love New York!
The Times They Are a-Changin’

New Paradigm for Prevention
ASHRAE Proposes a Standard to Prevent Legionnaires’ Disease

Engineers’ codes target Legionella

Group proposes new rules for building operators to prevent waterborne bacteria

by ADAM SMELTZ

An engineering group that influences building codes nationwide is drafting tough new standards to prevent Legionella, the waterborne bacteria blamed in a deadly Legionnaires’ disease outbreak in Pittsburgh.

Federal estimates show Legionnaires’, a form of pneumonia, kills more than 4,000 people and sicks about 21,000 others each year; three decades after researchers figured out how to control the bacteria in tap water.

The proposed standards would require building operators to verify they are monitoring the Legionella threat in commercial, residential and medical facilities with established risk factors, such as multiple whirlpools and spas. It also outlines methods to prevent the growth of the bacteria.

The cost of implementing these standards is unknown. Single-family homes would not be included in the proposed changes.

“It’s not the science or the engineering lacking here. It’s the lack of a management system that can be applied in a practical and defensible way,” said William McCoy, Standards Committee chairman at the American Society of Heating, Refrigerating and Air-Conditioning Engineers in Atlanta.

McCoy’s international committee, part of the 55,000-member engineering society, worked for the past six years to craft the first unified and enforceable domestic rules for Legionella control in the plumbing of large buildings, where the bacteria can fester and grow. The proposed plan could be voted on by the society’s board this year.

The international Code Council in Washington generally adopts ASHRAE recommendations in building code guidelines that are used by state and local code enforcement agencies across the country.

Current ICC recommendations do not mention Legionnaires’ disease, spokesman Steve Daggers said. The little-known council drew national attention in 2005 for advocating stringent fire sprinkler standards for single family homes that met with heavy resistance from builders and consumers.

ASHRAE will not perform a cost-

American Society of Heating, Refrigerating and Air-conditioning Engineers
The opinions expressed are those of the author and do not represent those of ASHRAE or other cited organizations.
ASHRAE 188: The Long & Winding Road

- Committee was authorized as a standard committee in June 2005
- Five Public Review Documents
• First *Legionella* standard in the United States.

• Approved June 26, 2015
Boy, I'm glad that's over!
Sadly, ASHRAE Too Late For NYC

- **First US Legionella Standard approved**: June 26, 2015
- **Start of New York City Outbreak**: July 7, 2015
- **Emergency regulations passed**: August 20, 2015

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Purpose of ASHRAE Standard 188

Establish minimum Legionellosis risk management requirements for building water systems.
New Responsibilities (And Liabilities)

**BUILDING OWNERS & FACILITY MANAGERS**

Responsible for implementing ASHRAE 188 requirements and safeguards to protect against *Legionella.*
FM Strategies: Legionella Standard

Part 1: ASHRAE Standard 188 Requires Risk Management to Prevent Legionnaires' Disease
Part 2: Standard 188: A Good Start to Preventing Legionnaires' Disease

ASHRAE Standard 188 Requires Risk Management to Prevent Legionnaires' Disease

By Janet E. Stout and Garry R. Boehlert December 2015

On June 26, 2015, ASHRAE issued ANSI/ASHRAE Standard 188-2015, Legionellosis: Risk Management for Building Water Systems. Ten years in the making, ASHRAE 188 is the first industry standard in the United States to address Legionnaires disease prevention. It provides minimum risk management requirements for Legionella found in building utility and potable water systems. This consensus document prepared by the leading experts in the industry ushers in a new era of responsibility for building owners regarding water safety.
Compliance

The building shall be surveyed to determine whether it has one or more of the listed water systems and/or the factors described that relate to risk for Legionellosis.
Water Systems Covered By 188

Potable and non-potable water systems, in the building or on the site

- Includes building water distribution systems (including centralized potable water heater systems)
- Cooling towers, evaporative condensers
- Whirlpools or spas
- Ornamental fountains, misters, atomizers, air washes, humidifiers or other non-potable water systems or devices that release water aerosols in the building or on the site
Section 5.2: Building Characteristics

- Multiple housing units
- > 10 stories high (including below grade)
- Patient stays exceed 24 hours
- One or more areas for purpose of housing or treating occupants receiving treatment for burns, chemotherapy, organ transplantation or bone marrow transplantation
Section 5.2: Building Characteristics

• One or more areas for the purpose of housing or treating occupants that are immuno-compromised, at-risk, taking drugs that weaken immune system, have renal disease, have diabetes, or chronic lung disease

• Housing occupants over the age of 65.
## Elements of Water Management Program

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program Team</strong></td>
<td>Persons responsible for Program development and implementation.</td>
</tr>
<tr>
<td><strong>Water Systems/Flow Diagrams</strong></td>
<td>Describe potable and non-potable water systems and develop water system-schematics.</td>
</tr>
<tr>
<td><strong>Water System Analysis/Control Measures</strong></td>
<td>Evaluate where hazardous conditions may occur and decide where control measures should be applied.</td>
</tr>
<tr>
<td><strong>Monitoring/Corrective Actions</strong></td>
<td>Establish procedure for monitoring whether control measures are within operating limits and, if not, take corrective actions.</td>
</tr>
<tr>
<td><strong>Confirmation</strong></td>
<td>Establish procedure to confirm Program is being implemented as designed (verification) and the Program effectively controls the hazardous conditions (validation).</td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td>Establish documentation and communication procedures for all activities of the Program.</td>
</tr>
</tbody>
</table>
New Responsibilities

Water Management Team

- Assist building owners with Program development and review monitoring water systems and results interpretation.
Knowledge

The Program Team shall have knowledge of the building water system design and water management as it relates to Legionellosis.
KNOWLEDGE IS KNOWING A TOMATO IS A FRUIT. WISDOM IS NOT PUTTING IT IN A FRUIT SALAD.

-MILES KINGTON-
Test Your Knowledge: True or False?

- *Legionella* is ubiquitous (everywhere).
- If chlorine levels at or above 0.5 mg/L in the supply water, *Legionella* is controlled.
- Only old buildings have *Legionella* problems.
- If total bacteria are controlled, *Legionella* is controlled.
- Water and energy conservation approaches minimize *Legionella* risk.
ASHRAE 188: Mind the Gaps
A Few Gaps

- Legionella testing isn’t required to validate that the risk management program is working.
- **BUT** testing is the only way to validate efficacy of your control measures and assess threat from Legionella.
- The standard requires reducing hazardous conditions to an “acceptable level” through monitoring and maintenance.
- **BUT** doesn’t define “acceptable level.”
Compliance Not Legionella Control

The ASHRAE 188 Legionella Standard tells building owners what to do but not how to do it.

• This creates gaps when it comes to Legionella control—gaps that could make building owners vulnerable and open to liability claims for failing to prevent disease.
A Few Gaps

• Legionella testing isn’t required to validate that the risk management program is working.

• The Program Team shall include consideration in determining whether to test for Legionella:
  ▪ If control limits not maintained
  ▪ Facility provides in-patient services to at risk or immunocompromised populations
  ▪ There’s a history of Legionellosis
Is the Sky Falling if I Find Some *Legionella*?
What is the acceptable amount of *Legionella*?
Preventing Legionnaires’ Disease Through *Legionella* Control

Zero Cases Is The Goal, Not Zero Legionella
Preventing Legionnaires’ Disease

- Zero Cases Is the Goal
- Zero Legionella cannot be achieved in complex water systems
- Controlling Legionella is about preventing disease, not about reaching zero Legionella in water.
Not All *Legionella* Are Dangerous
Don’t Chase Zero

• What type of Legionella is in the water?

• Of 58 species only half pose risk; *Legionella pneumophila* serogroup 1 causes majority of cases of Legionellosis
ASHRAE 188 Compliance
Good News, Bad News

- Standard is not prescriptive –
  - Good News: You get to make lots of decisions
  - Bad News: You get to make lots of decisions
ASHRAE 188: Your Decisions Fill The Gaps
Important Information to Avoid Outbreaks

• Outbreaks and New Construction
  ▪ With renovation, installation of low flow/electronic sensor faucets
  ▪ Commissioning process ineffective for *Legionella* removal
  ▪ Long dormant periods (months) before occupying

• CDC ELITE Labs
  ▪ All are not equal in Legionella testing proficiency

• Cooling Tower Biocides
  ▪ All are not effective against *Legionella*
A “Well-Maintained” Cooling Tower

Automated dosing of chemical biocides and clean

>3000 CFU/mL Legionella pneumophila serogroup 1
Cooling tower had dosing pumps and controller feeding (ineffective) biocides
Efficacy of Biocides in Controlling Legionella


<table>
<thead>
<tr>
<th>High-Performance Biocide Combinations</th>
<th>Under-Performance Biocide Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quat + Bromine</td>
<td>Bromine alone</td>
</tr>
<tr>
<td>Quat + Hydroperoxide</td>
<td>Bromine + Glutaraldehyde</td>
</tr>
<tr>
<td>Quat + Isothiazoline</td>
<td>Bromine + DBNPA</td>
</tr>
<tr>
<td>Carbamate + Isothiazoline</td>
<td>Quat + Carbamate</td>
</tr>
<tr>
<td>THPS + Isothiazoline</td>
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<tr>
<td>THPS + Bromine</td>
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<tr>
<td>THPS + Carbamate</td>
<td></td>
</tr>
<tr>
<td>THPS alone</td>
<td></td>
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</tbody>
</table>

Miller, et al  Assoc .Water Technologies 2008; THPS = Tetrakis (Hydroxymethyl) Phosphonium Sulfate
Biocide Effectiveness

Efficacy Affected By:

• Biocide type *(oxidizing vs. non-oxidizing)*

• Dose or concentration of biocide added – high enough?

• Duration of biocide exposure – long enough?
Microbiological Testing: HPC (Total) Bacteria

What Can We Learn about Legionella from an HPC Test?
Table 2
HPC genera commonly found in drinking water

<table>
<thead>
<tr>
<th>Acinetobacter</th>
<th>Methylomonas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinomycetes&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Micrococcus</td>
</tr>
<tr>
<td>Alcaligenes</td>
<td>Mycobacterium&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Aeromonas&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Morexella</td>
</tr>
<tr>
<td>Aeromonas hydrophila&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Nitrobacter</td>
</tr>
<tr>
<td>Arthrobacter</td>
<td>Nitrosomonas</td>
</tr>
<tr>
<td>Bacillus</td>
<td>Nocardia&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Beggiatoa</td>
<td>Proteus</td>
</tr>
<tr>
<td>Citrobacter freundii</td>
<td>Pseudomonas</td>
</tr>
<tr>
<td>Corynebacterium</td>
<td>P. cepacia</td>
</tr>
<tr>
<td>Crenothrix</td>
<td>P. fluorescens</td>
</tr>
<tr>
<td>Desulfovibrio</td>
<td>P. maltophilia</td>
</tr>
<tr>
<td>Enterobacter agglomerans</td>
<td>Serratia liquefaciens</td>
</tr>
<tr>
<td>Enterobacter cloacae</td>
<td>Sphaerotilus</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>Sphingomonas</td>
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<td>Flavobacterium</td>
<td>Staphylococcus</td>
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<tr>
<td>Flavobacterium meningosepticum</td>
<td>Streptococcus</td>
</tr>
<tr>
<td>Gallionella</td>
<td>Streptomyces</td>
</tr>
<tr>
<td>Hafnia alvei</td>
<td>Yersinia enterocolitica</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td></td>
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</tbody>
</table>
What Do You Learn From Heterotrophic Plate Count (HPC) Bacteria Testing?

• HPC method does not detect Legionella

• HPC cannot be used to predict presence or absence of Legionella

• HPC counts can be low when Legionella is high
Water-Saving Low Flow Faucets

Manual Faucet

Sensor Faucet
Non-touch fittings in hospitals: a possible source of *Pseudomonas aeruginosa* and *Legionella* spp.

M. Halabi, M. Wiesholzer-Pittl, J. Schöberl and H. Mittermayer
Anatomy of an Electronic Faucet

A = aerator
B = solenoid valve
C = check valve
D = inline filter
Electronic-Eye Faucets: *Legionella* Species Contamination in Healthcare Settings

Emily R. M. Sydnor, MD, MHS;¹² Gregory Bova;³ Anatoly Gimburg, BEE;³ Sara E. Cosgrove, MD, MS;¹ Trish M. Perl, MD, MSc;¹³ Lisa L. Maragakis, MD, MPH¹
Study Conclusions

- Periodic monitoring for *Legionella* recommended
- Consider removal from high risk areas – transplant units
I Have Legionella…
Now What?

DISINFECTION APPROACHES
Questions to Ask

• Was Legionella found in the water system?
  ▪ Pathogenic species?
  ▪ Extent of colonization?
  ▪ Colonization in sensitive areas?
## Secondary Disinfection Methods

- **Thermal shock treatment** *(heat & flush)*
- **Shock chlorination** *(>10 mg/L residual)*, may require water tanks to be 20-50 mg/L
- **Continuous supplemental chlorination** *(2-4 mg/L)*
- **Copper-silver ionization** *(continuous)*
- **Chlorine Dioxide** *(ClO2)*
- **Monochloramine**
- **Point-of-use filtration**
EPA/DEP Regulatory Approach

Regulatory Context
• Adding treatment in the facility could impact chemical and microbial water quality

• Certain federal and state regulatory requirements may apply.
Our Review: Journal of the American Water Works Association 2014

Maintaining *Legionella* control in building water systems

*This article reviews how *Legionella* and other waterborne pathogens can present a risk to consumers of potable water. In particular, building hot water systems have been established as the primary reservoir for bacteria linked to cases of Legionnaires’ disease (LD). These systems provide ideal conditions for *Legionella* proliferation because of their elevated temperature and lack of disinfection residual. Control of *Legionella* in potable water systems has become a focus for health care facilities because they serve a population that is particularly susceptible to LD from underlying health conditions, such as suppressed immune systems.*

Journal Am Water Works Assoc 2014; 106(10): 24-32
Newest Approach for *Legionella* Control in Building Water Systems

**MONOCHLORAMINE**
Control of *Legionella* contamination in a hospital water distribution system by monochloramine

Isabella Marchesi, PhD, Stefano Cencetti, MD, Patrizia Marchegiano, MD, Giuseppina Frezza, PhD, Paola Borella, MD, and Annalisa Bargellini, PhD

Modena, Italy
Monochloramine

- Injection of monochloramine to 1.5 - 3.0mg/L

- Observations:
  - Less disinfection by-products than chlorine
  - On-site generation
  - Hot water application proven effective
Evaluation of A New Monochloramine Generation System for Controlling Legionella In Building Hot Water Systems

Scott Duda, MS;1 Sheena Kandiah, MD, PhD;2 Janet E. Stout, PhD;1,3 Julianne L. Baron, BS;4 Mohamed Yassin, MD, PhD;2 Marie Fabrizio, BSN, CIC;2 Juliet Ferrelli, MS, MT (ASCP) CIC;2 Rahman Hariri, PhD;2 Marilyn M. Wagener, MS;5 John Goepfert;2 James Bond;2 Joseph Hannigan, CWT;6 Denzil Rogers;3
One Hospital – Two Approaches

• **Building 1**
  High percentage of outlets positive; monochloramine system installed

• **Building 2**
  High percentage of outlets positive; copper-silver ionization system installed
Building 1 - *Legionella* Distal Site Positivity Reduction With Monochloramine

![Bar chart showing distal site positivity reduction with monochloramine start date. The chart displays dates from 7/1/14 to 12/23/14 with a notable increase in positivity from 7/11/14 to 8/13/14, followed by a significant reduction with the introduction of monochloramine on 9/10/14. The chart indicates a consistent decrease in positivity after the intervention.]
Building 2. Copper-Silver Ionization: *Legionella* Distal Site Positivity vs. Time

Copper and Silver Ionization System Start Date: 9/18/14
Conclusions

• Both disinfection approaches were effective in reducing Legionella positivity

• Monochloramine was used in the building housing the highest risk group and to achieve the fastest reduction

• Legionella remediation is not “one size fits all”
Draft - Technologies for *Legionella* Control: Scientific Literature Review
New EPA Document

• *Legionella* in water systems of buildings can adversely impact public health.

• This draft document provides information on the use and effectiveness of *Legionella* control strategies.
Experience

EXPERIENCE IS THE NAME EVERYONE GIVES THEIR MISTAKES.

-OSCAR WILDE
Mistakes: Lessons Learned

• Include *Legionella* risk assessment and testing in cooling tower management plans
• Treat cooling towers with biocides effective against *Legionella*
• Understand that construction and renovation can increase *Legionella* risk
• Evaluate who is in the building (elderly, assisted living, healthcare, immunocompromised)
Mistakes: Lessons Learned

- Know that potable water systems (not cooling towers), in hospitals and other buildings with complex hot water systems, are the most important source of *Legionella* transmission.

- Proactive prevention is now an industry standard = ASHRAE 188 Water Management Programs and Risk Assessments
SPL’s Mission: 
End Legionnaires’ Disease

- No one should die from a preventable disease caused by a bacteria in water.
- Legionnaires’ disease can and should be prevented.
Let’s End LD Together
THANK YOU

Dr. Janet E. Stout
President, Microbiologist

info@specialpathogenslab.com

WWW.SPECIALPATHOGENSLAB.COM