LEGIONELLA
MONITORING AND
RISK ASSESSMENTS
Sampling Plans, Results and Remediation

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Objectives

• Understanding *Legionella* in the Built environment
• Role of *Legionella* testing in disease prevention
• Review approaches to prevention (ASHRAE, CMS, CDC)
What We Know Now

Potable water especially in hospitals (and other buildings) with complex hot water systems, is the most important source of *Legionella* transmission.
Cooling Towers

- NOT a common source for sporadic and hospital-acquired cases
- More commonly associated with large community outbreaks
Sampling Plans: Where to Test?

- Sample water systems known to be associated with cases of Legionnaires’ disease
Cases Linked to Water Systems

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

- Other water systems:
  - Spas and hot tubs
  - Decorative fountains
  - Humidifiers
  - Cooling towers
2016 CDC Report on Legionnaires’ Disease Outbreaks

Morbidity and Mortality Weekly Report

Vital Signs: Deficiencies in Environmental Control Identified in Outbreaks of Legionnaires’ Disease — North America, 2000–2014

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On June 7, 2016, this report was posted as an MMWR Early Release on the MMWR website (http://www.cdc.gov/mmwr).
Sources of Outbreaks

• 27 Outbreaks - Sources
  ▪ 44% Hotels and resorts
  ▪ 19% Long-term care facilities
  ▪ 15% Hospitals
  ▪ 21% Senior living facilities, workplaces, and the community
Potable Water vs. Utility (Cooling Towers)

• Potable water was the most frequent source of exposure (56%), followed by cooling towers (22%)
• Potable water sources accounted for 67% of health care–associated outbreaks (in hospitals and long-term care facilities).
Vital Signs: Health Care–Associated Legionnaires’ Disease Surveillance Data from 20 States and a Large Metropolitan Area — United States, 2015

Elizabeth A. Soda, MD1,2; Albert E. Barskey, MPH1; Priti P. Shah, MPH1; Stephanie Schrag, DPhil2; Cynthia G. Whitney, MD2; Matthew J. Arduino, DrPH3; Sujan C. Reddy, MD3; Jasen M. Kunz, MPH4; Candis M. Hunter, MSPH4; Brian H. Raphael, PhD2; Laura A. Cooley, MD2
Findings

• Problem is nationwide
• 20% of the reported cases healthcare-acquired
• Deadly - 25% mortality
• Many cases associated with long-term care
New York Is Being Proactive!

State-wide regulation requires testing and water management plans for cooling towers

AND

potable water systems of healthcare facilities
DATE: June 02, 2017
TO: State Survey Agency Directors
FROM: Director
Survey and Certification Group

SUBJECT: Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires’ Disease (LD)
Requirements for Surveyors and Healthcare Facilities

• This policy memorandum applies to:
  ▪ Hospitals, Critical Access Hospitals (CAHs) and Long-Term Care (LTC).
  ▪ This policy memorandum is also intended to provide general awareness for all healthcare organizations.
Effective Immediately

• Conduct a risk assessment to identify where *Legionella* and other opportunistic waterborne pathogens could grow and spread in the water system
Expectations

• CMS expects HCF’s to have water management policies to reduce the risk of growth and spread of:
  ▪ *Legionella* and other opportunistic pathogens in building water systems
• ANSI/ASHRAE Standard 188

• First *Legionella* standard in the United States.

• Approved June 26, 2015.
CDC Emphasizes Water Management

Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings

A PRACTICAL GUIDE TO IMPLEMENTING INDUSTRY STANDARDS
CMS Expectations

• Implement a water management program that includes:
  ▪ Control measures
  ▪ Temperature management
  ▪ Disinfectant level control, and
  ▪ Environmental testing for pathogens
Questions to Ask When Testing

• Was *Legionella* found in the water system?
  ▪ Pathogenic species?
  ▪ Extent of colonization?
  ▪ Colonization in sensitive areas?
TEST TO PROTECT

TESTING PLAYS AN IMPORTANT ROLE IN DISEASE PREVENTION
Why Test?

- Assess the risk
- Control the risk (through engineering controls or water treatment)
- Before cases occur
- Prevent Legionnaires’ disease!
Why Test?

If you don’t look for it, you won’t find it.

If you don’t find it, you don’t think you have a problem.

If you don’t think you have a problem, you don’t do anything about it.

—Bruce Dixon, M.D.
Director, Pittsburgh ACHD
Test to Find Out Where You Stand

• Is your facility in the 50% of buildings with or without *Legionella*?

• Myth – *Legionella* is not everywhere (ubiquitous)

• Healthcare facilities – greater risk?
Test to Find Out Where You Stand

• If you find *Legionella* – was it *Legionella pneumophila*, serogroup 1?
  ▪ Not all *Legionella* have the same risk
  ▪ *L. pneumophila* serogroup 1 has highest risk for disease
  ▪ Directs diagnostic approach
Approaches to Prevention

CDC REACTIVE

• After 1 transplant patient or 2+ cases within 6 months
  ▪ Combined epidemiologic and environmental investigation
  ▪ *Legionella* source identified = decontaminate

PROACTIVE

• Perform environmental surveillance before cases
• Perform clinical surveillance to identify unrecognized cases
  ▪ *Legionella* source identified = decontaminate
“We are not against testing water for the presence of *Legionella*…

We think it has its place, particularly in healthcare facilities.”

Cynthia Whitney, MD, Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, CDC. June 8, 2016 Pittsburgh Post Gazette
Approach to Environmental Sampling

• Select a minimum of 10 distal sites (faucets or showers) that roughly represent the water distribution system, plus hot water tanks or recirc. line.

• Include sites on multiple floors and wings, high risk areas like oncology, transplant units, medical surgical units.
Assessing Risk – Potable Water

Risk of Legionnaires’ disease was better predicted by the proportion of water system sites testing positive for *Legionella* than by the concentration of *Legionella* bacteria.

Calculate Distal Site Positivity

- Number of outlets positive for *Legionella* of 10 distal sites (faucets or showers) that were tested
- Estimates the probability of a patient “bumping into” *Legionella* (percent positive)
- If >30% risk increases, especially if *L. pneumophila*, serogroup 1 is present (now part of NYS regulation)
Sampling the water system of a building can give you a meaningful “snapshot” of the colonization status.
How to Test?

• Method of sample collection and processing can dramatically affect the results
  ▪ Cooling towers
  ▪ Potable water – building water distribution systems
    • Hot water primary reservoir
SAMPLE COLLECTION: FIRST DRAW HOT WATER
Do Not Flush Prior to Sample Collection

- No Flush
  - Collect immediately after opening faucet or shower valve
  - Flushing reduces recovery
- If CFU >0.5 log in the sample:
  - Immediate draw 97.7% positive
  - 2 min. flush 69.1% positive
SAMPLE COLLECTION:
FROM THE BASIN
You Can’t Tell by Looking

Automated dosing of chemical biocides and clean

>3000 CFU/mL
Legionella pneumophila serogroup 1
First Method Used to Detect *Legionella*
Legionella Testing
According to CDC

• CDC recommends using a testing method capable of detecting all members of the *Legionella* genus but also one that provides material for typing. At the moment, this means culture.

• Particularly true during an investigation and in the immediate aftermath
Legionella Testing

• Culture is more reliable (sensitive & specific) than other “rapid tests”

• New methods/approaches
  ▪ Molecular (qPCR and microarray)
  ▪ Most Probable Number (MPN)
ICT-Type Test: Quick But Inaccurate?

Fails to detect Legionella pneumophila serogroup 1

> 3,000 CFU/ml

Legionella culture successfully detects Legionella pneumophila serogroup 1
Molecular Testing: Quantitative PCR (qPCR)

• Benefits
  ▪ Rapid
  ▪ Genus and species specific probes
  ▪ Good agreement with culture with *Legionella pneumophila* and *L. pneumophila*, serogroup 1 probes

• Limitations
  ▪ Cannot discriminate between live and dead cells
  ▪ Genomic units (GU) do not directly correlate to CFU
MPN (Legiolert)

• Detects *Legionella pneumophila* using substrate reaction.
• Water samples are incubated at 39°C (± 0.5°C) for 7 days.
• Serotyping or species identification requires additional steps.
• Easy-to-use platform, similar to that of Colilert®.
Culture Methods for *Legionella* Testing & Identification:

Did You Know That Labs Differ in Their Methods?
“Apples to apples or apples to oranges”?
Culture Method

• Processing Methods
  ▪ Pretreatment (heat and/or acid)
  ▪ Filtration (yes/no or how much)
  ▪ Culture media (types and how many)

• Identification (ID) Methods
  ▪ Only presumptive agglutination test?
  ▪ Definitive ID with DFA or sequencing for unusual species?
Confirm the Lab Meets These Requirements

• Labs performing testing should be
  ▪ Accredited for microbiology testing, quality (ISO 17025) and for *Legionella* testing as a specific field of testing
  ▪ Not just CDC ELITE certified
Water quality — Enumeration of Legionella

Qualité de l’eau — Dénombrement des Legionella
Is the Sky Falling?

If I find some *Legionella*?
Preventing Legionnaires’ Disease

• Controlling *Legionella* is about preventing disease—not about reaching zero *Legionella* in water

• Zero cases is the goal

• Zero *Legionella* is not necessary to avoid outbreaks
WATER SAFETY PLAN
(RISK MANAGEMENT)
Legionella Water Safety

• Fundamentals of Legionella water safety
  ▪ Perform an assessment to understand Legionella risk in your facility

▪ Implement water safety plan to:
  • Understand the water system
  • Assess risks
  • Control risks
  • Verify and validate Legionella control through testing
Legionella Water Safety

• Know who is at risk for Legionnaires’ disease in your facility
  ▪ Highest risk: smokers, elderly and immune suppressed
  ▪ But, can affect those with no risk factors

• Identify key players who are responsible for water safety
  ▪ Facility managers, maintenance, occupants, regulators, engineers, water treatment providers, Legionella experts, etc.
Legionella Risk

• Know what part of a water system could lead to Legionella exposure
  ▪ Highest risk: Hot potable water systems

  ▪ Not all buildings have Legionella

  ▪ Risk is a function of
    • susceptibility of occupants
    • extent of colonization or exposure
    • pathogenicity of Legionella species
Essential Steps in *Legionella* Water Safety Plan

1. Pre-Assessment information
2. Onsite assessment
3. Baseline data assessment
4. Create water system flow diagrams
5. Water safety plan implementation
Evidenced-Based Plans

- Facility and occupant risk
- Field assessment data
- *Legionella* culture results
- Peer-reviewed literature
- Standards and guidelines
Final Thoughts

• Legionnaires’ disease and *Legionella* bacteria contamination can occur in old and new buildings and during renovation

• Risk can be managed:
  - Assessment and water safety plans
  - Think *Legionella*, particularly in healthcare facilities (CMS)
  - Test for *Legionella* before cases occur
New Responsibilities
(Liabilities?)
With Compliance Comes More Protection

Compliance with new standards (ASHRAE) and regulations (CMS & NYS) will provide a compelling defense against claims of negligence.
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 — Facilities Management

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.
Water Safety Plans

• Once you have a plan, follow it!

• Compliance is measured by:
  - ASHRAE 188 Elements
  - CDC Tool Kit
  - How your plan meets or exceeds compliance requirements
  - Whether you have followed your plan
Hospitals are often required to perform a supplemental disinfection of their water systems to protect individuals from hospital-acquired Legionella disease. The authors of this article recently studied one hospital where three cases of hospital-acquired Legionella disease were detected in less than two years. These cases were linked to a Legionella infection of the hospital’s water system. Chlorine dioxide (ClO₂) was considered a cost-effective approach to disinfection given that ClO₂ generators could treat the 23 buildings comprising the hospital complex from one central location.

The authors evaluated the efficacy of maintaining a residual of 0.3 to 0.6 mg/L of ClO₂ for Legionella control in the secondary distribution system of the 417-bed hospital over a one-year period. Monthly monitoring showed mean Legionella levels at hot water outlets and cold building source water areas decreased from 20 to 15% and 10 to 5%, respectively (p < 0.05). ClO₂ residuals decreased with increasing distance from the application point and temperature. Mean ClO₂ concentrations were lowest in hot water outlets (0.73 mg/L) followed by cold water outlets (0.32 mg/L) and reservoirs (0.68 mg/L). Complete eradication of Legionella was detected after 17 weeks, and no cases of Legionella disease were reported during this time.

keeping Legionella out of water systems
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
Short-Term Disinfection Is Whack-a-Mole
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
Interested in Learning More?

Dr. Janet E. Stout podcast: *Legionella* for Water Treatment Professionals

http://scalinguph2o.com
How are we doing?

PREVENTING LEGIONNAIRES’ DISEASE
Progress Has Been Slow…
Really Slow!
Celebrating More Than 40 Years of Making Headlines
Things That Happened in 1976 in Philadelphia

40 years is a long time!
Our 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

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