

Healthcare Water Systems

Accessible version: <https://www.cdc.gov/infectioncontrol/control/environment/index.html>



Guidelines for Environmental Infection Control in Health-Care Facilities

Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention (CDC)
Atlanta, GA 30329

2003
Updated: July 2019

“Moist environments and aqueous solutions in healthcare setting have the potential to serve as reservoirs for waterborne microorganisms”

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13

Local Regulations

Established

- New York City – Cooling Towers
- New York State – Cooling Towers
- New York State – Healthcare
- Garland, TX – Cooling Towers
- Veterans Admin – Potable Water

Proposed

- Florida – Cooling Towers
- New Jersey – All water systems



Some Local Regulations Address Potable and Non-potable

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Centers for Medicare & Medicaid Services

DEPARTMENT OF HEALTH & HUMAN SERVICES
Center for Medicare & Medicaid Services
Highways Department, Room 5010
Washington, DC 20261



DATE: June 02, 2017

TO: State Survey Agency Director

FROM: Director, Survey and Certification Group

SUBJECT: Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Case and Outbreaks of Legionnaires' Disease (LD)

Pub. No. 17-08 (Replaces C-001-10A)
REVISED 06/02/2017

- Conduct a facility risk assessment
- Implement a water management program
- Specify testing protocols, control measures, etc.

National Regulation to Address Legionella in Potable Water

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Legionella and Legionnaires' disease

A Case of Legionnaires' Disease

Source: Public water supplies

Growth: Building (warm) water systems

- Faucets, showers
- Hot water tanks
- Decorative fountains
- Pools, spas
- Cooling tower

Not airborne, surfaces, condensation

- Reservoir



A Case of Legionnaires' Disease

Legionella is not ubiquitous, ~50% of building water systems

Lots of Legionella species and serogroups (>60)

Legionella pneumophila serogroup 1 causes majority of infections

- Pathogenic Legionella

W Lp1 W

- Reservoir



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A Case of Legionnaires' Disease

3 Routes: Aspiration, Aerosolization, Direct Installation

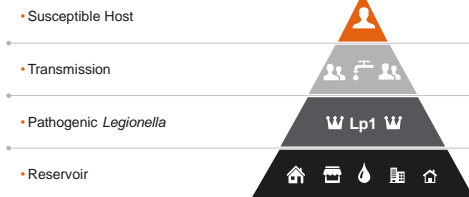


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A Case of Legionnaires' Disease

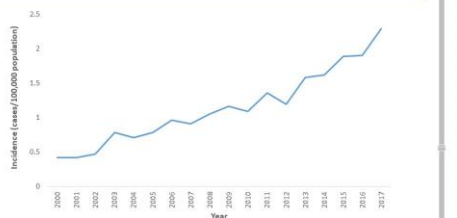
Primarily: Elderly, Smokers, Immunocompromised



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Legionnaires' disease is on the rise in the United States



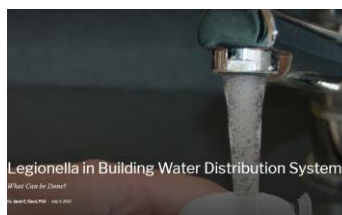
Rate of reported cases increased 5.5 times (2000–2017)

Source: National Notifiable Diseases Surveillance System

Source: Environmental and Professional (EPC)

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Legionella in Building Water Distribution Systems

By Sarah Rose PhD | 14.3.2017

“...mortality for Legionnaires' disease continues to be high – as high as 25 percent for cases acquired in the healthcare facility.”

<https://www.workingpressuremag.com/legionella-in-building-water-distribution-systems/>

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Management of *Legionella* in Water Systems

Committee on Management of Legionella in Water Systems
 Water Science and Technology Board
 Board on Life Sciences
 Board on Population Health and Public Practice
 Division on Earth and Life Studies
 Health and Medicine Division
 A Consensus Study Report of
 The National Academies of
 SCIENCES • ENGINEERING • MEDICINE

THE NATIONAL ACADEMIES PRESS
 Washington, DC
www.nap.edu

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“ Stronger Policies Needed to Protect the Public From Legionnaires' Disease.”

<https://www.nap.edu/catalog/25474/management-of-legionella-in-water-systems>

Other Opportunistic Waterborne Pathogens

24

Opportunistic Waterborne Pathogens

Legionella

Pseudomonas aeruginosa

Nontuberculous mycobacteria (NTM)

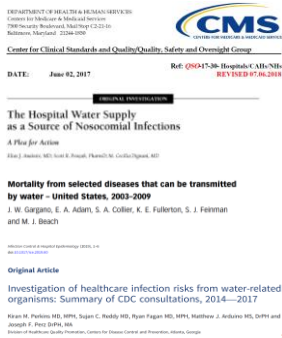
Acinetobacter

Burkholderia

Stenotrophomonas

Fungi

Serratia marcescens



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Source/Reservoir

Legionella

Building Water Systems

Other Pathogens

Building Water Systems

Surfaces

Soil, Dust, Debris

Air

Cleaning Solutions, Soap

Medical Devices, Solutions

Sink Drains, Sanitary

Flowers, Fruits and Vegetables

Infected Patients or Staff

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Transmission

Legionella

Aspiration

Inhalation / Aerosols

Other Pathogens

Aspiration

Inhalation / Aerosols

Direct Contact

Indirect Contact

Environmental Contact

Infection Site

Legionella

Lungs / Pneumonia

Other Pathogens

Lungs / Pneumonia

Urinary Tract

Soft Tissue / Eyes

Burns

Wounds

Blood

Also: Growth Factors, Survival Outside of Water, Susceptibility to Disinfectants

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Environmental Testing

Different sampling plans

Different culture media

- Not the same as clinical medias

Different laboratory qualifications and methods



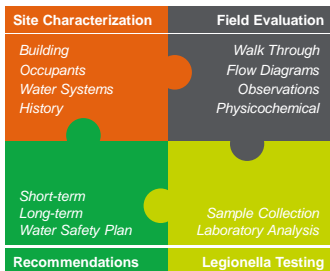
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Risk Assessment and Water Safety Programs

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Risk Assessment



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Sampling Plan for Risk Assessment

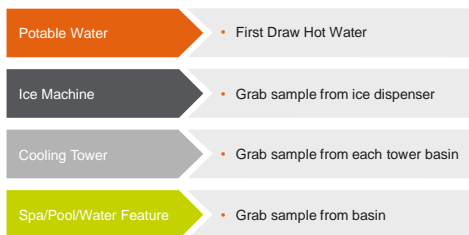
“What is the **greatest chance** someone may be **exposed** to *Legionella* from the water system?”



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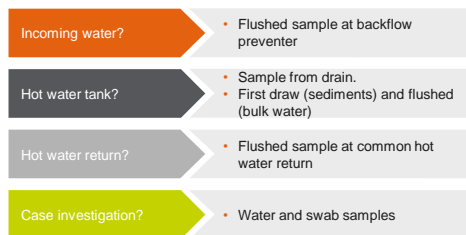
Sampling Approach for Risk Assessment



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Other Sampling Plans



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Evidenced Based Recommendations

Data Analysis

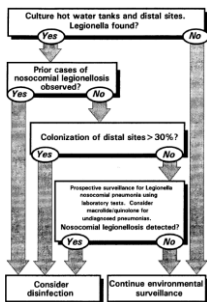
- Physicochemical measurements
- Environmental testing results
- Clinical data (testing or cases)

Outcomes

- Water system adjustments
- Disinfection
- Water Safety Plan

Approaches to Prevention and Control of Legionella Infection in Allegheny County Health Care Facilities, 1997.

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Water Safety and Management Program

ASHRAE Standard 188

First and only *Legionella* standard in the United States

Scope:

- Minimum *Legionella* risk management requirements
- Applies to human-occupied buildings (except single-family)
- Intended for use by owners and managers of buildings
- Includes design, construction, commissioning, operation, and repair of buildings



Legionellosis: Risk Management for Building Water Systems

Approved by the ASHRAE Standards Committee on May 12, 2015, for the ASHRAE Board of Directors on June 3, 2015, and for the American Society of Heating, Refrigerating and Air-Conditioning Engineers on June 15, 2015.



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ASHRAE 188 – Water Safety Approach

Program Team	<ul style="list-style-type: none"> Persons responsible for Program development and implementation
Flow Diagrams	<ul style="list-style-type: none"> Water system descriptions Water system schematics
Analysis	<ul style="list-style-type: none"> Assess potential for <i>Legionella</i> growth and determine control locations
Control Measures	<ul style="list-style-type: none"> Determine control limits to manage potential for <i>Legionella</i>
Monitoring/Corrective Actions	<ul style="list-style-type: none"> Establish monitoring procedures for controls Determine actions to take when outside limits
Confirmation	<ul style="list-style-type: none"> Verification: Is program being implemented Validation: Is <i>Legionella</i> being controlled
Documentation	<ul style="list-style-type: none"> Program documentation and communication

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ASHRAE 188 – Design & Commissioning

Design Compliance	<ul style="list-style-type: none"> Design address potentially hazardous conditions which could promote <i>Legionella</i> growth
Documentation	<ul style="list-style-type: none"> Final installation deliverables
Balancing	<ul style="list-style-type: none"> All water systems are balanced and reported
Commissioning	<ul style="list-style-type: none"> Post-construction flushing and disinfection prior to beneficial occupancy

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Legionella and Other Pathogens

Risk Assessment

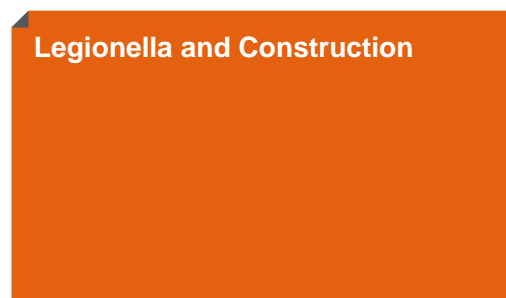
- Assessment for other pathogens should be driven by infection prevention concerns
- Water may not be the only source of other pathogens

Water Safety Plans

- ASHRAE 188 written for Legionella
- Other pathogens may have different control measures, mitigation approaches, and validation methods

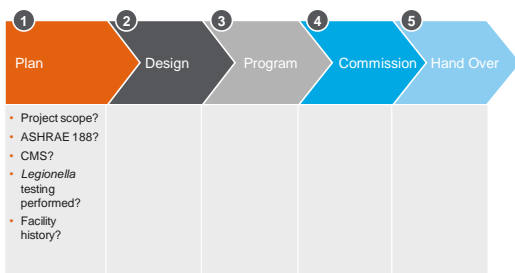
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40

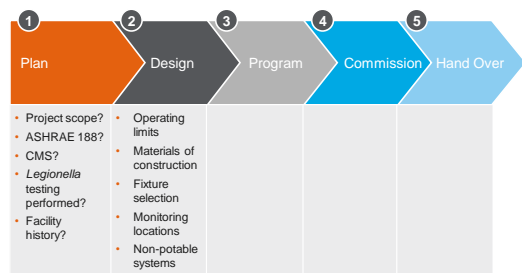
Legionella and Construction



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Legionella and Construction



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Design Stage

Materials

Choices

- SS, copper, PVC, CPVC, PP-R, PE-X, PE-RT, DI, CI, rubber, epoxy...

Uses

- Pipe, valves, equipment, gaskets, filters, coating...

Interactions

- Disinfectants, water chemistry, dissimilar metals

Fixtures

- Opportunity to promote bacteria growth
- Point of use filter compatibility
- Disinfection compatibility
- Splashing and surfaces

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Design Stage

Monitoring Points

- Temperature
- Flow
- Water quality
- Sample collection
- Flushing
- Chemical injection

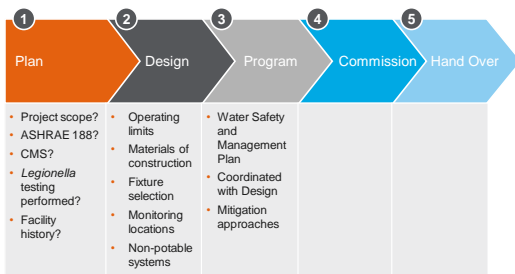
Non-Potable Systems

- Backflow prevention
- Proximity to occupants
- Extent of aerosolization
- Chemical treatment program
- Isolation of piping or basins

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Legionella and Construction



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Program Stage

Coordination with WSP

Examples:

- Check/change filters, but not accessible
- Control limit monitoring, but no sample point
- Flush tank or basin, but insufficient drain point
- Maintain complete circulation, but off-line basin or pipe segment

Mitigation Approaches

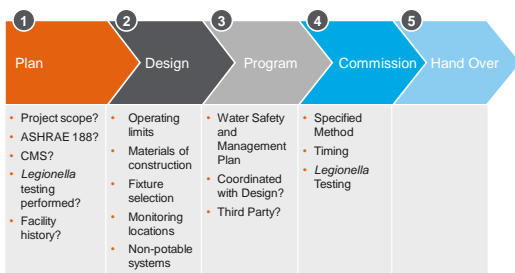
Examples:

- Thermal disinfection, but mixing valves installed
- Chemical disinfection, but incompatible materials
- Install POU filter, but no adapters

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Legionella and Construction



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Commissioning – ASHRAE 188

Does say....

Meet AWWA C651/652 or Local Regulation

Complete within 3 weeks prior to occupancy

- If delayed occupancy flushing or re-disinfection

Confirm water system meets performance parameters for operation

Does not say...

- Actual chlorination requirements
 - AWWA C651 25 mg/L for 24 hours
 - ICC Plumbing Code 50 mg/L for 24 hours
- Hot and cold water systems and equipment
- Pre/Post chlorine checks and logging
- Extent of flushing and disinfection
- Qualification requirements of company performing disinfection
- Is Legionella testing needed
 - Species, concentration, extent, action limits
 - How many samples, location, collection method
 - Laboratory qualifications
- Who is responsible to perform testing?
- What if testing fails?
 - How to maintain water systems after testing
 - Who is responsible for on-going flushing
 - Who is responsible if occupancy extends beyond three weeks

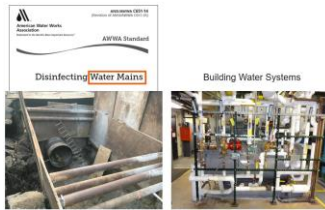
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Concerns with Commissioning

- Standards not designed for building distribution systems or *Legionella* validation

Disinfection Standards – AWWA C651

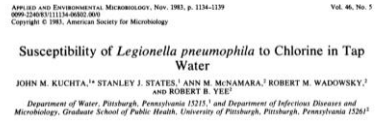


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Concerns with Commissioning

- Standards not designed for building distribution systems
- Legionella* is more resistant to chlorine than coliforms



At 21°C and 0.1 mg/L free chlorine

- 99% kill *Legionella pneumophila* in 40 minutes
- 99% kill *E. coli* < 1.0 minute

Legionella is more resistant to chlorine than other bacteria such as coliform bacteria.

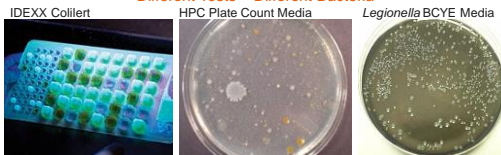
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Concerns with Commissioning

- Standards not designed for building distribution systems
- Legionella* is more resistant to chlorine than coliforms
- Assumption that if coliforms or HPC is controlled then no risk for *Legionella*

Different Tests = Different Bacteria



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Validation of Legionella Control

- *Legionella*
- HPC
- *E. coli* / Coliform
- Temperature
- Disinfectant (chlorine)
- pH
- Flushing
- New equipment or pipes

“ The only way to know *Legionella* is being controlled is to test for *Legionella*.”

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Goal: Prevent Disease

53

Goal: Prevent Disease

Regulatory

- Some regulations, standards and guidelines exist
- Need to do more to protect the public from *Legionella*

Other Opportunistic Pathogens

- Other pathogens are associated with water
- Primarily a healthcare concern
- Consider risk approaches differently than *Legionella*

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Goal: Prevent Disease

Risk Assessment and Water Safety

- Approaches existing to understand and manage risk
- Environmental testing for *Legionella* only way to determine risk
- No correlation between *Legionella* and other pathogens

Construction

- Address conditions favorable to *Legionella* growth
- *Legionella* specific commissioning required
- Actively test building water systems prior to and after beneficial occupancy

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Questions/Discussion



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56

Thank you!



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Acknowledgement:



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57