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## Water Safety & Legionella Risk Reduction for Ambulatory Surgical Centers

January 18, 2018

**Presented by**

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## Learning Objectives

- ▲ Summarize the origins and types of microorganisms present in premise plumbing systems
- ▲ From biofilm to outbreaks: How premise plumbing systems can be a source and vector of Legionnaires' Disease (LD) and other waterborne pathogens
- ▲ Morbidity/mortality associated with Legionnaires' disease
- ▲ Water as a source of HAIs
- ▲ Overview of strategies to reduce risk

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## Key Takeaways

- ▲ Water can be a source and vector of infection
- ▲ The bacteria that cause both Legionnaires' disease and other infections can contaminate premise plumbing systems
- ▲ There is a strong body of evidence showing infection risk, illness and death from contaminated premise plumbing systems
- ▲ Strategies to reduce risk include education, risk assessment, secondary disinfection, POU filters and pathogen testing

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A horizontal process flow diagram with five steps in chevron-shaped boxes:
 

- Water entering a building is not sterile
- Design and use creates biofilms
- Pathogens may be present in biofilms
- Water can be a source & vector of infection
- Infection risk can be reduced

 Below this, a larger blue chevron box contains the text:
 

Design and use creates biofilms → Pathogens may be present in biofilms

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### Biofilms – Biology Finds a Way

- ▲ Aquatic bacteria find themselves in a nutrient-poor environment
  1. Attachment and adherence
  2. A microbial colony develops
  3. A microbial community forms
  4. The biofilm grows
  5. Bacteria escape
- ▲ Certain bacteria create the biofilm
- ▲ Other bacteria find the architecture and environment appealing
- ▲ Grazing amoeba looking for a meal

A diagram showing a cycle of five numbered steps (1-5) with arrows indicating a clockwise flow. The steps correspond to the list on the left. The diagram shows a biofilm growing on a surface and then detaching into the water.

COURTESY: Center for Biofilm Engineering, Montana State University, Bozeman, MT (with thanks)

**To survive and thrive, they must find food, water, shelter and a place to raise their families.**

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A horizontal process flow diagram with five steps in chevron-shaped boxes:
 

- Water entering a building is not sterile
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Water can be a source & vector of infection

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Perhaps the most granular example of how a healthcare facility water system can be the source and vector of infection.

## LEGIONNAIRES' DISEASE



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## Legionnaires' Disease

### A brief history

- ▲ Disease was first recognized and characterized in **1976**
- ▲ Infection occurred in attendees at the American Legion's state convention in Philadelphia
  - More than 200 people were sickened with severe pneumonia and 34 people died
  - Many of the people who became ill had stayed at the Bellevue-Stratford hotel in Philadelphia
- ▲ Public health officials were baffled by this outbreak initially named Legion disease
  - Theories centered on the agent being a toxin, virus, a fungus, or perhaps, a bacterial form of pneumonia
- ▲ After several months of research, scientists at CDC identified the causative agent – a bacteria
- ▲ The bacteria was named *Legionella pneumophila*



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## Legionellosis

### What is it?

- ▲ **Legionnaires' Disease (LD)**
  - A serious, potentially deadly form of bacterial pneumonia caused by *Legionella pneumophila*
  - Atypical pneumonia
  - Hospitalization common
  - Incubation period of 2-14 days after exposure
  - Serious neurological and renal sequelae can result
- ▲ **Pontiac Fever**
  - Less-severe influenza-like illness
  - Incubation period of 24-72 hours after exposure
  - Hospitalization uncommon

### Legionella Facts

-  Inhaled as an aerosol or water mist
-  Aspirating water or ice chips has caused disease (rare cases)
-  Drinking contaminated water does NOT cause legionellosis
-  Not considered contagious

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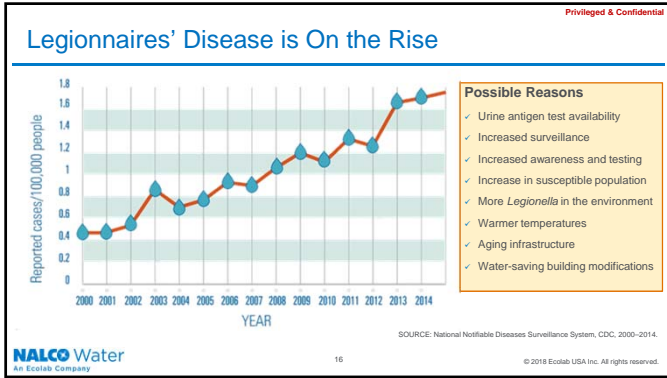
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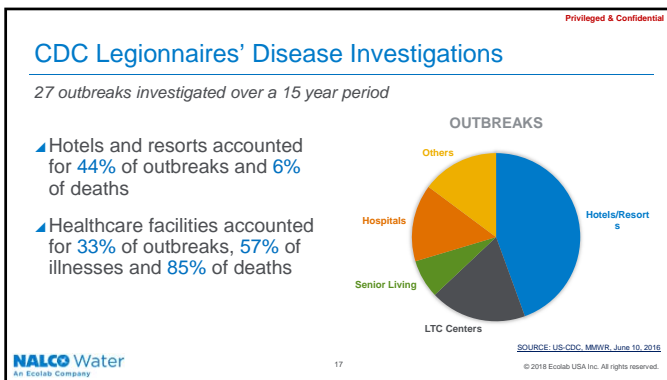
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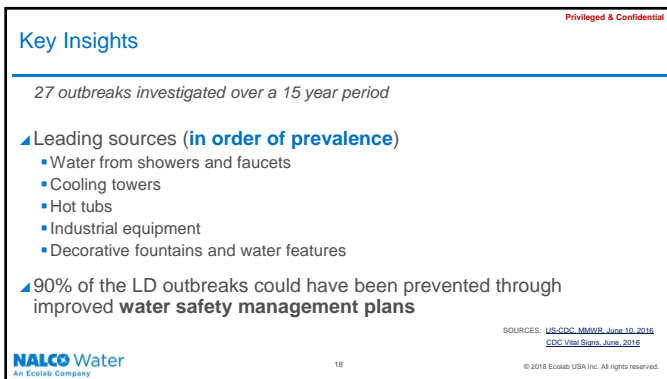
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### CDC's Observed Deficiencies

- ▲ "Inadequate disinfectant in potable water"
- ▲ "Inadequate disinfectant in cooling tower"
- ▲ "Inadequate disinfectant in hot tub"
- ▲ "Disinfectant not routinely added to decorative fountain"
- ▲ "Stagnation... closed wing with unused potable water system"
- ▲ "Use of tap water in personal respiratory device"
- ▲ "Insufficient clinical testing for *Legionella* among patients with healthcare-acquired pneumonia"

SOURCE: US-CDC, MMWR, June 10, 2016  
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### LD in the Healthcare Environment

- ▲ LD is under-recognized and under-reported
- ▲ 25% of people who contract LD from a healthcare facility will die
- ▲ Showers, faucets, jetted therapy pools, ice machines, cooling towers, decorative fountains and water features are primary vectors
- ▲ Healthcare facility leaders need to be aware that LD is a risk in their facilities
- ▲ A **water safety management program** can reduce *Legionella* growth and spread in buildings

SOURCE: CDC, Vital Signs, June 2017  
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### Healthcare Associated Outbreaks of LD

Building Type	Source	Year	Illnesses, Deaths
Long Term Care Center	Potable water	2002	31 illnesses, 2 deaths
Long Term Care Center	Cooling towers	2005	82 illnesses, 23 deaths
Hospital	Potable water	2006	10 illnesses, 3 deaths
Senior Living Facility	Potable water	2006	6 illnesses, 0 deaths
Senior Living Facility	Potable water	2009	10 illnesses, 1 deaths
Hospital	Decorative Fountain	2010	8 illnesses, 0 deaths
Hospital	Potable water	2011	13 illnesses, 1 deaths
Long term Care Center	Potable water	2011	10 illnesses, 8 deaths
Hospital	Potable water	2012	21 illnesses, 5 deaths
Long Term Care Center	Unknown	2013	19 illnesses, 5 deaths
Long Term Care Center	Cooling tower	2013	41 cases, 6 deaths
Veterans' Home	Unknown	2015	56 cases, 11 deaths

SOURCE: US-CDC and Haupt et al. 2012  
Note: Although ASC facilities have not had issues, many State health agencies (e.g., Illinois, Indiana, Ohio) will expect compliance with the CMS S&C-17-30 policy that was issued June 2017.  
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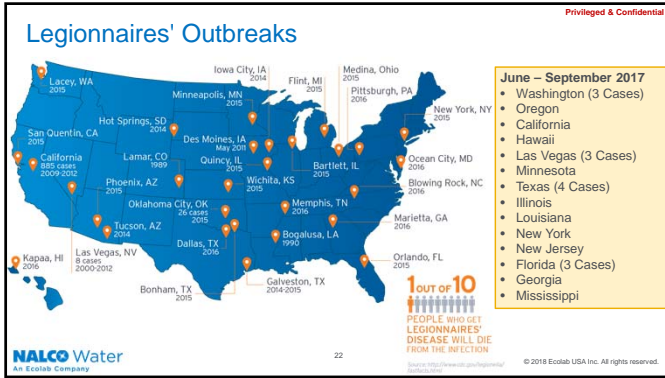
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### Water as a Source & Vector of Infection

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Opportunistic Waterborne Pathogens present in building water systems have been linked to healthcare-associated infections (HAIs)

- *Legionella pneumophila*
- *Pseudomonas aeruginosa*
- *Stenotrophomonas maltophilia*
- *Acinetobacter baumannii*
- *Mycobacterium chelonae*
- *Aspergillus* and *Fusarium* spp.

Literature citations of waterborne HAIs

- Bone marrow transplant units
- Oncology wards
- Surgical ICUs
- Sub-acute care units
- Neonatal units
- Burn units

**Hospital Water:**  
An Overlooked and Controllable Source of Healthcare-Associated Infections

Anastasi et al. 2002  
Anastasi et al. 2003  
Cevia et al. 2010  
Einer et al. 2005  
Holmes et al. 2009  
Walker et al. 2013

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### Gram-negative Bacteria, NTM & Fungi

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Microorganisms that are present in water have been linked to healthcare associated infections

Infections can result from...

- Aerosols of water particles from flowing water
- Bathing & washing
- Drinking
- Contaminated ice
- Rinsing medical devices
- Eye wash stations

*Pseudomonas aeruginosa*

SOURCE: US CDC, James Archer (with thanks)

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### Water as a Source & Vector of Infection

- 74% of taps without temperature selection were contaminated with *P. aeruginosa* (2007)
- In 15 of 45 patients, the genotypes of *P. aeruginosa* infections matched isolates from faucets in patient rooms
- 132 patient cases of *P. aeruginosa* were investigated
  - In 42% of these cases, the DNA fingerprint of *P. aeruginosa* infections from patients was identical to the DNA fingerprint of *P. aeruginosa* found in the inner part of faucets in an ICU
- 38 patient cases of *P. aeruginosa* were investigated
  - 39% of water samples from electronic faucets in areas including hematology units and ICUs yielded *P. aeruginosa*.
  - The DNA relatedness of isolates of *P. aeruginosa* infections in 38 patients matched isolates from 52% of the faucets



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SOURCE: Myers et al. 2014  
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### Water as a Source & Vector of Infection

- A 2009 study showed that NTMs are enriched >100-fold above background water samples in showerhead biofilms.
- In 2010, a hospital-acquired outbreak of LD sickened 8 people. The source was identified as a decorative fountain in the hospital public area.
- A 2014 study showed that NTM was found in 106/183 (58%) of endpoint (sinks/faucets) water samples over a three year surveillance period. Authors cited concern with risks of infection.
- A 2015 study showed the source of a postoperative breast infection by *Mycobacterium fortuitum* to be the hospital water supply.
- A pseudo-outbreak of *Elizabethkingia meningoseptica* infection in 30 patients over a 22 month period was epidemiologically linked to the hospital water system.



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SOURCES:  
Cragg et al. 2014  
Feszel et al. 2009  
Haupt et al. 2102  
Jaubert et al. 2015  
Moore et al. 2016

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### Ice Machines

- Contaminated ice machine as a potential source for transmission of carbapenem-resistant *Acinetobacter baumannii*<sup>1</sup>
  - Investigation of potential sources of transmission of multidrug-resistant gram-negative bacilli on a spinal cord injury unit
  - Genetically related carbapenem-resistant *Acinetobacter baumannii* was isolated from;
    - Ice machine water outlet spout and drain
    - Hands of a nurse
    - The stool of 3 patients
  - Could ice machines serve as reservoir for Gram-negative bacilli?
  - Can ice machines become contaminated by the hands of personnel that were in contact with a colonized patient?
  - Was the potable water entering the ice machine the source?



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<sup>1</sup> Donskey, Nov. 1, 2017. Am. J. of Infection Control, Vol. 45:1273-1275  
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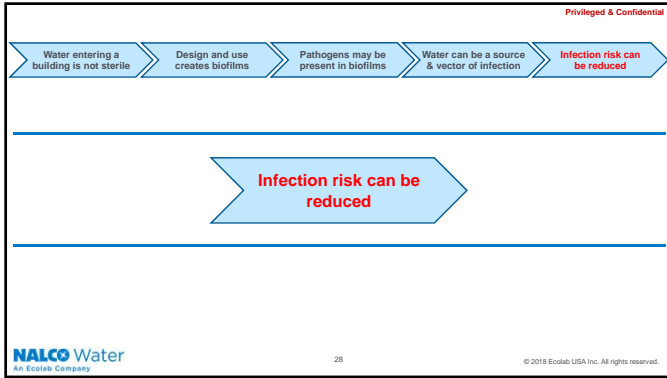
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### 90% of Outbreaks are Preventable

**Legionnaires' Disease**  
The water management programs in buildings to help prevent outbreaks

**9 in 10**  
CDC investigations show almost all outbreaks were caused by problems preventable with more effective water management.

SOURCE: CDC Vital Signs, June 2016

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### Why This and Why Now?

ASHRAE

ASHE  
American Society for Healthcare Engineering  
of the American Hospital Association

Department of Veterans Affairs

CDC  
CENTERS FOR DISEASE CONTROL AND PREVENTION

EPA  
ENVIRONMENTAL PROTECTION AGENCY

The Joint Commission

CMS  
CENTERS FOR MEDICARE & MEDICAID SERVICES

SOURCE: US-CDC Vital Signs, June 2016.

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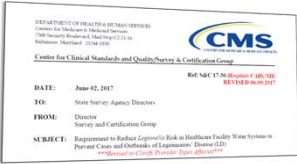
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### CMS Requirement S&C 17-30

Requires healthcare facilities to develop policies and procedures to reduce *Legionella* risk in building water systems



**A facility must...**

- ✓ Implement a Water Management Program per **ASHRAE Standard 188**
- ✓ The program should define testing protocols, control measures/limits, corrective action, regular review & documentation.

According to the **Indiana State Department of Health**, compliance with CMS is... "Ultimately, the responsibility for infection control rests with the certified entity, which is the ASC."

According to the **Ohio Department of Health**, "while the CMS directive does not specifically identify ASCs, in their opinion it does apply to all certified health care facilities (including ASCs). Monitoring might not be as aggressive as other settings, but it is expected that this oversight should be incorporated within the center's infection control program".



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### Elements of a Water Management Program

ASHRAE Standard 188

#### START WITH A PLAN

- 1 Organize a Program Team  
Development & Implementation
- 2 Describe Your Water Systems & Flow Diagrams
- 3 Analyze System Hazards
- 4 Define Control Measures & Monitor Them
- 5 Intervene When Control Limits are Not Met
- 6 Review & Confirm the Program
- 7 Document, Communicate & Adjust



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### How to Manage Waterborne *Legionella* Risk

- 🔍 Conduct a Facility Risk Assessment
- ✅ Develop a Water Management Program
- 🧪 Confirm Performance: *Legionella* Monitoring & Water Temp/Oxidant Testing
- 🔗 Integrate Strategies: Long- & Short-Term Controls, Contingency Protocols & Emergency Response



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## WATER SAFETY EXPERTISE

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Global Experts in Water Safety  
**25+ years**



**Research**  
Microbiologists, Scientists & Engineers

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

Starting in 1999



**80,000** tests/year globally

**We have boots on the ground everywhere.**  
Local service delivered by sales & service associates worldwide.



**10,000+** Water Safety Plans Implemented Globally

Healthcare, Hospitality, Education, Commercial, F&B, Manufacturing, Industrial



**Disinfection of 1 billion+ gallons** of potable & non-potable water annually

EXPERTISE AND SOLUTIONS THAT MAKE THE WORLD CLEANER, SAFER AND HEALTHIER

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