

Whole-Genome Sequencing

- *L. pneumophila* serogroup 1 isolates recovered from the South Bronx Hotel (building A) cooling tower were **identical** to the *L. pneumophila* serogroup 1 isolates from 26 patients linked to this outbreak.

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



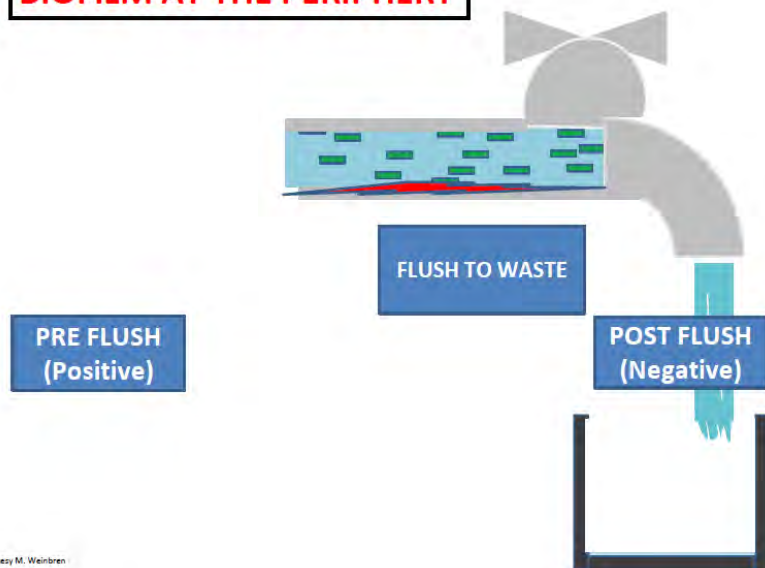
SAMPLE COLLECTION

First Draw Hot Water

- Do not Flush
 - Collect hot water immediately after opening faucet or shower valve
 - Flushing reduces recovery
 - Immediate draw 97.7% positive reduced to 69.1% after 2 min. flush



BIOFILM AT THE PERIPHERY



SAMPLE COLLECTION: FROM COOLING TOWER BASIN

Test Because You Can't Tell
by Looking



Automated dosing of
chemical biocides
and clean



>3000 CFU/mL
Legionella pneumophila
serogroup 1

Laboratory Detection Methods

Legionella Testing According to CDC

- CDC recommends using a testing method capable of detecting all members of the *Legionella* genus (not just *Legionella pneumophila*) and provides material for typing.
- At the moment, this means culture.
 - [ISO 11731 Second edition 2017-05](#)
- Particularly true during an investigation and in the immediate aftermath

Legionella Testing

- Culture is more reliable (sensitive & specific) than other “rapid tests”
- Preliminary results available in 4 days, final in 7 days.
- Alternative methods/approaches
 - [Molecular \(qPCR and microarray\)](#)
 - [Most Probable Number \(L. pneumophila only\)](#)
 - [Immunochromatographic \(ICT\) test](#)

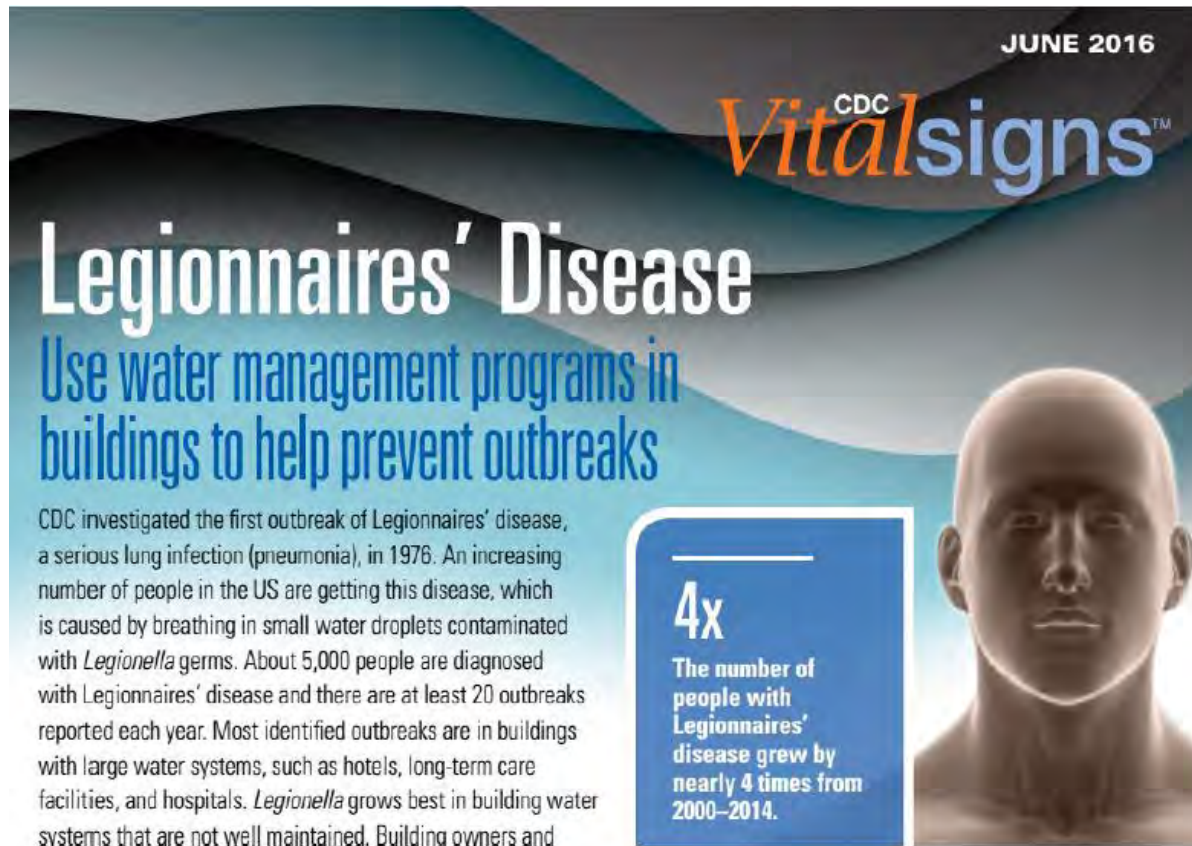
ICT-Type Test: Quick But Inaccurate?



Culture Method

- Industry standard/best practice
 - Standards based
 - ISO 11731 (1&2)
 - ASTM D 5952
 - CDC
 - International – HSE L8 ACP 2013
 - Laboratory Proficiency Programs
 - NY ELAP
 - ELITE is not a traditional proficiency program

Greater Focus On Legionella Prevention



JUNE 2016


CDC
*Vital*signs™

Legionnaires' Disease

Use water management programs in buildings to help prevent outbreaks

CDC investigated the first outbreak of Legionnaires' disease, a serious lung infection (pneumonia), in 1976. An increasing number of people in the US are getting this disease, which is caused by breathing in small water droplets contaminated with *Legionella* germs. About 5,000 people are diagnosed with Legionnaires' disease and there are at least 20 outbreaks reported each year. Most identified outbreaks are in buildings with large water systems, such as hotels, long-term care facilities, and hospitals. *Legionella* grows best in building water systems that are not well maintained. Building owners and

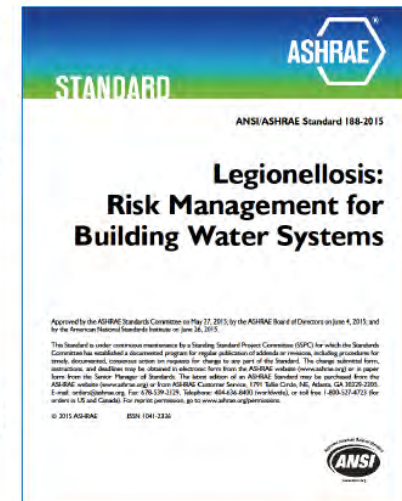
4x
The number of people with Legionnaires' disease grew by nearly 4 times from 2000–2014.



CDC Focuses on Effective Water Management For Legionnaires' Disease Prevention (AKA ASHRAE 188)

ASHRAE Standard 188

- First *Legionella* standard in the United States
- Approved June 26, 2015
- Revised 2018
- Establish minimum Legionellosis risk management requirements for building water systems.



Revised Standard 188-2018



ANSI/ASHRAE Standard 188-2018
(Supersedes ANSI/ASHRAE Standard 188-2015)
Includes ANSI/ASHRAE addenda listed in Annex D.

Legionellosis: Risk Management for Building Water Systems

See Information Annex D for approval dates.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. The change submitted form, instructions, and deadline may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Service Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org; Fax: 404/333-7129; Telephone: 404/333-9000 (toll-free), or toll-free 1-800-333-4723 (US orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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2018 Code-intended Language

FOREWORD

ASHRAE Standard 188 establishes minimum legionellosis risk management requirements for building water systems. The 2018 edition benefits from changes to improve usability and from comprehensive updates that replace permissive language with enforceable, code-intended language to facilitate adoption of the standard for code and regulatory purposes. For a full list of changes to the 2015 edition of Standard 188, see Informative Annex D.

The purpose of ASHRAE Standard 188 is to establish minimum legionellosis risk management requirements for building water systems.

Code Change and Regulations

- ASHRAE Standard 188 is a voluntary standard
- Legionella prevention, detection and control requirements should be incorporated into building and plumbing code

New Responsibilities

BUILDING OWNERS & FACILITY MANAGERS

- Responsible for implementing ASHRAE 188 requirements and safeguards to protect against *Legionella*

WATER MANAGEMENT TEAM

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

Building Survey

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.



- ✓ Cooling Tower
- Spa/Pool
- ✓ Decorative Water Feature
- Other Aerosol Devices
- Multiple Housing Units
- ✓ >10 Stories
- ✓ Healthcare
- Long term Care
- ✓ CMS Compliance



WATER SAFETY AND MANAGEMENT PLAN

Elements of a Water Management Program

Program Team – Persons responsible for Program development and implementation.

Water Systems/Flow Diagrams – Describe potable and non-potable water systems and develop water system-schematics.

Water System Analysis/Control Measures – Evaluate where hazardous conditions may occur and decide where control measures should be applied.

Monitoring/Corrective Actions – Establish procedure for monitoring whether control measures are within operating limits and, if not, take corrective actions.

Confirmation – Establish procedure to confirm Program is being implemented as designed (verification) and the Program effectively controls the hazardous conditions (validation).

Documentation – Establish documentation and communication procedures for all activities of the Program.

Standard 188-2018 Normative Annex A Healthcare Facilities



ANSI/ASHRAE Standard 188-2018
(Supersedes ANSI/ASHRAE Standard 188-2015)
Includes ANSI/ASHRAE addenda listed in Annex D

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Elements of a Water Management Program

Program Team – Persons responsible for Program development and implementation.

- Infection control
- Facility managers
- Engineering
- Administration
- Water treatment providers
- *Legionella* experts

Executing Your Plans

1. Establish Program Team
- ➡ 2. Determine level of *Legionella* Knowledge and time of team to develop plans
3. Perform site assessment
4. Complete risk assessment report
5. Address assessment recommendations
6. Develop water safety and management plan
7. Implement monitoring
8. Implement validation program
9. Verification by Program Team

Test Your Knowledge: True or False?

Knowledge

The program team shall have
knowledge
of the building water system design
and water management
as it relates to Legionellosis

- *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 (TFC or ATC) are controlled, *Legionella* is controlled.
- Water and energy conservation approaches minimize *Legionella* risk.
- *Legionella* is not a concern during construction.

FALSE

Water Safety and Management Plan

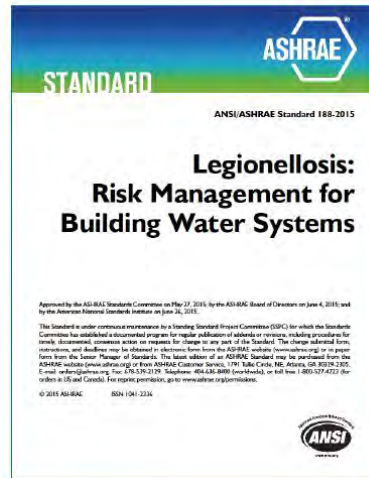
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| 4 Building List | 11 Contingency Response Plan |
| 5 Potable Water Systems | 12 Designing New Building Water Systems |
| 6 Cooling Towers | 13 Documentation |
| 7 Whirlpool Spas | 14 Resources |
- 

- Section 8.
Requirements
For Designing
Building Water
Systems

8. REQUIREMENTS FOR DESIGNING BUILDING WATER SYSTEMS

8.1 General. When designing for new construction, renovations, refurbishment, replacement, or repurposing of a facility, the following shall be documented:



Addresses A
Known Risk:
Delayed
Occupancy

Legionella Outbreak UAB University Hospital

Hematology/oncology Unit



2 patients die at UAB after testing positive for legionellosis

Posted: May 27, 2014 2:10 PM CDT
Updated: Jun 24, 2014 5:30 PM CDT

By WBRC Staff | CONNECT

BIRMINGHAM, AL (WBRC) - Two out of eight patients who tested positive for the legionella bacteria have died at UAB, hospital officials confirm.

Legionella is a bacteria that can cause a form of pneumonia called legionellosis, or Legionnaire's disease, according to Dr. Loring Rue, UAB's Chief Patient Safety and Clinical Effectiveness Officer.

Rue says most people are exposed to legionella regularly and usually don't get legionellosis, but people with weak immune systems are typically more susceptible to legionellosis.

Most people get infected by inhaling the bacteria. It can't be transferred by person to person contact.

After eight patients in the hematology/oncology unit tested positive for legionellosis, UAB Hospital implemented water restrictions in a section of the hospital on Saturday.

The bacteria was discovered in one unit that shares plumbing with two floors. So far, they have not found any new infections outside of that one unit.

The hospital installed filters on shower and faucet heads, flushed the water system and shocked it with extreme temperatures in an effort to make sure the water was safe. Rue said. They also asked patients to wear masks when



Retirement Community

New Unit

- May 2014, 10 cases following completion of new hematology-oncology unit
- *L. pneumophila*, serogroup 1 isolated from 50% (17/34) distal sites (faucets/showers)
- Cases stopped following shock disinfection and installation of Point-of-Use (POU) filters
- Long-term, hot water monochloramine

Second case of Legionnaire's disease reported at Ellicott City retirement community



Retirement Community Outbreak After Opening in 2016

- Newly constructed buildings officially opened in April
- 2 residents diagnosed with Legionnaire's disease in May and June
- Water restrictions, health dept., news
- Disinfection measures
 - Short-term (hyperchlorination)
 - Long-term supplemental (monochloramine on the hot water system)

Changes In Water Quality



Flint, Michigan

Flint water crisis likely the cause of deadly Legionnaires outbreak

By Sara Ganim, CNN | Mar 30, 2017

Water Quality in Flint Michigan



That's in Your Water!



Cross section of 4 inch pipe from hospital hot water system

Weather and Legionnaires' Disease

Weather-Dependent Risk for Legionnaires' Disease, United States

Jacob E. Simmering, Linnea A. Polgreen, Douglas B. Hornick, Daniel K. Sewell, Philip M. Polgreen

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 23, No. 11, November 2017

Wet Weather and Legionnaires' Disease?

Rain, flooding likely led to spike in Legionnaires' disease

Reports of Legionnaires' disease follow heavy rains.

✉ 📄 Comments 0 Recommend 4 Share 1 0

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-wracked 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.

DISINFECTION APPROACHES



DISINFECTION OPTIONS

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 chlorination (2-4 mg/L)
- Copper-silver ionization (continuous and short-course)
- Chlorine Dioxide (ClO₂)
- Monochloramine
- Point-of-use filtration

Efficacy of Disinfection Methods

- Testing should be performed to demonstrate efficacy:
 - Baseline testing prior to installation and start-up
 - Test within 2-4 weeks of start-up
 - Test quarterly for one year
 - Adjust monitoring schedule based upon performance and patient risk

Evidence-based Approach to Evaluating Efficacy

- Do some research – don't assume the salesperson will tell you everything you need to know
 - Consult with experts
 - Get information from other users of the technology
 - Don't "google" it!

Field Evaluation: Monochloramine

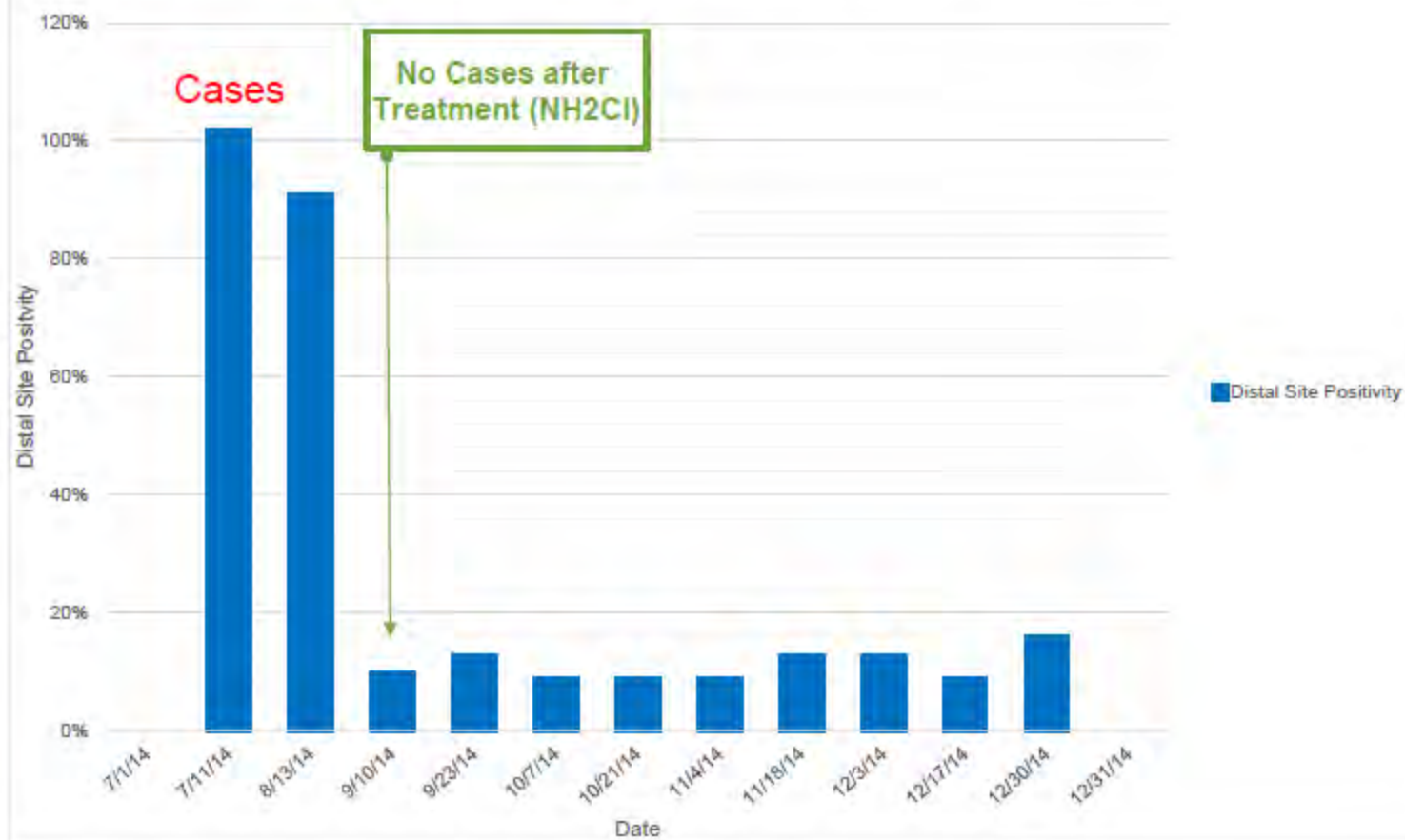
INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY NOVEMBER 2014, VOL. 35, NO. 11

ORIGINAL ARTICLE

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 Rogers²

High (>30%) *Legionella* Distal Site Positivity And Cases Prior to Treatment



Disinfection Review

FRANK P. SIDARI III, JANET E. STOUT, SCOTT DUDA, DOUG GRUBB, AND ALAN NEUNER

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. SECONDARY

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. In

Journal Am Water Works Assoc 2014; 106(10): 24-32

Summary

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

Any organization that disputes this
and tells people
not to test
their water systems
as part of an effective prevention
strategy
is at best foolish
and at worst endangering lives

Janet E. Stout, PhD, September 13, 2018
Plumbing Engineer: Vol 46 (9)
<https://www.phcpropos.com/publications/1-plumbing-engineer>

Summary


- Each building owner must assess the risk and validate their water management plans to demonstrate control of the hazard (*Legionella*).
- Determining the risk or validating a water management plan cannot be done without testing for *Legionella*.

Resources

www.legionella.org

LEGIONELLA.ORG[ABOUT](#)[TEAM](#)[CONTACT](#)

[ABOUT THE DISEASE](#)[PUBLICATIONS](#)[RESEARCH](#)[FAQs](#)[GUIDELINES](#)[ASK THE EXPERTS](#)[LEGIONELLA TESTING](#)



Prevention of Hospital-Acquired Legionellosis

More hospitals are facing the dilemma of *Legionella* outbreaks as they discover the drinking water is the source. This article provides an update of the use of PCR detection for water, the use of CFU/ml vs. distal site positivity as an indicator of risk, risk assessment, neurologic complications in patients, and new laboratory tests for patient management.

[READ MORE](#)

Legionnaires' Disease

Legionnaires' disease is a severe, often lethal, form of pneumonia. It's caused by the bacterium *Legionella pneumophila* found in both potable and nonpotable water systems. Each year, an estimated 56,000 to 113,000 people are infected with the *Legionella* bacteria in the United States. See What's New for the latest on Legionnaires' disease.

Recent FAQs

[Legionnaires' Disease](#)[Legionnaires' Disease](#)[Water Treatment](#)[Prevention](#)[Infection Control](#)

Q: Drinking from a water fountain in a hospital with *Legionella* in the water?

Q: Can Legionnaires' disease be contracted from decorative fountains?

In Our Opinion

Legionnaires' Disease in Children
by Neil Shector-Meyers

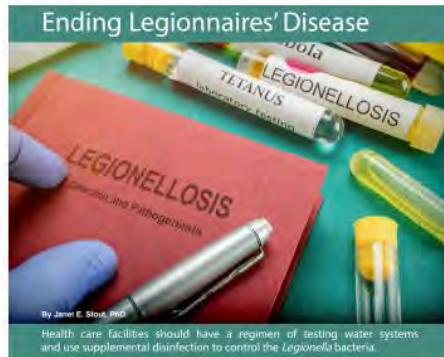
Legionella has not been a prominent pathogen in children with pneumonia. The discovery of Legionnaires' disease as a community-acquired pneumonia in immunocompetent (healthy) children occurred fortuitously.

Recent Publications

[Prevention of Hospital-Acquired Legionellosis](#)[Legionella: macrolides or quinolones?](#)[Environmental culturing for Legionella: Can we build a better mouse trap?](#)

Plumbing Engineer Magazine

<https://www.phcppros.com/articles/8058-ending-legionnaires-disease>



By Janet E. Stork, PhD

Health care facilities should have a regimen of testing water systems and use supplemental disinfection to control the *Legionella* bacteria.

I am a Legionnologist. What is that, you ask? It's the name for an infectious disease epidemiologist who has been studying *Legionnaires' disease* for more than 30 years. And because I'm a Legionnologist, I have the long view of our path to prevention of *Legionnaires' disease*. It may seem distant to many and perhaps a little's missed. But I am a glacially-dil type of person and my mission is evidence-based, grounded in science and guided by field experience.

In 1982, the results of my first study of *Legionella* bacteria in hospital plumbing systems were published in the *New England Journal of Medicine*. It was a groundbreaking study because my colleagues and I identified the hospital hot water system as the source of the outbreak of *Legionnaires' disease* at the Pittsburgh VA Hospital. At the time, cooling towers had been thought to be the principal source of exposure. In the field of an endemic, chronic and occasionally fatal *Legionella* pneumonia, the first study that provided cases for more than 20 years. Few can make the claim.

Now, 35 years later, we know that potable water, especially the warm-water systems of large buildings such as hospitals, is the primary source of transmission of this deadly form of bacterial pneumonia.

Among outbreaks investigated by the Centers for Disease Control and Prevention (CDC), exposure to *Legionella* bacteria from water distribution systems of buildings was responsible for 46 percent of the outbreaks; cooling towers caused only 22 percent of cases.

Health-care facilities are especially vulnerable. A review of 27 *Legionnaires' disease* outbreaks investigated by the CDC during 2000-2014 indicated that health-care-associated *Legionnaires' disease* accounted for 33 percent of the outbreaks, 57 percent of the cases and 85 percent of deaths. In addition, 53 percent of all *Legionnaires' disease* outbreaks were attributed to water system exposures.

Unfortunately, *Legionnaires' disease* is on the rise. The CDC found that there are about 6,000 new diagnoses of *Legionnaires' disease* annually in the United States; rates of the disease are up a staggering 450 percent since 2002. Dr. Laura Corbett, a medical epidemiologist with the CDC, spoke at the 2017 ID week conference on the causes of the rising number of cases of *Legionnaires' disease*, stating that the report cases went up by nearly 300 percent. You can view a video of her comments at <https://www.cdc.gov/media/releases/2017/s171107-legionnaires-disease.html>.

What's more, the incidence of reported *Legionnaires' disease* cases in the U.S. tripled between 2000 and 2008, with medical costs estimated at \$21 million per year. This

©Plumbing Engineer

September 2018

Pa Patient Saf Advis 2017 Sep;14(3).

Legionella: Could This Potentially Deadly Bacteria Be Lurking in Your Facility's Water Distribution System?

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THE PENNSYLVANIA PATIENT SAFETY ADVISORY

[HTTP://PATIENTSAFETY.PA.GOV](http://patientsafety.pa.gov)

Join The Fight To Protect!

Join the fight to end Legionnaires' disease.
It can be prevented. Test to protect before cases occur!



This concludes The American Institute of Architects
Continuing Education Systems Course

AIA Rochester

Linda Hewitt 585.232.7650



THANK YOU

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