DCA, 2018 IPC and ISPSC Task Force Meeting

Legionella Prevention

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November 27, 2018

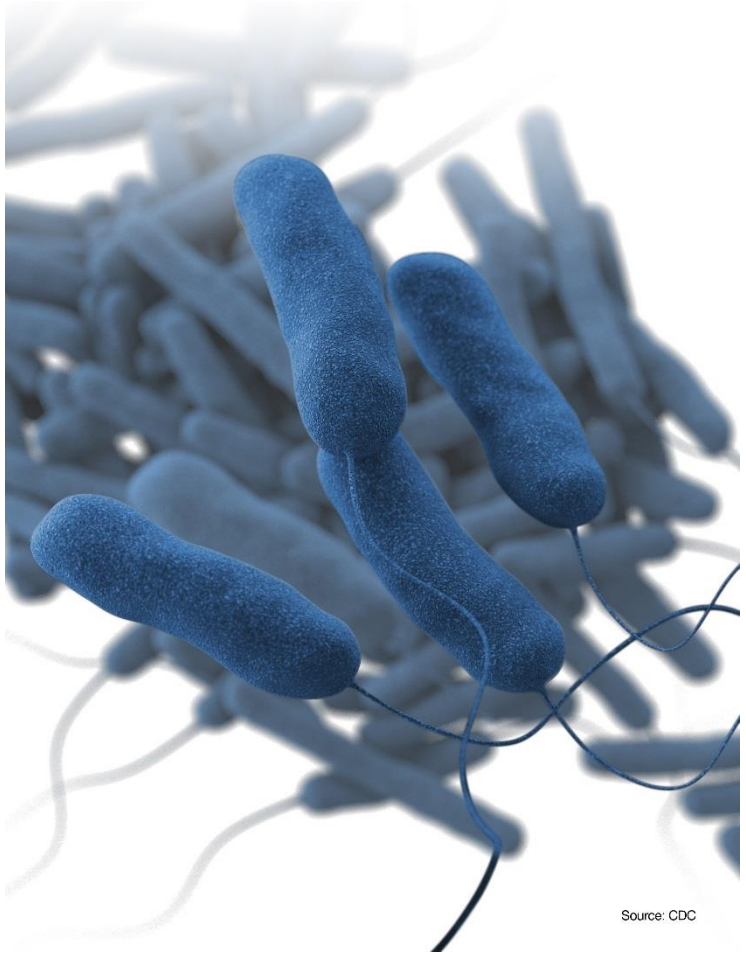
Georgia Department of Public Health

Legionella

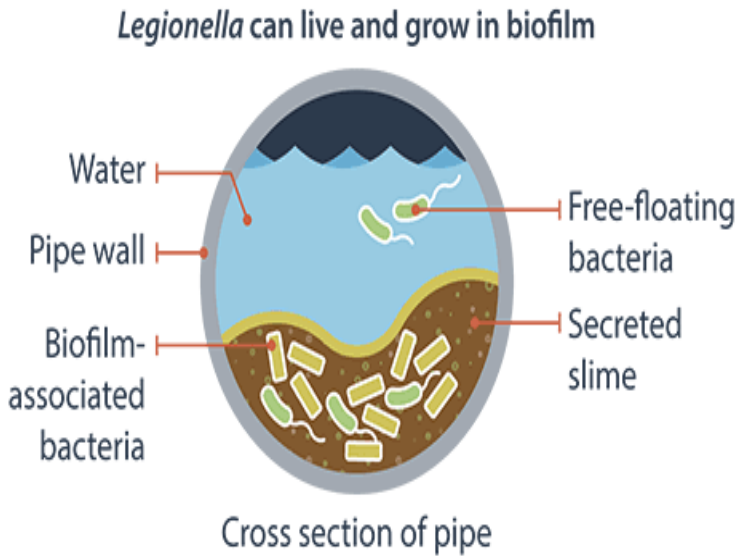
Gram-negative bacteria

Multiple species

- All species and serogroups are potentially pathogenic
- Most Legionellosis caused by *L. pneumophilia*
- Multiple serotypes, but *L. pneumophilia* 1 is most common



Legionella – ecology



Found naturally in warm water

Grows and survives well in biofilms, particularly in area where there is low water flow (i.e. dead legs)

Cooling towers, hot tubs, hot water tanks and heaters, showers and faucets, decorative fountains, large plumbing systems

Lives in the built environment

Grows optimally in temperatures from 77°-108°F, survives in 68-125 °F

Chlorine-sensitive (not if in biofilm)

Legionellosis

Illness caused by *Legionella* bacteria

Three main categories:

- With pneumonia: Legionnaire's Disease
- Respiratory/Fever w/o pneumonia: Pontiac Fever
- Non-respiratory: Extrapulmonary (wound infection)

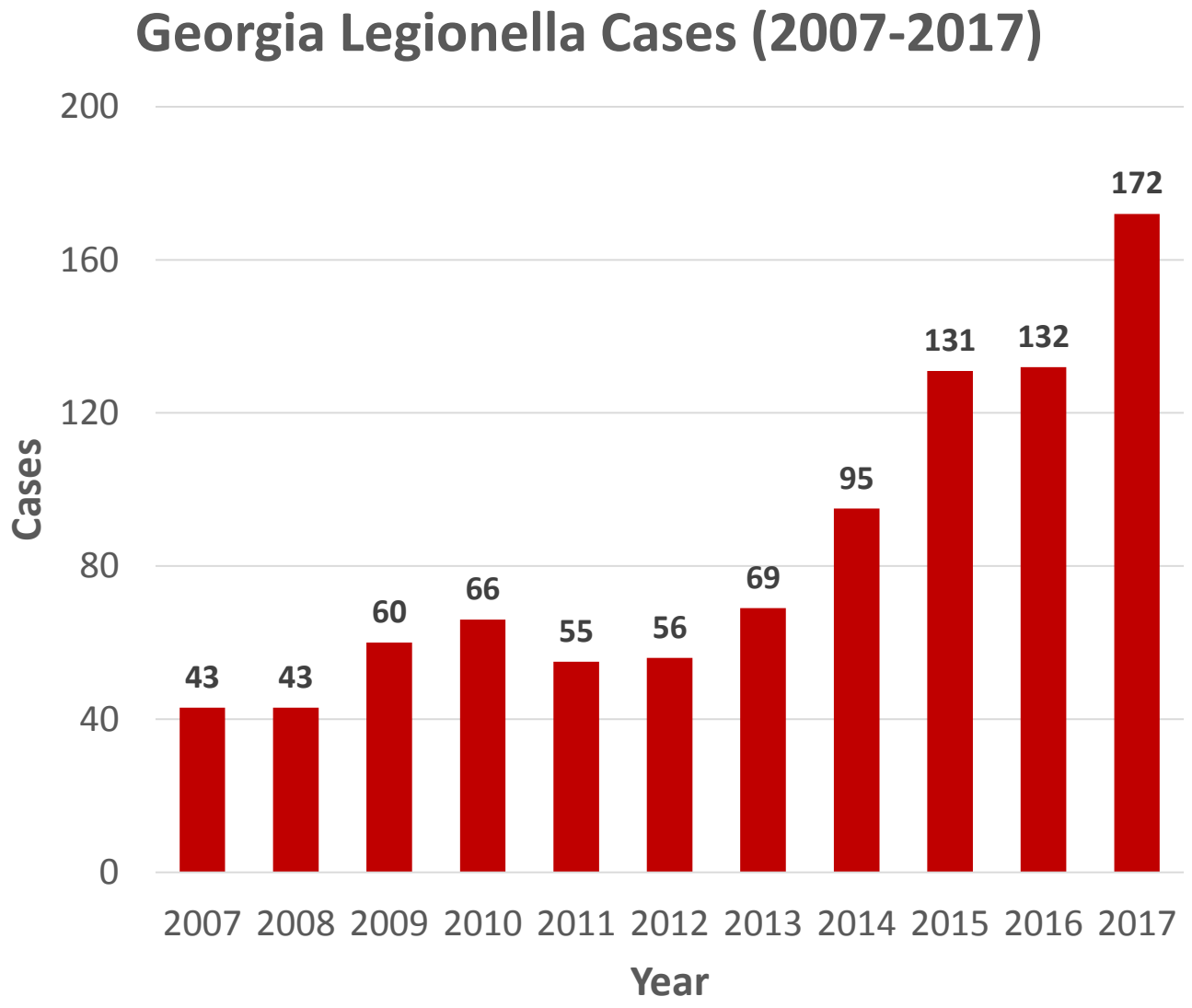
Symptoms start 1-14 days after exposure

Treated with antibiotics

Very Serious Health Outcomes!

- 44% ICU (intensive care unit) Admission
- 27% Required Ventilation
- 9% Death

Legionellosis in Georgia



Legionellosis in Georgia

172 Reported Cases in 2017

- 97% hospitalized
- 51% admitted to ICU
- 9% death rate
- 13 outbreak investigations (5 in 2016)
- Outbreaks in variety of settings
  - Hospitals
  - Hotels
  - Hot tubs/recreational water
  - Occupational/industrial
  - Correctional institutions
  - Fitness centers
  - Assisted living
  - Residential complexes (e.g. condo buildings)
  - Outpatient medical office buildings
  - And more…
- Most GA outbreaks are associated with potable premise plumbing!

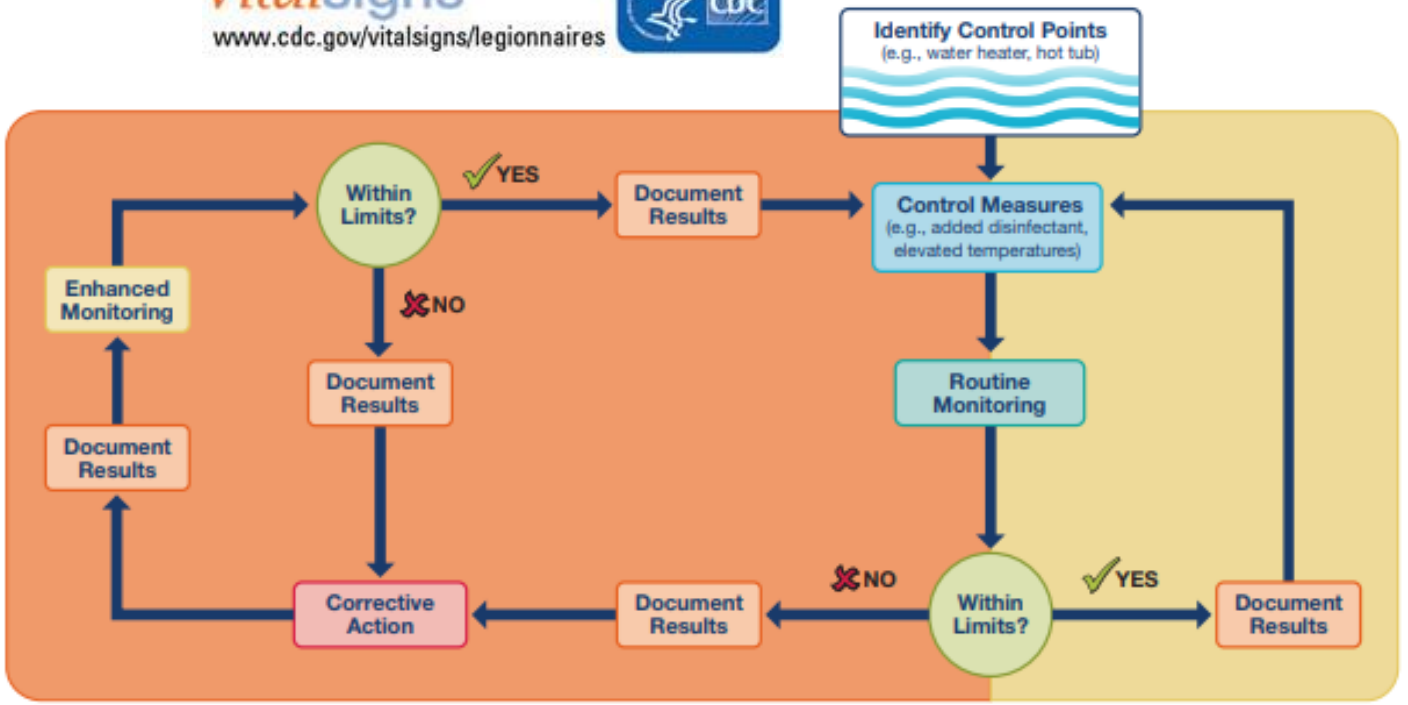
Cases are Preventable!

Key = Water Management Program (WMP)

- Regular checks of water temperature, pH balance, chlorine levels

WMP Key Components

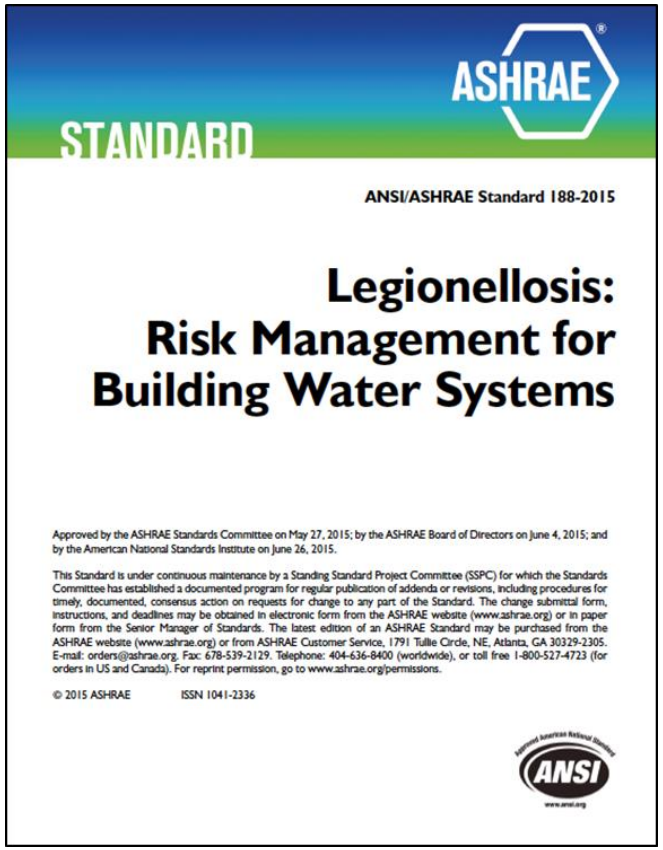
- WMP Team
- Description of Water Systems
- Identify risk areas and control points
- Measure and document water parameters
- Respond to critical measures (changes in temperature/pH/disinfectant, service disruptions, etc.) according to plan!

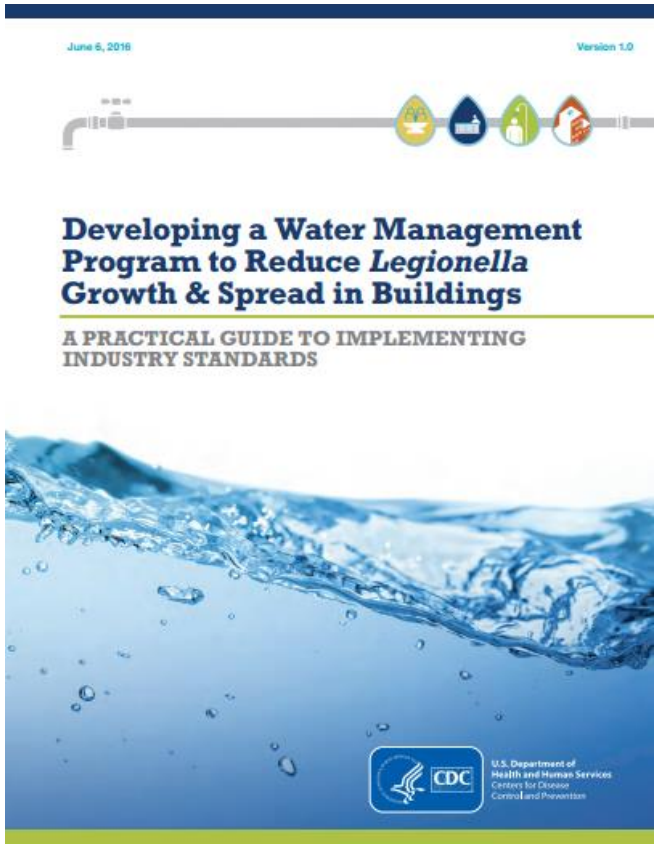


New Resources

ASHRAE Standard 188

CDC Partner Toolkit intended to help with interpretation and implementation of ASHRAE Standard 188





Environmental Risk Factors

- Construction
- Water main breaks
- Changes in municipal water quality
- Biofilm, scale, and sediment
- Water temperature, pH fluctuation
- Inadequate levels of disinfectant
- Changes in water pressure
- Water stagnation

Example 2—Water main break

1. Jason receives several complaints from building occupants of foul-tasting water. He also notes a brownish tint to the water entering the building during his daily visual inspection. Jason immediately contacts the water provider and discovers that there was a water main break nearby but that a boil water advisory was not issued. He sends a notice to building occupants about the main break and that they should limit water usage for the next 4 hours while facilities clear the line.

Environmental Interventions

Environmental assessment

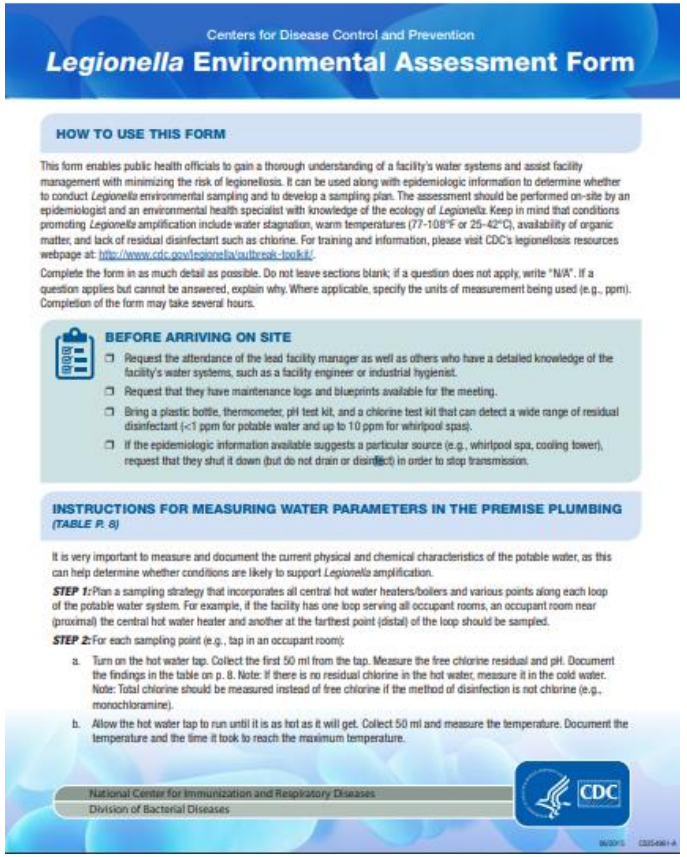
- Plumbing structure, chlorine residuals, water temperature

Environmental testing

- Water sample testing at CDC certified laboratory

Remediation

- Plumbing engineering changes
- Hyperchlorinate or heat water
- Serial repeat testing
- Requires skilled contractor
- Hard to eradicate!



Centers for Disease Control and Prevention

***Legionella* Environmental Assessment Form**

HOW TO USE THIS FORM

This form enables public health officials to gain a thorough understanding of a facility's water systems and assist facility management with minimizing the risk of legionellosis. It can be used along with epidemiologic information to determine whether to conduct *Legionella* environmental sampling and to develop a sampling plan. The assessment should be performed on-site by an epidemiologist and an environmental health specialist with knowledge of the ecology of *Legionella*. Keep in mind that conditions promoting *Legionella* amplification include water stagnation, warm temperatures (77-108°F or 25-42°C), availability of organic matter, and lack of residual disinfectant such as chlorine. For training and information, please visit CDC's legionellosis resources webpage at: http://www.cdc.gov/legionella/outbreak-toolkit/.

Complete the form in as much detail as possible. Do not leave sections blank; if a question does not apply, write "N/A". If a question applies but cannot be answered, explain why. Where applicable, specify the units of measurement being used (e.g., ppm). Completion of the form may take several hours.

BEFORE ARRIVING ON SITE

- ❒ Request the attendance of the lead facility manager as well as others who have a detailed knowledge of the facility's water systems, such as a facility engineer or industrial hygienist.
- ❒ Request that they have maintenance logs and blueprints available for the meeting.
- ❒ Bring a plastic bottle, thermometer, pH test kit, and a chlorine test kit that can detect a wide range of residual disinfectant (<1 ppm for potable water and up to 10 ppm for whirlpool spas).
- ❒ If the epidemiologic information available suggests a particular source (e.g., whirlpool spa, cooling tower), request that they shut it down (but do not drain or disinfect) in order to stop transmission.

INSTRUCTIONS FOR MEASURING WATER PARAMETERS IN THE PREMISE PLUMBING *(TABLE P. 8)*

It is very important to measure and document the current physical and chemical characteristics of the potable water, as this can help determine whether conditions are likely to support *Legionella* amplification.

STEP 1: Plan a sampling strategy that incorporates all central hot water heaters/boilers and various points along each loop of the potable water system. For example, if the facility has one loop serving all occupant rooms, an occupant room near (proximal) the central hot water heater and another at the farthest point (distal) of the loop should be sampled.

STEP 2: For each sampling point (e.g., tap in an occupant room):

a. Turn on the hot water tap. Collect the first 50 ml from the tap. Measure the free chlorine residual and pH. Document the findings in the table on p. 8. Note: If there is no residual chlorine in the hot water, measure it in the cold water. Note: Total chlorine should be measured instead of free chlorine if the method of disinfection is not chlorine (e.g., monochloramine).

b. Allow the hot water tap to run until it is as hot as it will get. Collect 50 ml and measure the temperature. Document the temperature and the time it took to reach the maximum temperature.

National Center for Immunization and Respiratory Diseases
Division of Bacterial Diseases

CDC

Outbreak Examples

Hospital A

- Patient admitted for transplant
- Patient develops pneumonia and tests positive more than 14 days after admission → Public health investigation
- Positive environmental results, emergency remediation, implement/update WMP, follow up testing

Hospitals are required to have WMP by Centers for Medicare and Medicaid Services to prevent this situation

Apartment Building B

- 25 story apartment building with centralized hot water distribution
- Resident ill with legionellosis in March
- Three more residents ill with legionellosis over next seven months → Public health investigation
- Positive environmental results, emergency remediation, implement/update WMP, follow up testing

ASHRAE 188 efforts could have prevented this, but no code in place

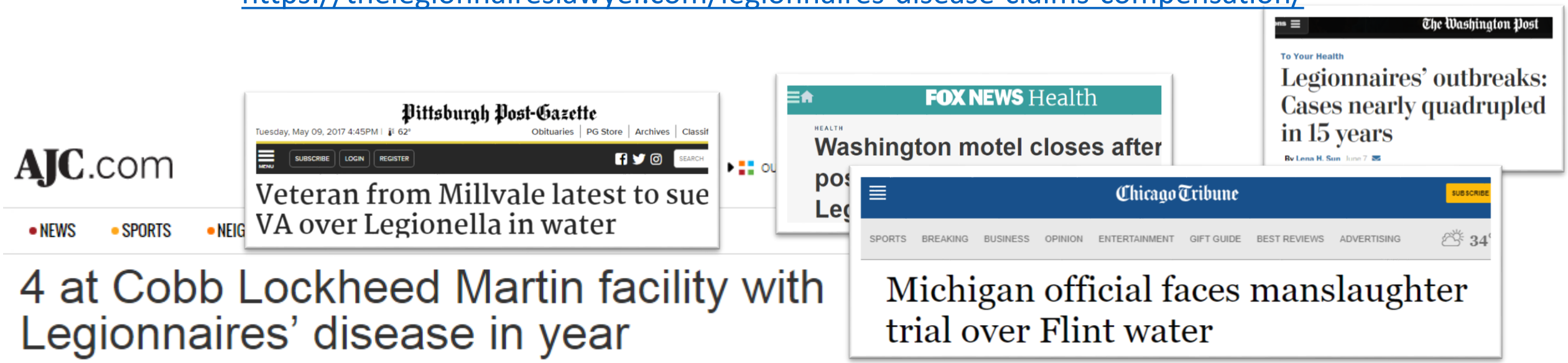
Costs of Outbreaks

- Outbreak investigations may require repeated rounds of testing and expert consultation
- One example from a private laboratory/consultant estimates consulting activities (conference calls, site assessments, sample plans, disinfection recommendations, final report) to be approximately $15,000
- Testing is not included in this amount and depending on results, follow up testing may be necessary for months after the initial round of testing

https://www.gsaadvantage.gov/ref_text/GS21F114BA/0N6P3P.2VD2T6_GS-21F-114BA_SPLCATALOG.PDF

Why should building owners/operators care?

- Don't want residents/visitors to develop illness
- Liability issues--shouldn't be main reason but lawyers and insurance companies are already on it!
  - https://www.aig.com/content/dam/aig/america-canada/us/documents/business/industry/legionelladiseaseinhospitalitywhitepaper-brochure.pdf
  - https://www.douglasandlondon.com/environmental-toxic-exposure/legionnaires-disease
  - https://thelegionnaireslawyer.com/legionnaires-disease-claims-compensation/



Conclusions

- Legionella causes severe illness and is increasing in frequency
- Outbreaks require a lot of time and effort and cost
- ASHRAE 188 provides guidance on preventive measures
- The Georgia Department of Public Health supports incorporating ASHRAE 188 language into the upcoming Georgia adoption of the International Plumbing Code.

Thank you

Key Georgia Department of Public Health Contacts

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ANSI/ASHRAE Standard 188-2015

Legionellosis: Risk Management for Building Water Systems

Published June 26, 2015

Claressa Lucas, PhD
Member SSPC-188
November 27, 2018

Slides adapted from…

ANSI/ASHRAE Standard 188-2015

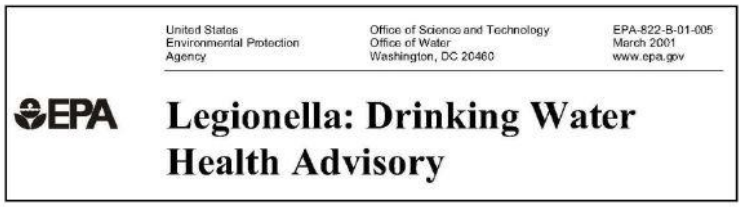
► Standard 188 can be purchased from ASHRAE at:
http://www.techstreet.com/ashrae/products/1897561

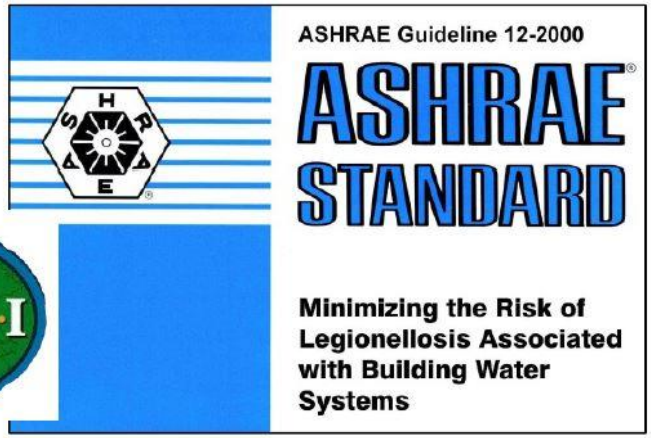
► Standard 188 can be read for free from ASHRAE website under the Preview ASHRAE Standards, bottom left of page, at:
www.ashrae.org/standards

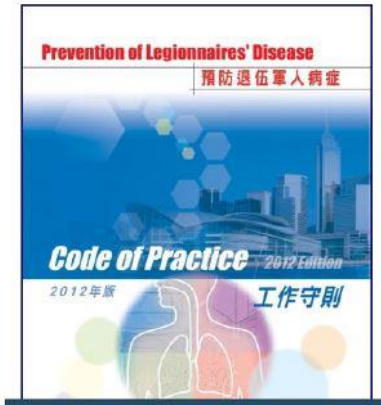
Background

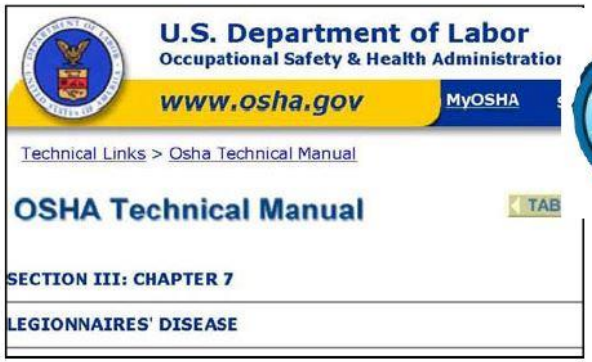
- While Legionnaire's disease has been known for many years, recent outbreaks have increased awareness of the disease, its causes and prevention strategies
- The Centers for Disease Control & Prevention estimates:
  - each year between 8,000 & 18,000 cases LD in U.S.
  - more than 10% of these cases are fatal
- ASHRAE has been actively involved in providing information on *Legionella* since 1979 in response to the first Legionnaire's disease outbreak in 1976 and the subsequent discovery by the CDC of the causative bacteria – *Legionella*

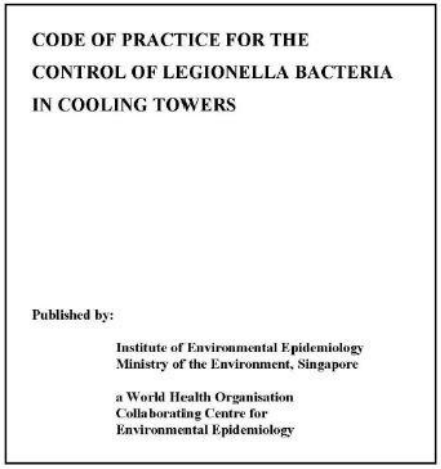
Guidelines Since Early 1990s …

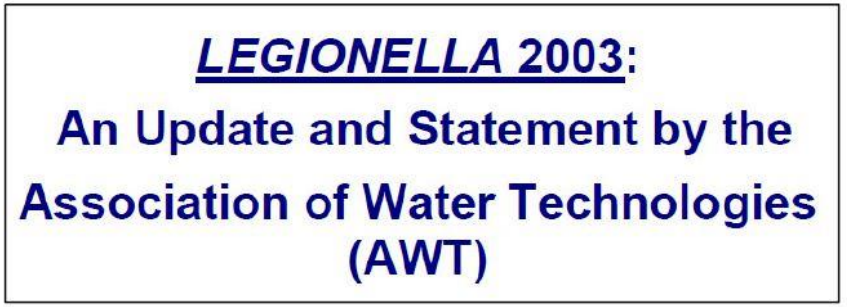


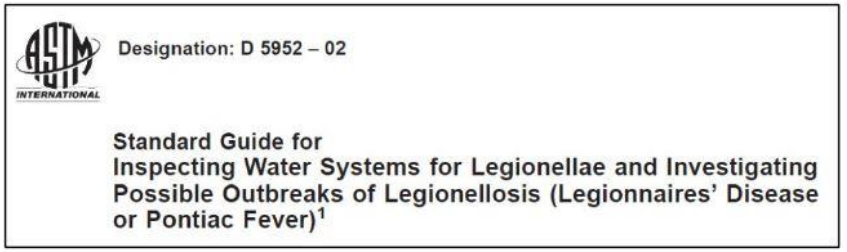








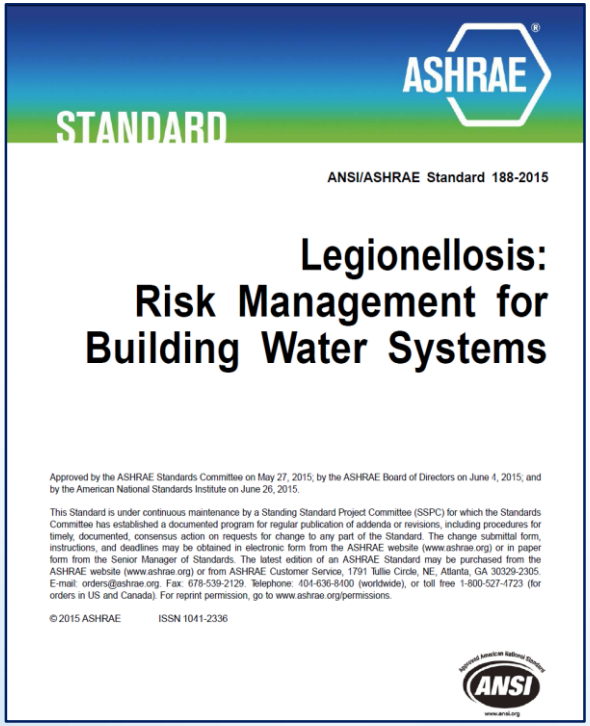




Legionellosis: Risk Management for Building Water Systems

- This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of ASHRAE
- Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as:

  "…substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution."



ASHRAE Standard Development

- ASHRAE obtains **consensus** through participation of its national and international members, associated societies, and public review
- Every effort is made to **balance** the concerned interests on all project committees

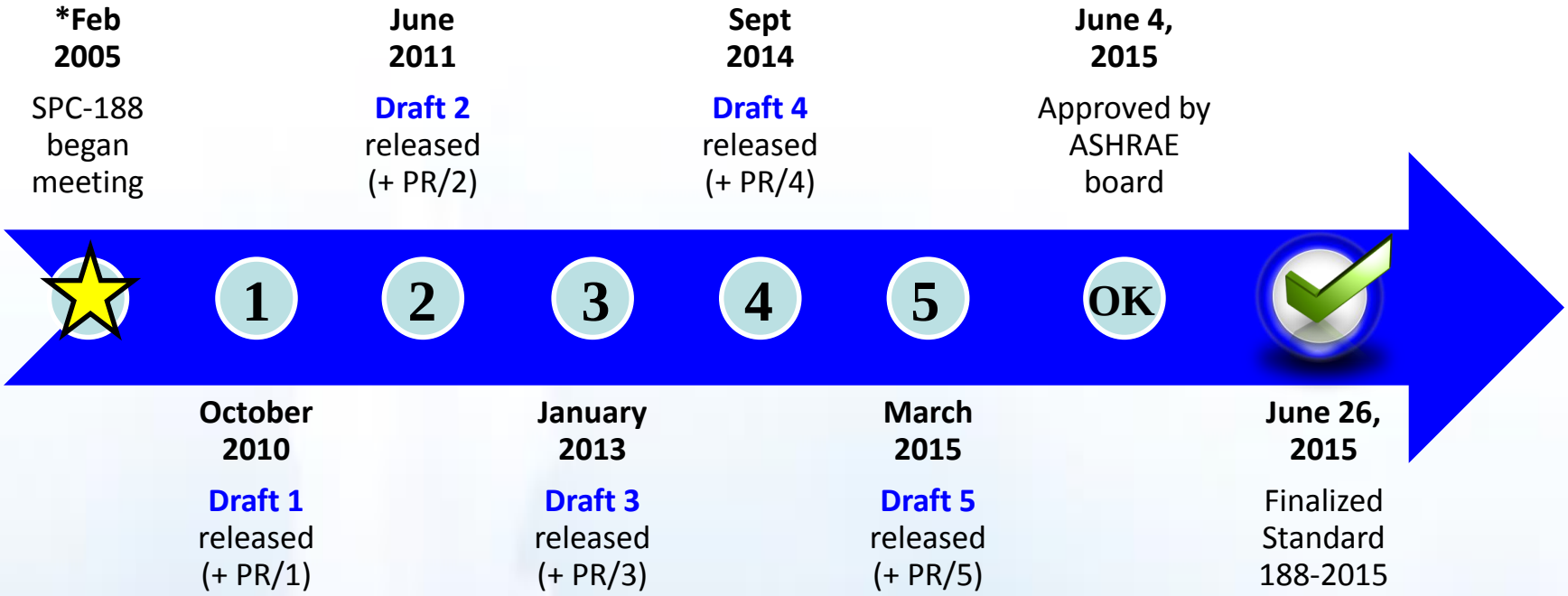
- This project committee was comprised of *Legionella* & water treatment specialists, consulting engineers, health professionals, building owners & operators, manufacturers, government officials, and others from around the world

ASHRAE Standard Development

- ASHRAE develops subject matter, voluntary consensus standards that are accredited by the American National Standards Institute (ANSI)

Standard 188 is a Standard Practice with design considerations; written in 'mandatory' and 'code intended language'; and readily adoptable into related codes, regulations or legislation!

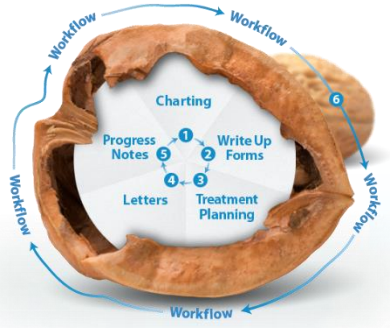
The History Line of Standard 188

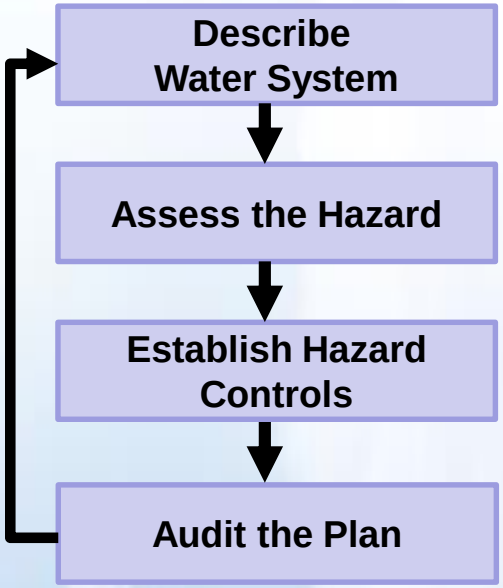


*Feb 2005: 1st meeting of GPC-12 (guideline) - later as SPC-188

PR = Public Reviews (required by the ANSI/ASHRAE process)

In a NUTSHELL …





Compliance with Standard 188 requires facility owners (their managers) to:

1→ **Establish a Team** with assigned responsibilities & accountabilities

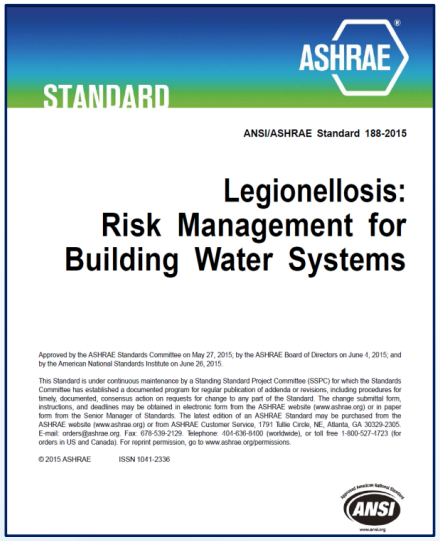
2→ **Have**, **Practice**, **Audit** and **Maintain** a Water Management Plan for **legionellosis risk management** of their building water systems

188: LB Control Measures!

ASHRAE 188 provides a framework, But the TEAM must develop specific Legionella control measures for …

- New Construction
- Siting
- Startup and Shutdown
- Inspections
- Maintenance
- Cleaning and Disinfection
- Water Treatment
- Monitoring (temperatures, disinfectant levels, etc.)
- Responding to Legionnaires' disease

A ‘closer’ look at



Standard 188 …

The SPC-188 Team: 32 Voting Members

(7 Professional Organizations / Many Other Active Professionals)

ASHRAE Standing Standard Project Committee 188
Cognizant TC: Environmental Health Committee
Co-cognizant TCs: 3.6, Water Treatment; and 6.6, Service Water Heating Systems
SPLS Liaison: Patricia Graef
ASHRAE Staff Liaison: Stephanie Reiniche

Thomas E. Watson,* *Chair*	Claressa Lucas*	Robert J. Cunningham, III
Paul A. Lindahl, Jr.,* *Vice-Chair*	Scott E. Mayes*	David F. Geary
Michael P. Patton,* *Secretary*	Clifton McClellan*	Ronald George
Stu Asay*	William F. McCoy*	Joseph M. Hannigan, Jr.
Clive R. Broadbent*	Richard D. Miller*	Lauri Hicks
Helen R. Cerra*	R. Lee Millies, Jr.*	Thomas W. Johnson
Steven Cutter*	Eric R. Myers*	Sergio La Mura
John D'Angelo, Jr.*	Amy Nichols*	David F. Geary
Peter DeMarco*	Richard J. Pearson*	Frank Myers
Linda L. Dickey*	William E. Pearson, II*	Patrick L.P. Racine
Charles E. Dorgan*	Billy Smith*	Patsy Root
Sara Ferrari*	Alan Spence*	Aaron Rosenblatt
Katherine K. Flamm*	Janet E. Stout*	Kevin A. Scarlett
William A. Gaines, III*	Walter N. Vernon*	Leon Shaprio
Carolyn Gilliland*	Ronald E. Wood*	Matt Sigler
Patricia T. Graef*	Jon J. Cohen	Wayne R. Thomann
Tim Keane*	Todd Cornwell	Alain Trahan

** Denotes members of voting status when the document was approved for publication*

Voting Member Professional Organizations on 188

Included …

1) **CDC**: *Centers for Disease Control & Prevention*
2) **AWT**: *Association of Water Technologies*
3) **ASHE**: *American Society for Healthcare Engineering*
4) **APIC**: *Association for Professionals in Infection Control & Epidemiology*
5) **ASPE**: *American Society of Plumbing Engineers*
6) **IAPMO**: *International Association of Plumbing and Mechanical Officials*
7) **NSF** International

The ASHRAE SPC-188 Team …

'Legionellosis: Risk Management for Building Water Systems'

ANSI/ASHRAE 188-2015

ANSI/ASHRAE 188-2015

- **PURPOSE**: **Establish minimum *Legionellosis* risk management requirements for *building water systems*.**
- **SCOPE:**

1) for design, construction, commissioning, operation, maintenance, repair, replacement, and expansion of new and existing buildings and their associated water systems

2) applies to human-occupied commercial, institutional, multi-unit residential, and industrial buildings ... excludes single-family residential buildings

3) use by owners and managers of such defined buildings and those involved in the design, construction, installation, commissioning, operation, maintenance and service of their *centralized building water systems* and components

188: Section 4. Compliance

4.1 Building **Designer** Requirements …
comply w/survey per Sec.5 and then Sec.8

4.2 Building **Owner** Requirements …
comply w/survey per Sec.5 and then Sec.6 & 7

4.3 **Health Care Facility** Requirements …
comply with Sec. **4.2** ←**OR**→ with Annex A

188 compliance requires Section 5 surveys be repeated (at least) annually, fully documented & available for review at any time.

188: Sec/4.3 Health Care Facilities

4.3.1 Health care facilities that do not meet **all** of the qualifications of Section **4.3.2** (below) shall comply with the requirements in Section 4.2

4.3.2 Health care facilities that meet **all** of the following qualifications shall comply with either the requirements in Section **4.2** – OR – the requirements in the Normative Annex A, "Health Care Facilities" …

188 compliance for Health Care Facilities is ultimately one of two paths: Section 4.2 – OR – Annex A

188: Section 4.3.2 Health Care Facility Qualifications for Annex A

(a)… health care facility is accredited by an accrediting agency or by the *authority having jurisdiction (AHJ)* over the health care IC activities

(b)… the health care facility IC program has a certified infection preventionist … or the health care facility has an epidemiologist with a minimum Master's Degree or equivalent

Compliance for Health Care Facilities via Annex A of the standard requires (a) and (b) above

188: Section 5. Building Survey (1)

5.1 → Determine whether it has one or more:

(a) cooling towers or evaporative condensers providing cooling/refrigeration for HVAC&R or other systems;

(b) whirlpools or spas either in the building or on site;

(c) ornamental fountains, misters, humidifiers, air washers, atomizers or other *nonpotable* water systems or devices that release water aerosols

All buildings must be surveyed to identify nonpotable water aerosolizing/misting devices or systems

Bottom Line for Section 5.1 →

Implement a Water Management Program (WMP) for…

- Cooling Towers
- Whirlpool Spas
- Ornamental Fountains
- Misters, Atomizers, Humidifiers, Air Washers
- Other Devices that release water droplets

188: Section 5. Building Survey (2)

5.2 → Determine whether it is **characterized** by one or more of the following risk factors that relate to legionellosis:

(a) multiple housing units with one or more **centralized hot water** systems;

(b) more than **10 Stories** (including levels below grade);

(c) health care facility w/patient stays exceeding 24 hours;

(d-e) an area housing or treating occupants with certain medical conditions or risk factors: burns, immunocompromised, solid organ or bone marrow transplantations, chemotherapy, at-risk with renal disease, diabetes, or chronic lung disease;

(f) identified as housing for occupants **over the age of 65**.

Bottom Line for Section 5.2 →

Implement a WMP for premise plumbing systems if a building is characterized with any one of the following:

- Multiple housing units with a **centralized hot water** system,
- More than **ten stories**,
- Housing designated for **people over 65** years of age,
- Patients staying >24 hours,
- An area housing or treating people with certain medical risk factors …

ANSI/ASHRAE 188-2015

Implement a WMP for potable systems if a building has an area for housing or treating people …

- **for burns, cancer chemotherapy, or solid organ or bone marrow transplantation;**
- **that are immunocompromised or otherwise more susceptible than the general population because of age, medication, health, smoking, occupation or drug treatment;**
- **that have renal disease, diabetes, or chronic lung disease**

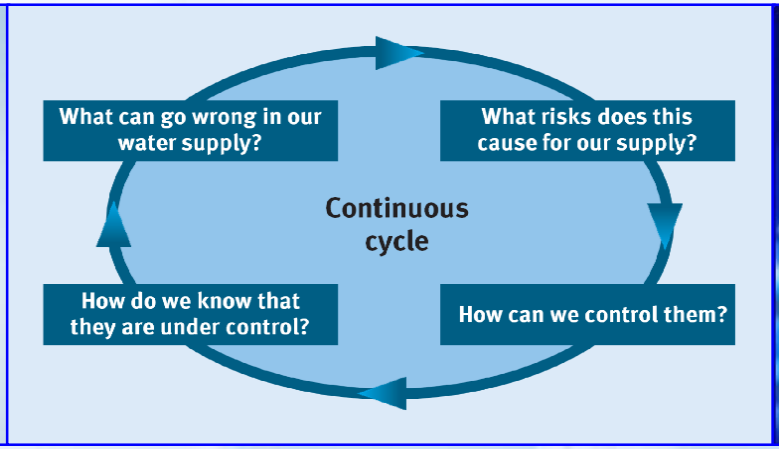
188: Section 6. General Requirements

6.1 → Principles of a Water Management Program

6.1.1-6.1.7: outline of risk management principles

6.2 → Program Development (WMP)

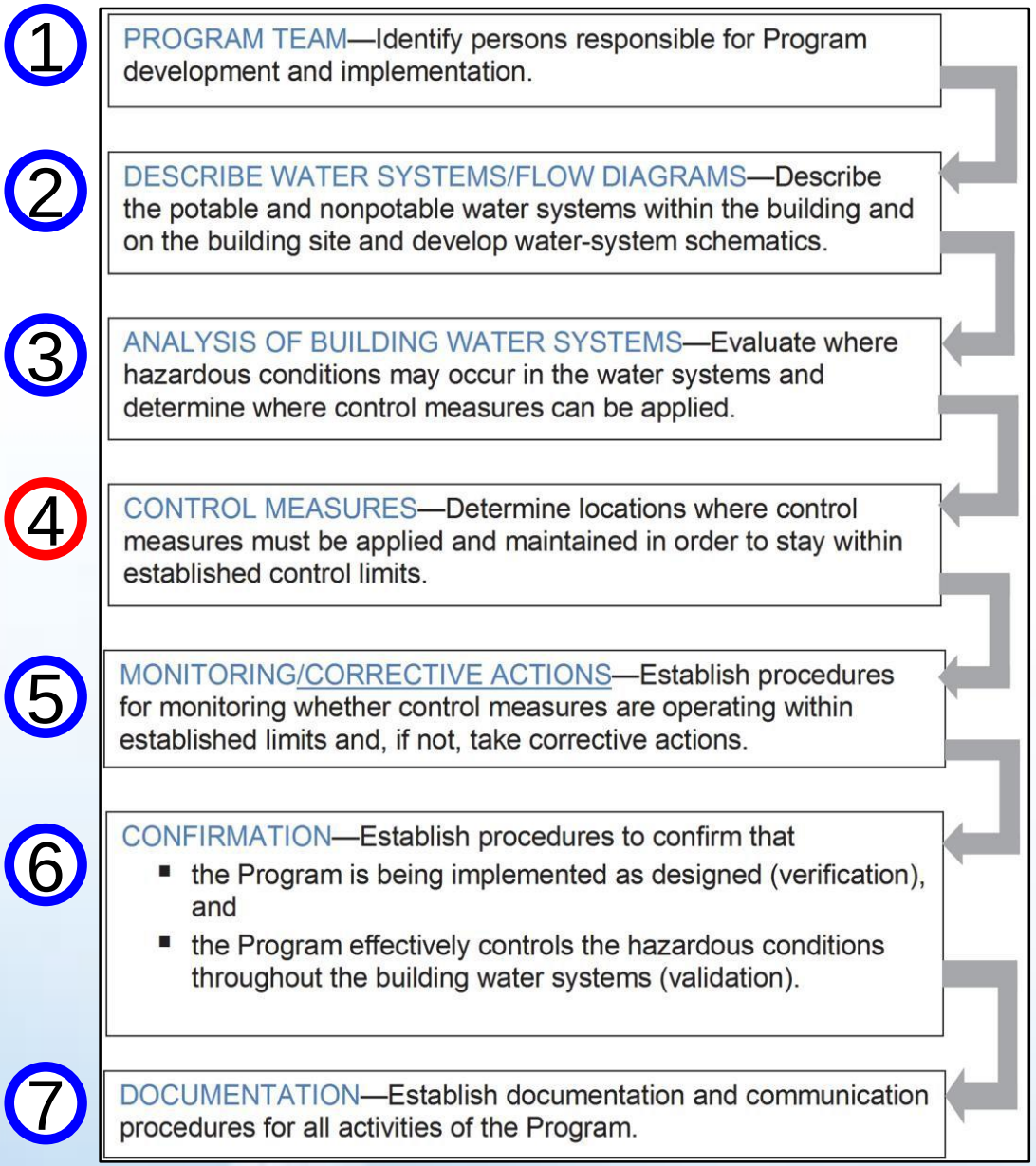
6.2.1-6.2.9: detail of management program development



ANSI/ASHRAE Standard 188-2015:

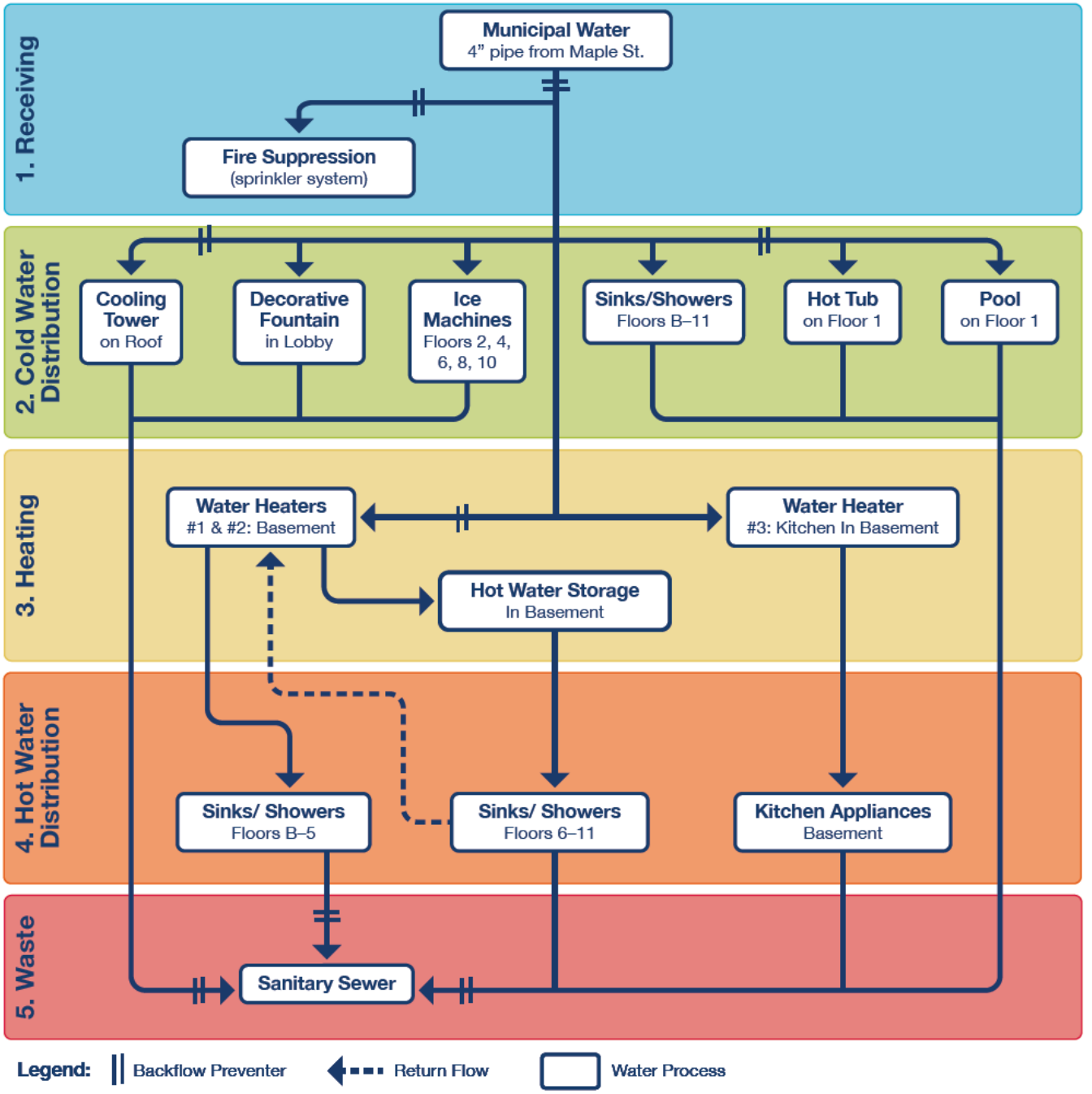
Figure 1.

Elements of a Water Management Program (WMP)



CDC 188 'ToolKit' (June 2016)

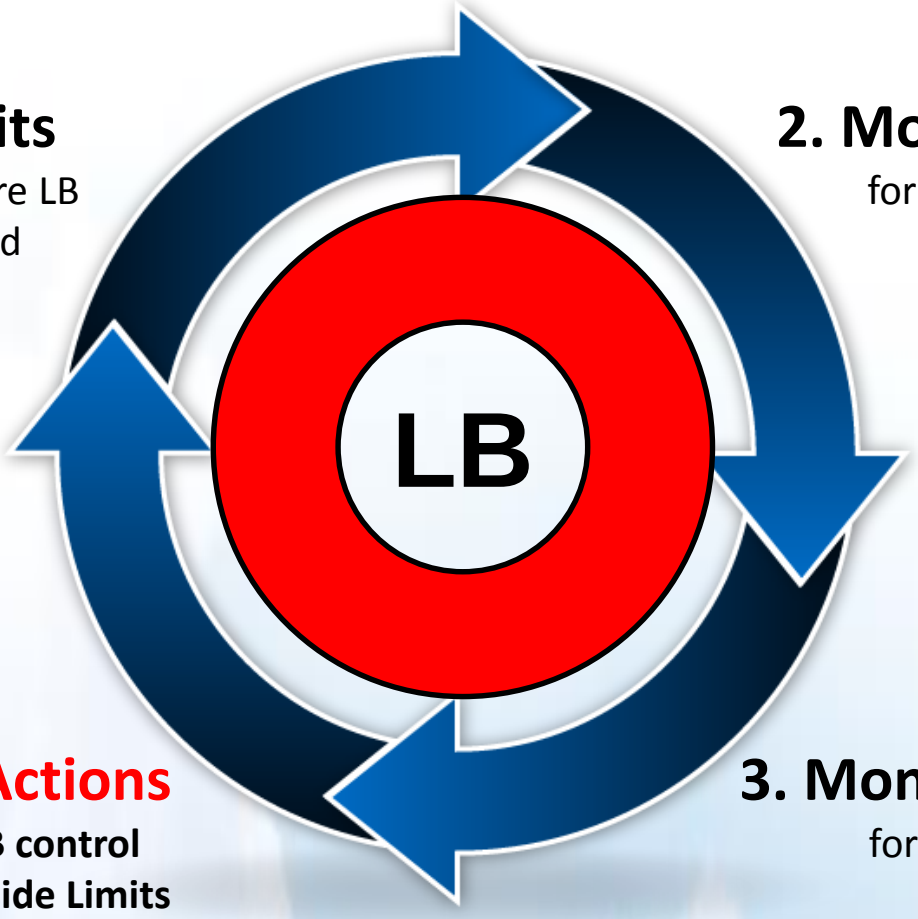
Flow Diagrams



Establish for every LB Control →

1. Control Limits
for each point where LB control is applied

2. Monitoring Method
for each point where LB control is applied



4. Corrective Actions
to make when LB control measures are Outside Limits

3. Monitoring Frequency
for each point where LB control is applied

Water Management Program (6.1)

WMP: VERIFICATION →

The process and evidence used to support that compliance with the Plan is being done – i.e. record-keeping, control monitoring, process procedures and other evaluations. It ensures that the Water Management Plan is being correctly followed in practice;

"Are you Doing what you Planned to Do?"

WMP: VALIDATION →

The process or evidence used to support that the hazard control strategies of the plan are effective. Testing for the control of the hazard or assessment of technical, scientific, medical and other data that can be used to show that control measures for the hazard are effective – i.e. no legionellosis;

…"Are you Doing the Right Thing – Does it Work?"

188: Section 7. Requirements for Building Water Systems

7.1 Potable Water Systems

7.2 Cooling Towers & Evaporative Condensers

7.3 Whirlpool Spas

7.4 Ornamental Fountains & Other Water Features

7.5 Aerosol-Producing Humidifiers, Misters, Atomizers and Air Washers

Section 7 is the more extensive & detailed section in Standard 188 – it deals with the various potable & nonpotable water system requirements

188: Section 8. Requirements for Designing Building Water Systems

8.1 General

8.2 Final Installation Documents

8.3 Balancing

8.4 Commissioning

Section 8 deals with legionellosis risk/hazard considerations and the documentation required when designing for new construction, renovations, refurbishment, replacement, or repurposing of a facility.

ANSI/ASHRAE 188-2015

Designers must provide Documentation, Drawings, and/or Instructions for …

- Monitoring & Control
- Code Compliance
- Operation & Maintenance
- Control System Operation
- Calibration
- Installation & Start-up
- Commissioning (including Flushing & Disinfection)

- Filling & Draining
- Equipment Sizes
- Piping Layout
- System Materials
- Pipe Sizes
- Design Flow Rates
- Design Temperatures
- Impact of Heat Loss or Gain

ANSI/ASHRAE 188-2015

Designers must note locations of …

- Equipment
- Access (note inadequate access)
- Filling and Draining
- Flushing
- Sampling
- Temperature monitoring
- Treatment
- No flow & Low Flow areas
- Outside Air Intakes
- Possible Cross Connections

ANSI/ASHRAE 188-2015

Prior to Occupancy . . .

- Balance Water Systems

- Disinfect & flush no more than 3 weeks before any part of the building is occupied for its intended purpose

188: ANNEX A – Health Care Facilities

A1. Supplemental Definitions for Terms used in Annex A

A2. Designated Team

A3. Water System Flow Diagram

A4. Risk Management Plan – *Legionellosis RM plan*

A5. Existing Buildings, New Construction & Renovations

A6. Building Water System Procedures *(Sec. 7 elements)*

A6. is the more extensive/detailed section of Annex A – it deals with all the various potable & nonpotable water system requirements

188: ANNEX A – Health Care Facilities

What Is Different?

Program Team	→	Designated Team
Water Management Program	→	Legionellosis Risk Management Plan
Section 7	→	A6.1 Building Water System Procedures

If You Test for *Legionella* . . .

→ **Be Prepared & make sure all stakeholders know, including Public Relations, about *Legionella* Testing!**

1. **That testing is FOR a Reason & WITH a Plan;**
2. **That testing is a Pro-Active Position;**
3. **That testing provides the Only Direct Validation of *Legionella* control;**
4. **And, How to communicate a Positive Test Result!**

ASHRAE Standards – Special Note:

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

'Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.'

Adoption of ASHRAE Standards

← *CODE vs. LEGISLATION* →

Typical Adoption Cycle for an ASHRAE Standard:

1) Into Related Codes → Typically 1-5 Years or more;
2) Into Related Legislation → **Immediately**, as decided by local Municipal, County or State agencies

Portions of Standard 188 were quickly adopted and passed into Legislation in New York City, while New York State issued emergency regulations that ultimately became the Law

SUMMARY

- ***Legionella*** is a common bacteria in man-built water systems;
- **Disease Causation is Not Simple** – involves many factors:
  - Favorable conditions for LB growth & amplification
  - Means of transmitting water aerosols containing LB
  - Exposure route to Susceptible persons
- **Cooling Water & Potable Water Systems** are all important;
- **ANSI/ASHRAE Standard 188-2015**
  - Owners/Managers – as well as Design Engineers, plus
  - Minimum Legionellosis Risk Requirements
  - Must Establish a Water Management Program

ANSI/ASHRAE 188-2015

Water Management Programs – Simply Put …
"Don't Make a Mountain Out of a Molehill!"

A Water Management Program should be thorough – keeping it simple (KISS) should be more than adequate!

ANSI/ASHRAE 188-2015

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QUESTIONS

DISCUSSION

Encouraging Building Water Systems Management

Claressa Lucas, PhD

ELITE Program Coordinator

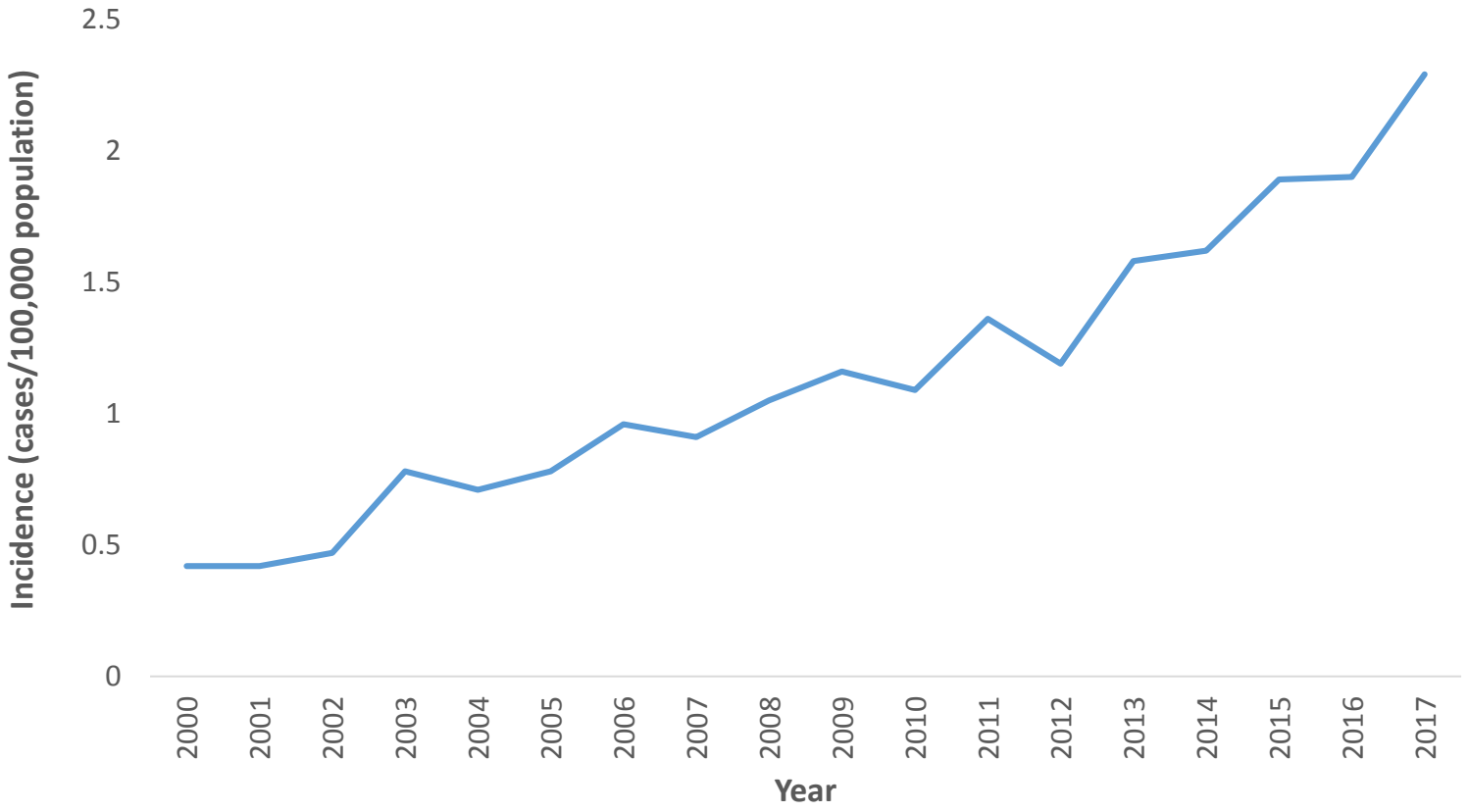
National Center for Immunization and Respiratory Diseases

2018 IPC/ISPC Task Force Meeting

November 27, 2018

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Legionnaires' disease is on the rise in the United States

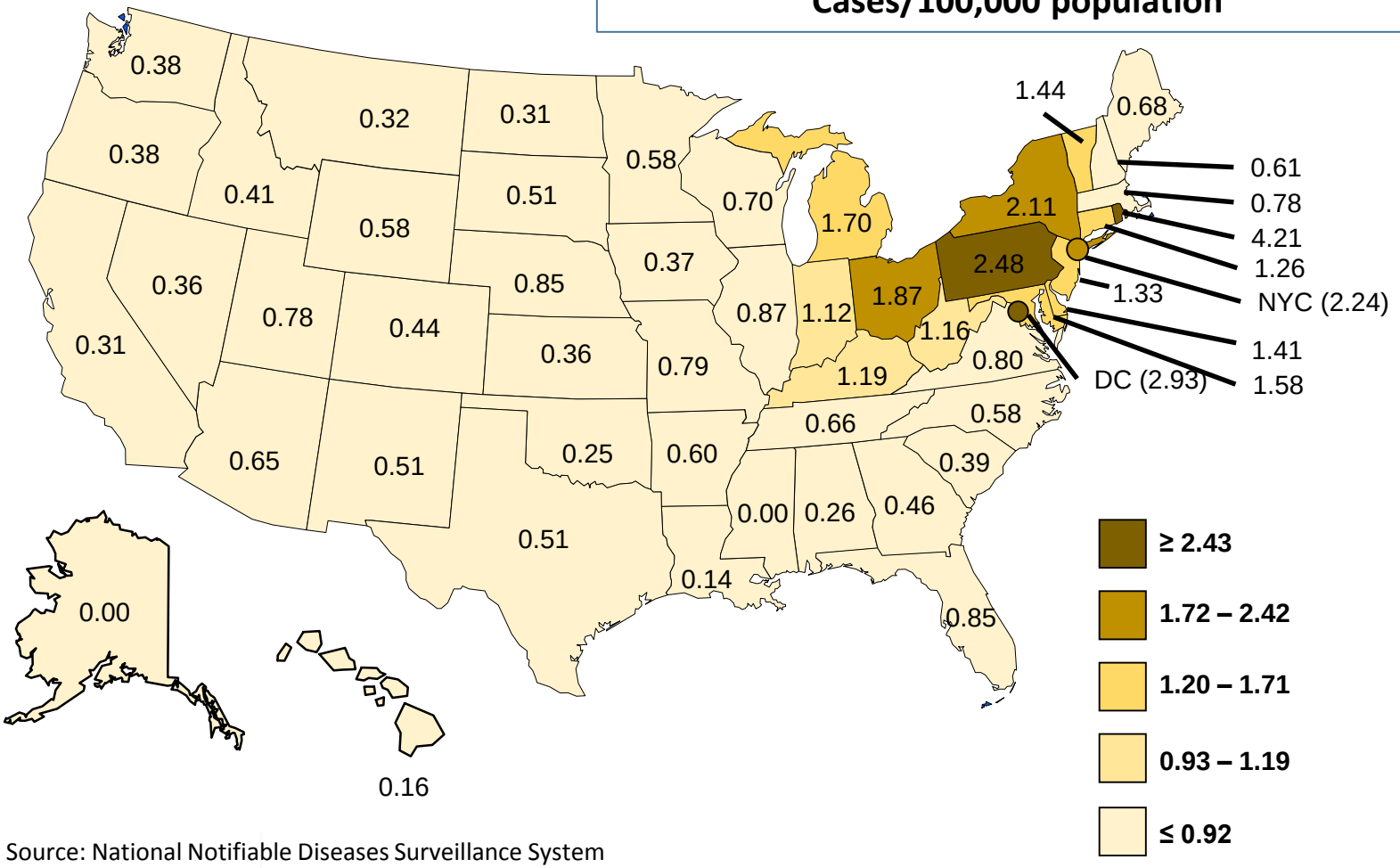


Rate of reported cases increased 5.5 times (2000–2017)

Source: National Notifiable Diseases Surveillance System

Reported rates of legionellosis in the United States demonstrate geographic variability

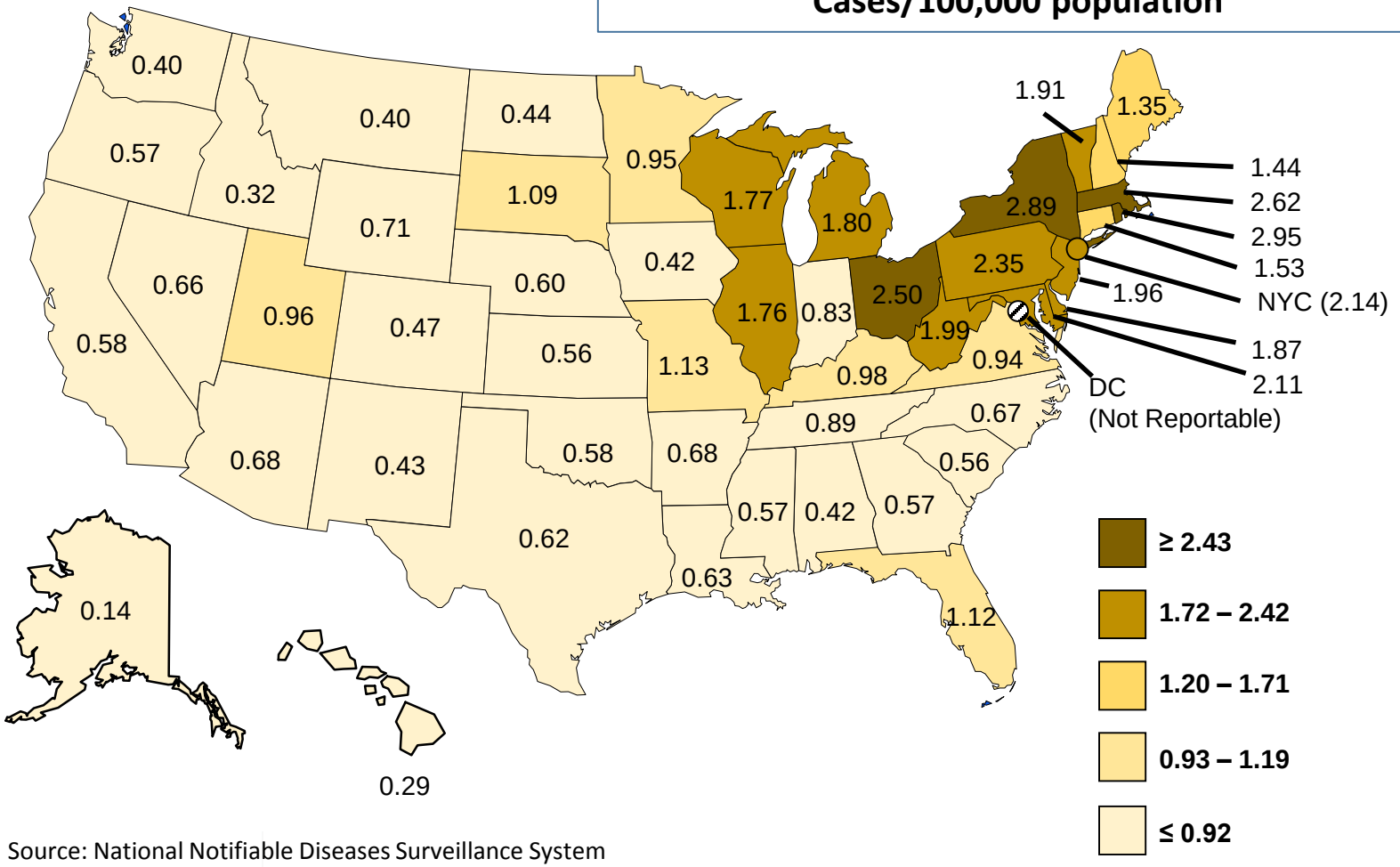
Rates of reported legionellosis cases by state, 2007
Cases/100,000 population



Source: National Notifiable Diseases Surveillance System

Reported rates of legionellosis in the United States demonstrate geographic variability

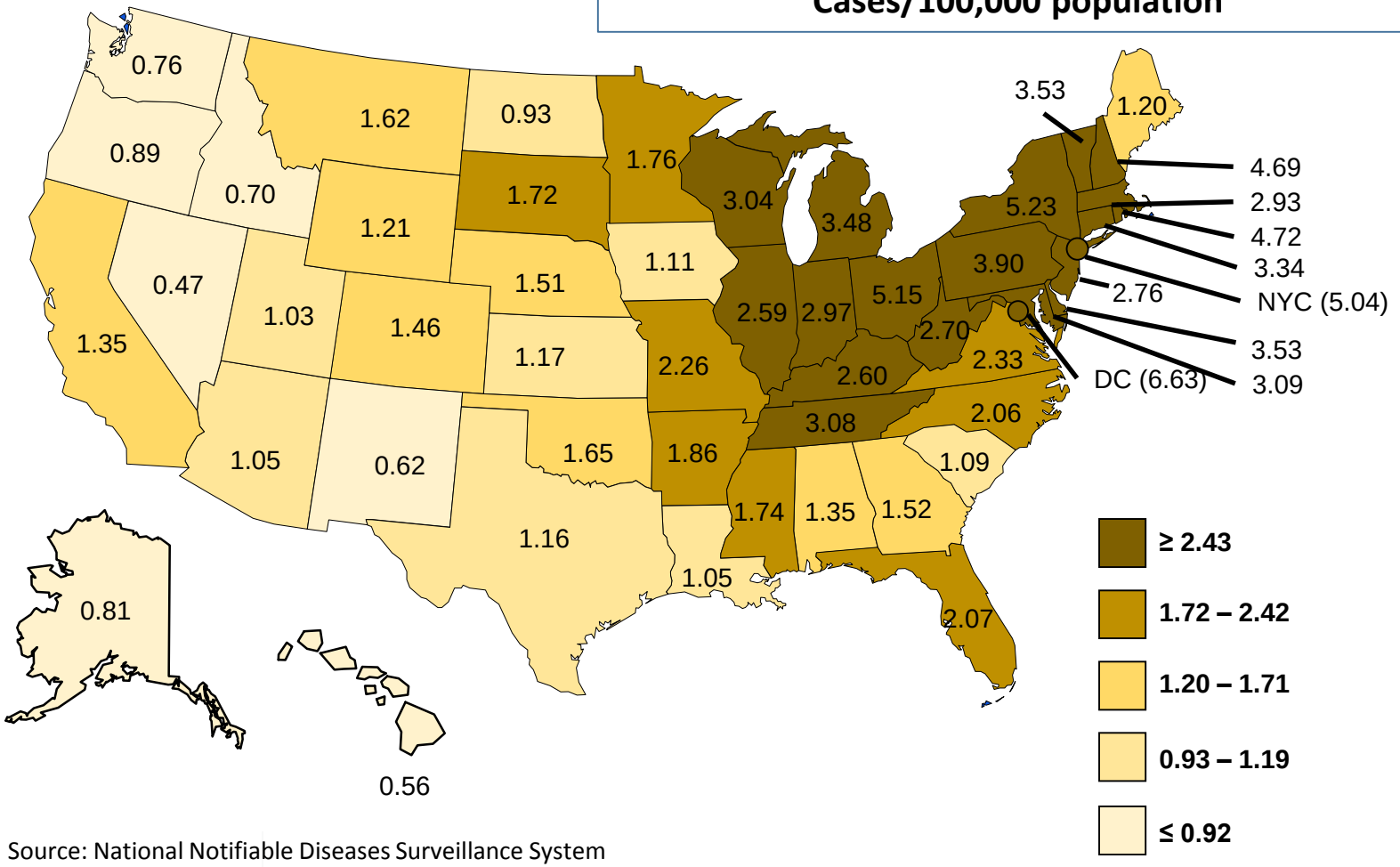
Rates of reported legionellosis cases by state, 2012
Cases/100,000 population



Source: National Notifiable Diseases Surveillance System

Reported rates of legionellosis in the United States demonstrate geographic variability

Rates of reported legionellosis cases by state, 2017
Cases/100,000 population

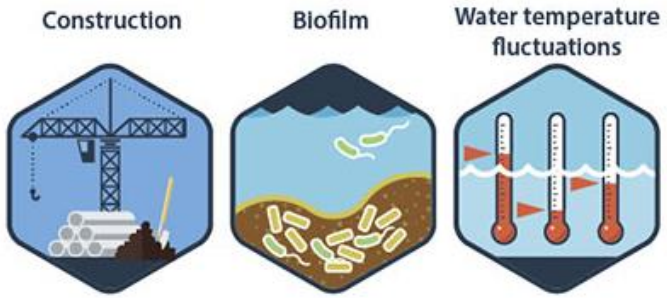


Source: National Notifiable Diseases Surveillance System

Legionella to Legionnaires' disease

Legionella lives in fresh water

1. Internal and external factors can lead to *Legionella* growth in building water systems.



Certain conditions can lead to _Legionella_ amplification

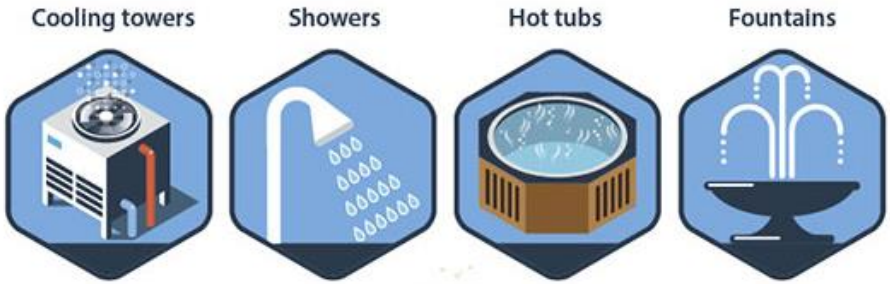
2. *Legionella* grows best in large, complex water systems that are not adequately maintained.

https://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html

Legionella to Legionnaires' disease

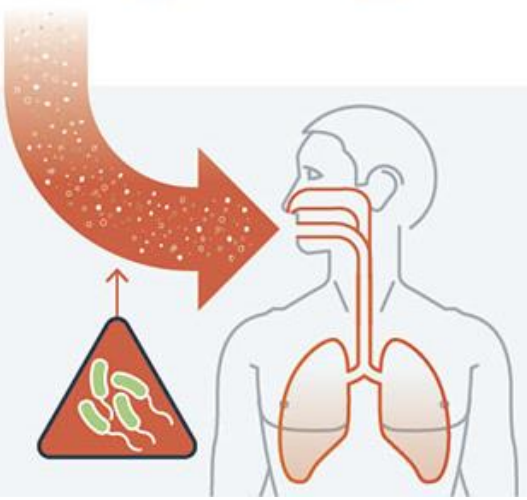
Certain devices can lead to aerosolization

3. Water containing *Legionella* is aerosolized through devices.



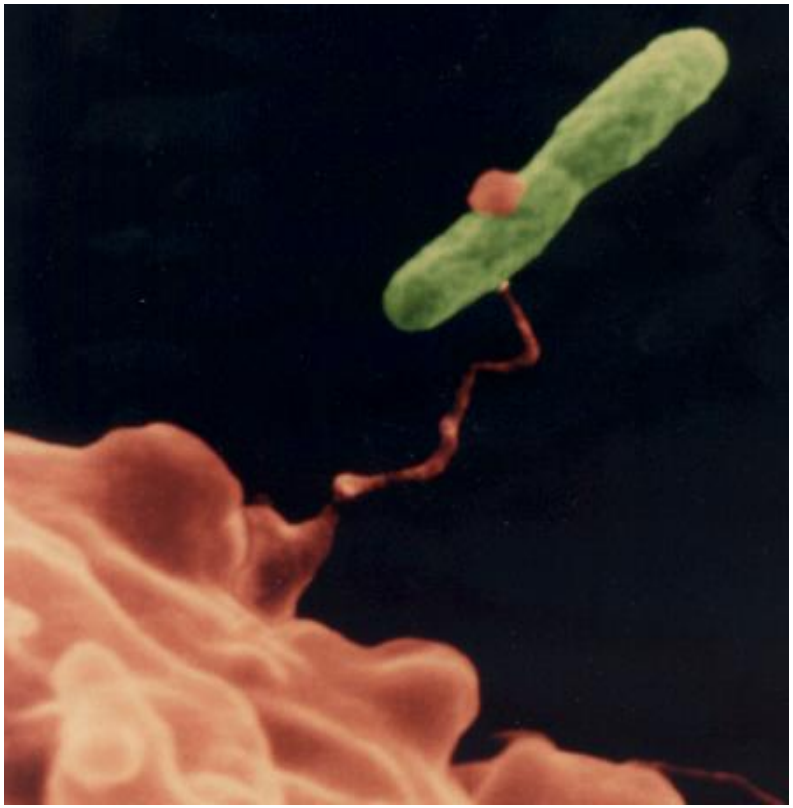
***Legionella* can be transmitted to susceptible hosts**

4. People can get Legionnaires' disease when they breathe in mist or accidentally swallow water into the lungs containing *Legionella*. Those at increased risk are adults 50 years or older, current or former smokers, and people with a weakened immune system or chronic disease.

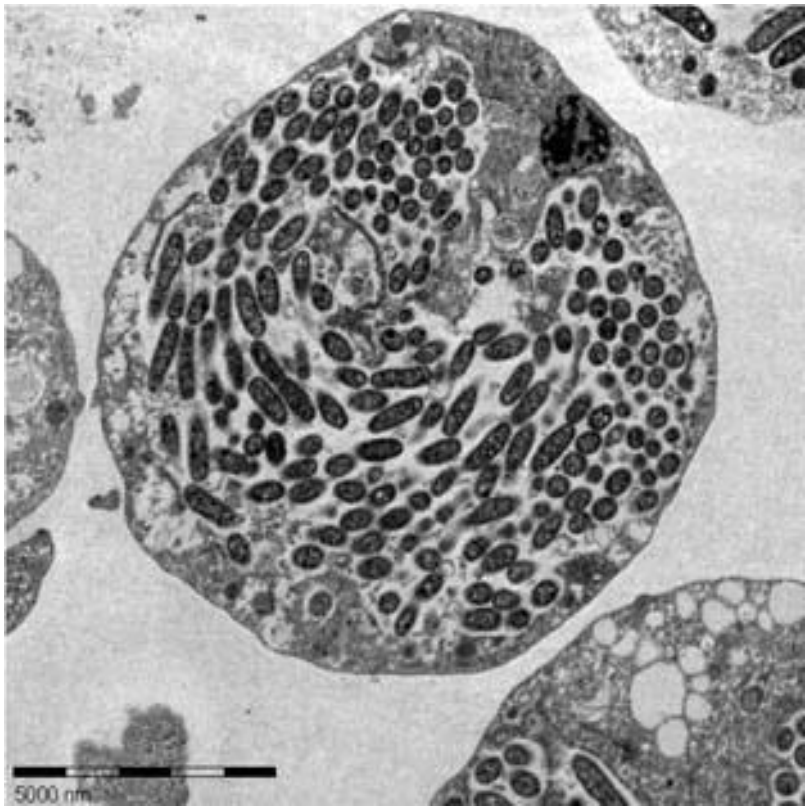


https://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html

Legionella grow within a host



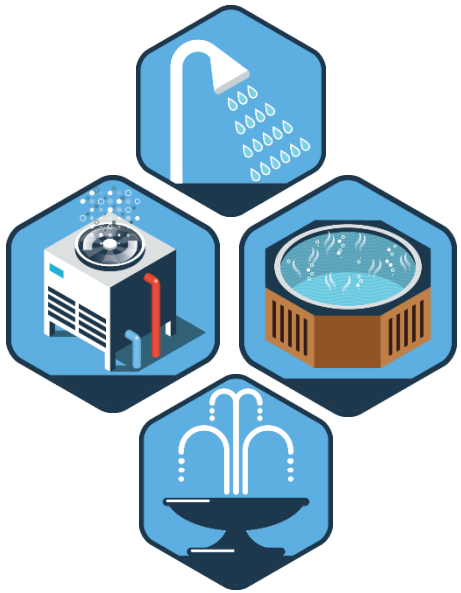
Credit: Public Health Image Library, CDC



Credit: Holland/Özel, Robert Koch-Institut

What do we know about source attribution?

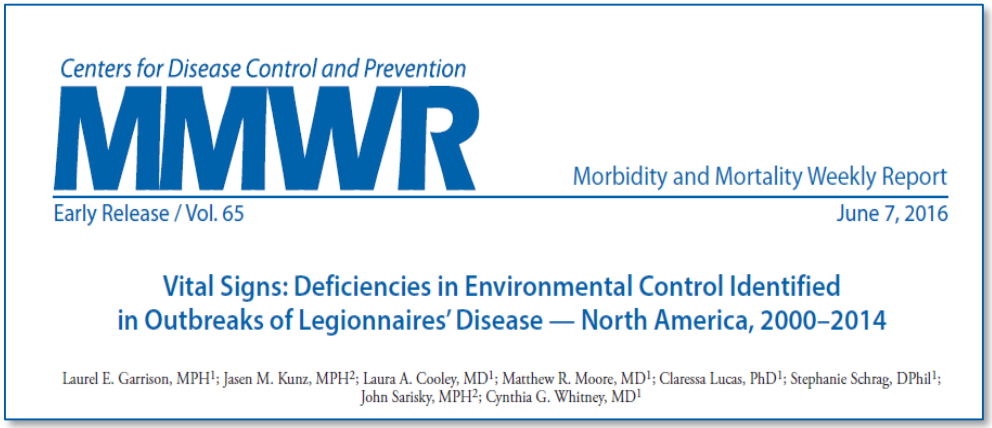
- **2016: CDC analyzed data from 27 building-associated outbreaks (2000–2014)**
- **Common settings**
  - Hotels (44%)
  - Long-term care facilities (19%)
  - Hospitals (15%)
- **Common sources**
  - Potable water (56%)
  - Cooling towers (22%)
  - Hot tubs (7%)
  - Decorative fountains (4%)
  - Industrial equipment (4%)



Source: Garrison LE et al. *MMWR*. 2016;65(22):557–61.

What can be done to prevent Legionnaires' disease?

- **Effective WMPs can reduce the risk of Legionnaires' disease**



Centers for Disease Control and Prevention

MMWR

Morbidity and Mortality Weekly Report

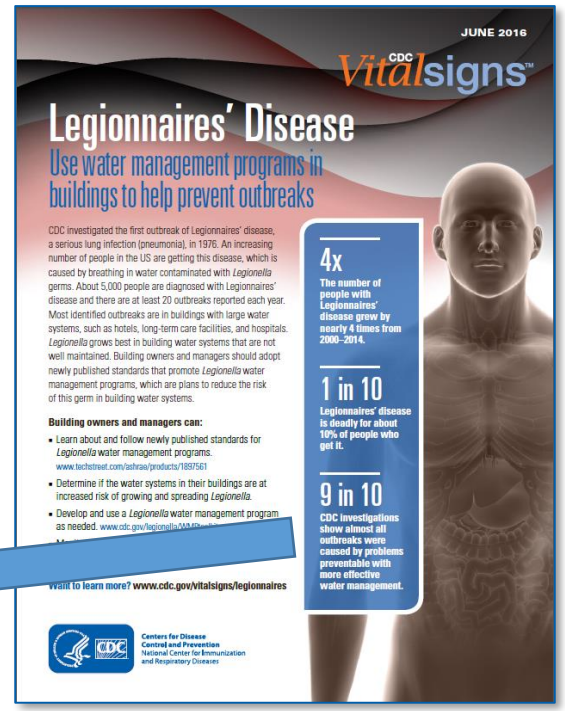
Early Release / Vol. 65 June 7, 2016

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

Laurel E. Garrison, MPH[1]; Jasen M. Kunz, MPH[2]; Laura A. Cooley, MD[1]; Matthew R. Moore, MD[1]; Claressa Lucas, PhD[1]; Stephanie Schrag, DPhil[1]; John Sarisky, MPH[2]; Cynthia G. Whitney, MD[1]

9 in 10

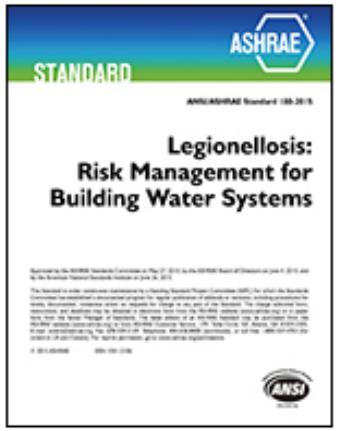
CDC investigations show almost all outbreaks were caused by problems preventable with more effective water management



2016 *MMWR* Vital Signs
www.cdc.gov/vitalsigns/legionnaires

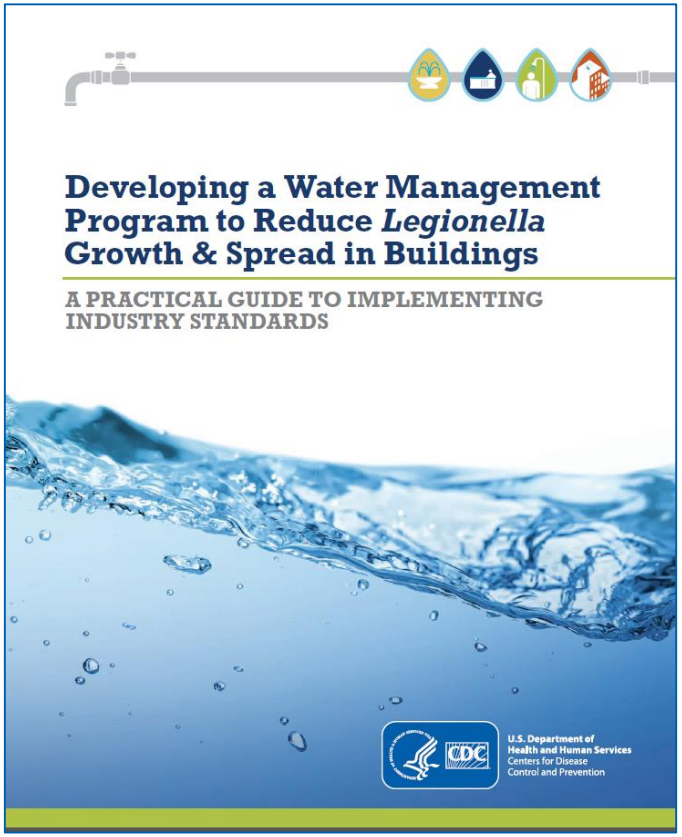
Primary prevention of Legionnaires' disease

- **Ensuring proper maintenance of building water systems and aerosol-generating devices is key**
- **Current guidelines, standards, and protocols**
  - HICPAC (2003, 2004)
  - ASHRAE Guideline 12 (2000)
  - VHA Directive 1061 (2014)
  - ASHRAE Standard 188 (2015)
  - AIHA Guideline (2015)
  - NYC/NYS regulations (2015, 2016)
  - NSF protocol 453 (2017)
  - CMS Memo (2017)
  - Others in development



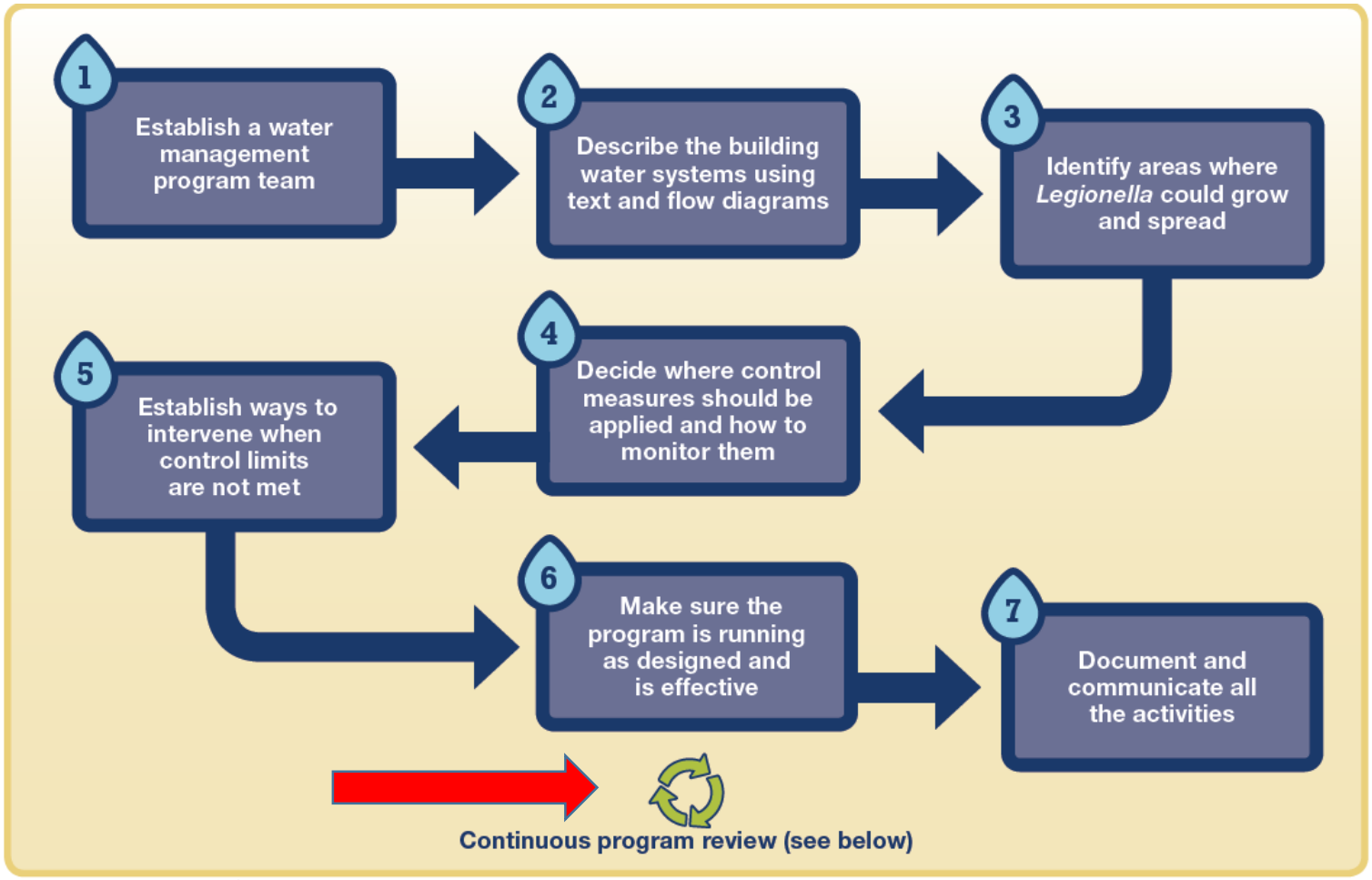
Increasing uptake of ASHRAE 188

- **Step-by-step guide to creating a WMP**
- **Does not provide specific instructions**
- **CDC supportive of adopting ASHRAE 188 language into International Plumbing Code**



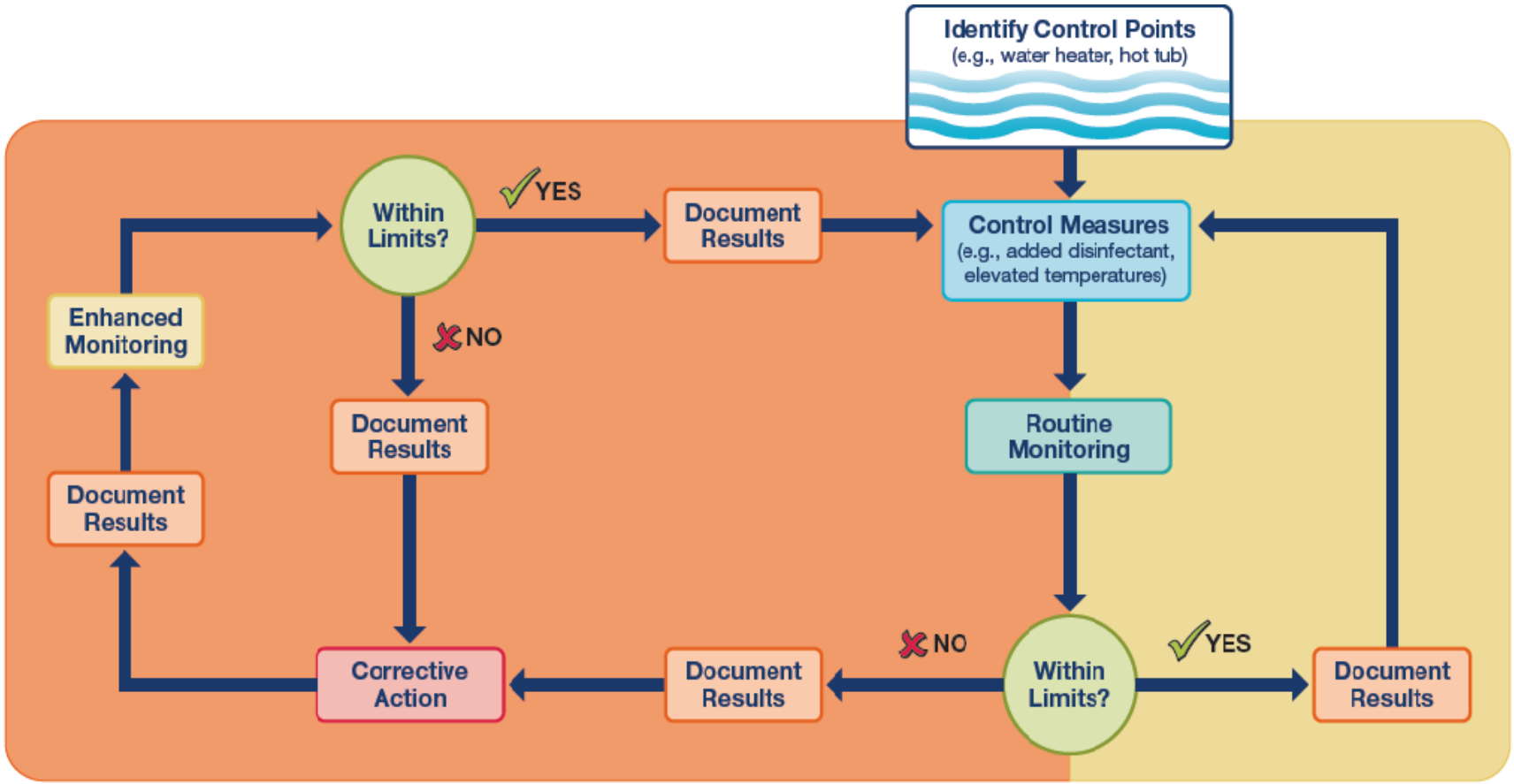
www.cdc.gov/legionella/WMPtoolkit

Elements of a Water Management Program



Source: CDC Water Management Program Toolkit

Daily Activities



Source: CDC Water Management Program Toolkit

Defining Important Terms

Verification: initial and ongoing confirmation that the Program is being implemented as designed.

Validation: initial and ongoing confirmation that the Program, when implemented as designed, effectively controls the hazardous conditions throughout the building water systems.

Source: ASHRAE Standard 188

Validating a Program

"The Program Team shall establish procedures to confirm…that the Program…effectively controls the hazardous conditions throughout the building."

Excerpt paraphrased from ASHRAE Standard 188 Section 6.2.8

Testing: conducting a planned sequence of observations or measurements of physical, chemical, or microbial characteristics of water to assess whether conditions throughout building water systems meet the goals set by the Program Team

Source: ASHRAE Standard 188

Traditional *Legionella* Culture – Processing Samples

Enumerating *Legionella* by Traditional Culture

BCYE Direct	PCV Concentrated 20X Acid Treatment	GPCV Direct Acid treatment
Not detected	0.1 cfu/ml	120 cfu/ml

Accuracy and Precision of Enumeration

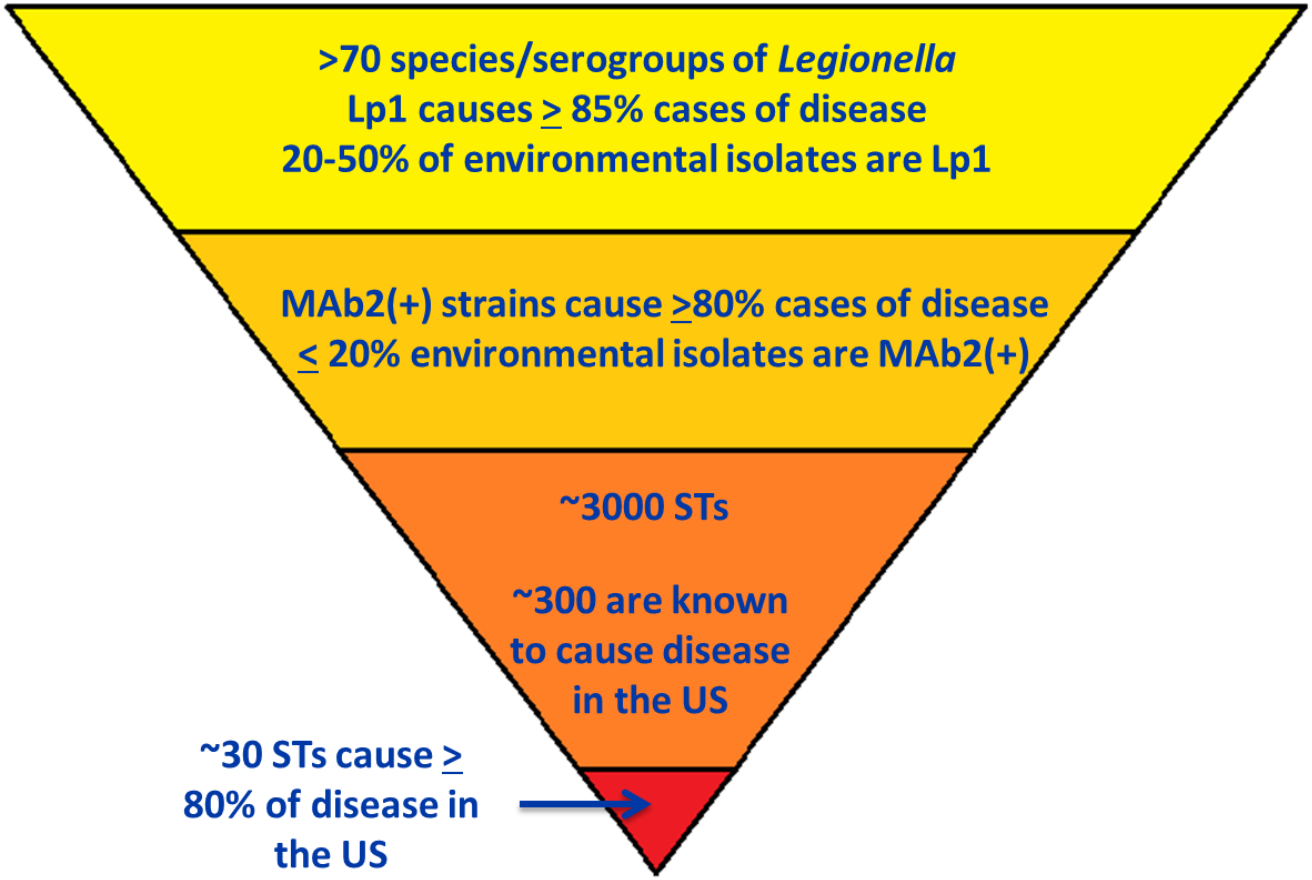
Sample type	Number Tested	Percent Positive	Mean QC (cfu/ml)	Mean Result	Log difference
Pure Negative	789	3%	0	18	0.53
Pure Positive	854	91%	10,191	9,840	-1.54
Pure Variable	903	54%	1,149	3,493	-0.65
Mixed Negative	968	5%	0	32	0.93
Mixed Positive	781	73%	3,516	3,446	-1.80
Mixed Variable	971	51%	257	142	-.076

Other Detection Methods

- Liquid culture with bacterial enzyme detection
- Nucleic acid based
- Antibody capture and visualization

- Increased sensitivity
- Faster turnaround time
- Limited specificity
- Variable sensitivity
- Live/dead discrimination

Pathogenicity of Legionellae



Summary

- Water management is a dynamic process.
- Water management programs should be site specific.
- Program Team decides validation criteria.
- *Legionella* test results may inform validation.
- *Legionella* test results are NOT predictive of disease.
- Periodic Program review is crucial for effective management.

http://www.cdc.gov/legionella/index.html

Thank you!

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov