Legionella

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Legionella

- Gram negative, flagellated bacteria

- Many species; several serogroups
  - *L. pneumophila* Serogroup 1 is the most common
  - All species and serogroups could cause disease

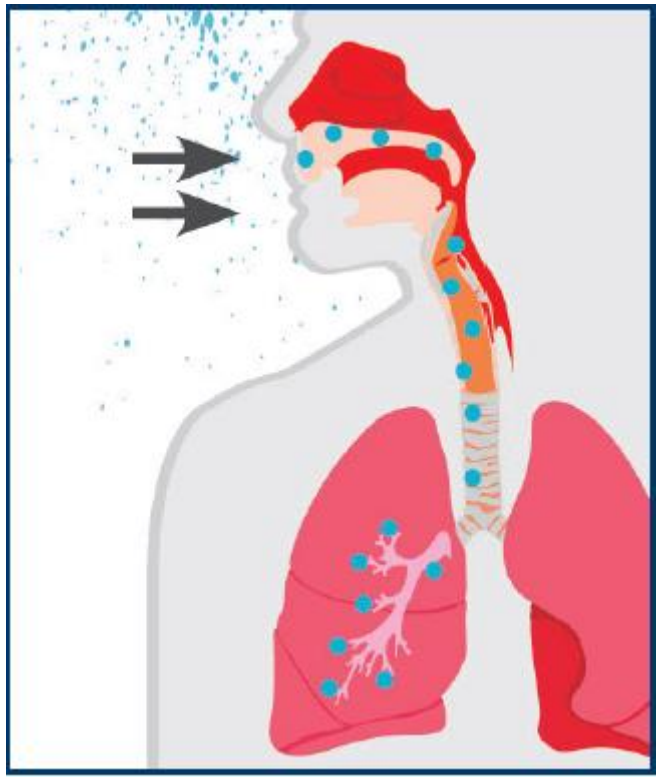
- In the wild: parasite of freshwater amoebae
  - Uses same skills to live inside alveolar macrophages

What is Legionnaires' disease?

- Bacterial infection
- Serious, often deadly, pneumonia
- Transmitted by breathing in water droplets containing *Legionella*
- In general, people do not spread Legionnaires' disease to other people

- *Legionella* can also cause Pontiac Fever

Symptoms



- Cough
- Shortness of breath, pain in chest
- Muscle/body aches
- Headache
- Fever or chills
- Radiographic evidence of pneumonia
- Mental confusion (lethargy, agitation, stupor)
- Diarrhea (watery, non-bloody), nausea, vomiting, abdominal pain

Diagnostic testing for Legionella

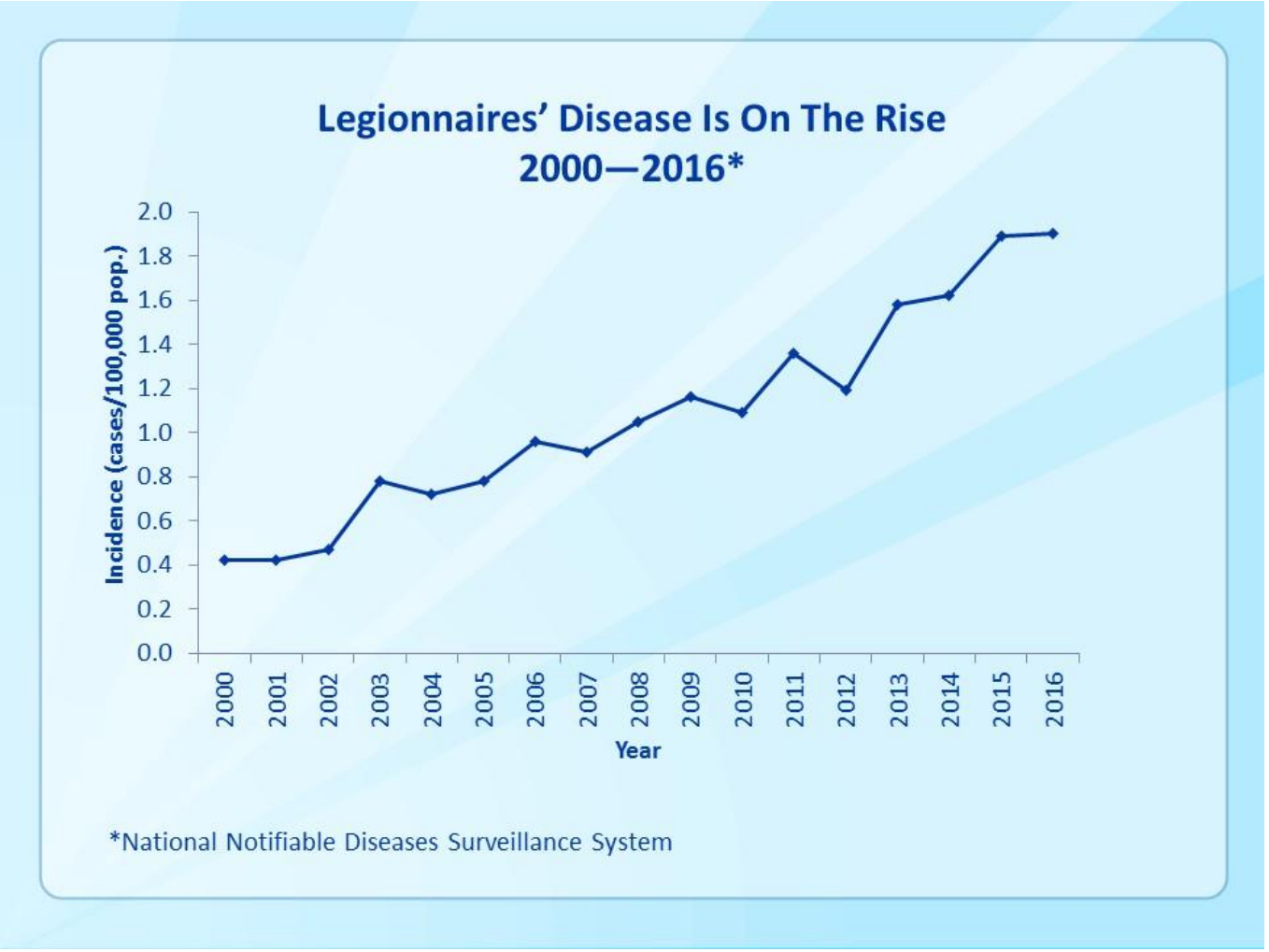
https://www.cdc.gov/legionella/downloads/fs-legionella-clinicians.pdf

- **Order both a culture of a lower respiratory specimen and a urinary antigen test when testing patients for *Legionella*.**
  - Make sure to specifically request culture for *Legionella*- it requires a very specific special media
  - Culture is important for epidemiologic investigation and linking cases
  - Urine tests do not necessarily identify non-*L. pneumophila* serogroup 1, although there is cross-reactivity

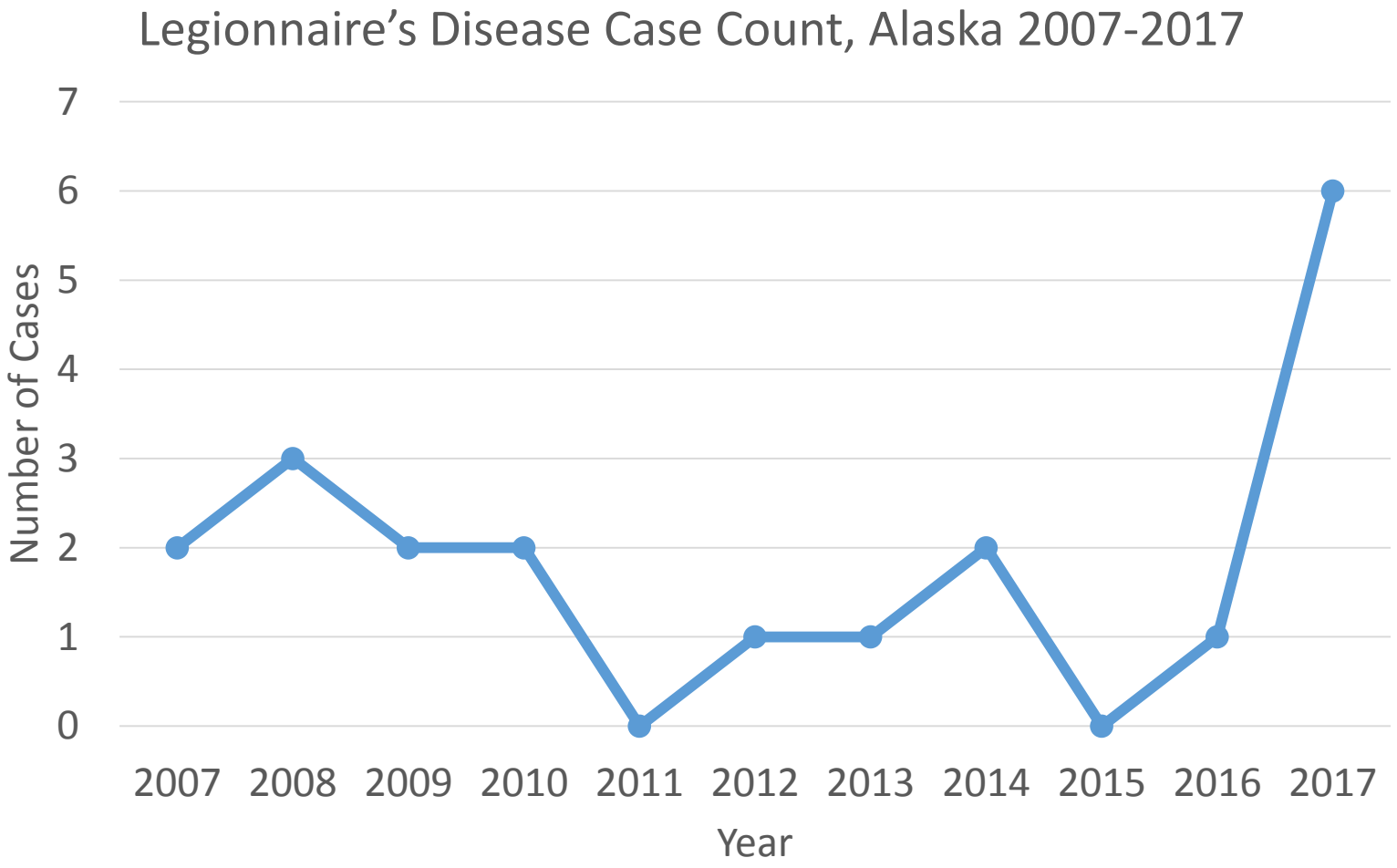
Risk Factors for Legionnaire's disease

- Adults 50 years or older
- Current or former smokers
- People with chronic lung disease
- Immunocompromised (transplant or chemotherapy)
- Underlying chronic conditions such as diabetes, kidney or liver failure

Epidemiology -- Nationwide



Epidemiology -- Alaska



How does *Legionella* spread?

Legionella is usually spread by inhalation of contaminated water droplets

Most common sources:

- Showerheads and sink faucets
- Cooling towers
- Hot tubs
- Decorative fountains and water features
- Hot water tanks and heaters
- Large plumbing systems, such as in hospitals or big hotels

6. Cycle repeats

formation

colonization

Formation of biofilms

- Biofilms are an important factor for survival and growth
  - Metabolic assistance
  - Absorbs disinfectant before it can kill bacteria

- Various factors increase the likelihood of biofilm formation, including:
  - ✓nutrients, both in the source water and in the materials of the system
  - ✓scale and corrosion
  - ✓warm water temperatures
  - ✓stagnation or low flow

Devices where Legionella can grow or spread

- Water heaters
- Water hammer arrestors
- Expansion tanks
- Water filters
- Electronic and manual faucets
- Aerators
- Faucet flow restrictors
- Centrally installed misters, atomizers, air washers, and humidifiers
- Nonstream aerosol-generating humidifiers
- Infrequently used equipment including eyewash stations
- Medical equipment (such as CPAP machines, hydrotherapy equipment, bronchoscopes)

Infection risk depends on the system

To cause disease, *Legionella* must: 1) Grow 2) Spread into water 3) Be aerosolized 4)Be inhaled

- Small microenvironments can have different conditions that are better for growth
  - Fountain lighting creates warm areas
  - “Dead legs” have stagnant water
- Biofilm can release intermittently from growth-supportive environments and be disseminated; big water changes can cause releases
- Devices can aerosolize

Why Are Legionnaires Disease Diagnoses Becoming More Common in the United States?

JAMA article suggests multifactorial:

- 4.5 fold increase in cases since 2000
- Aging infrastructure (i.e. pipes, cooling towers)
- Aging population with higher risk factors: smoking, travel, immunosuppression and recurrent or prolonged pneumonia
- Climate-warm, rainy and humid

Rubin R. Why Are Legionnaires Disease Diagnoses Becoming More Common in the United States?. *JAMA*. 2018:319(17):1753–1754.

What can you do to prevent Legionella? Prevention/toolkit

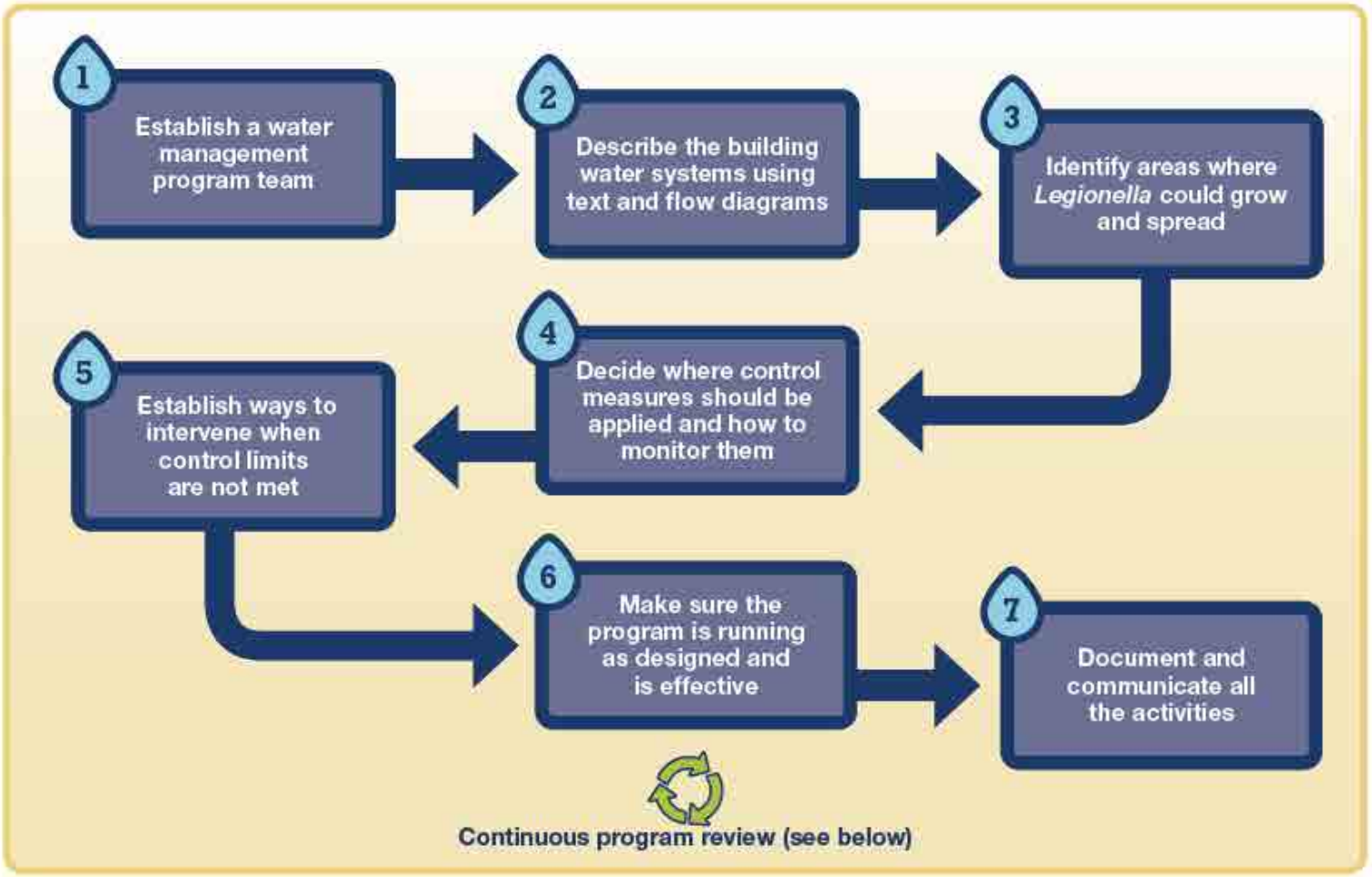
https://www.cdc.gov/legionella/downloads/toolkit.pdf

Toolkit steps to identify and manage conditions that grow *Legionella*:

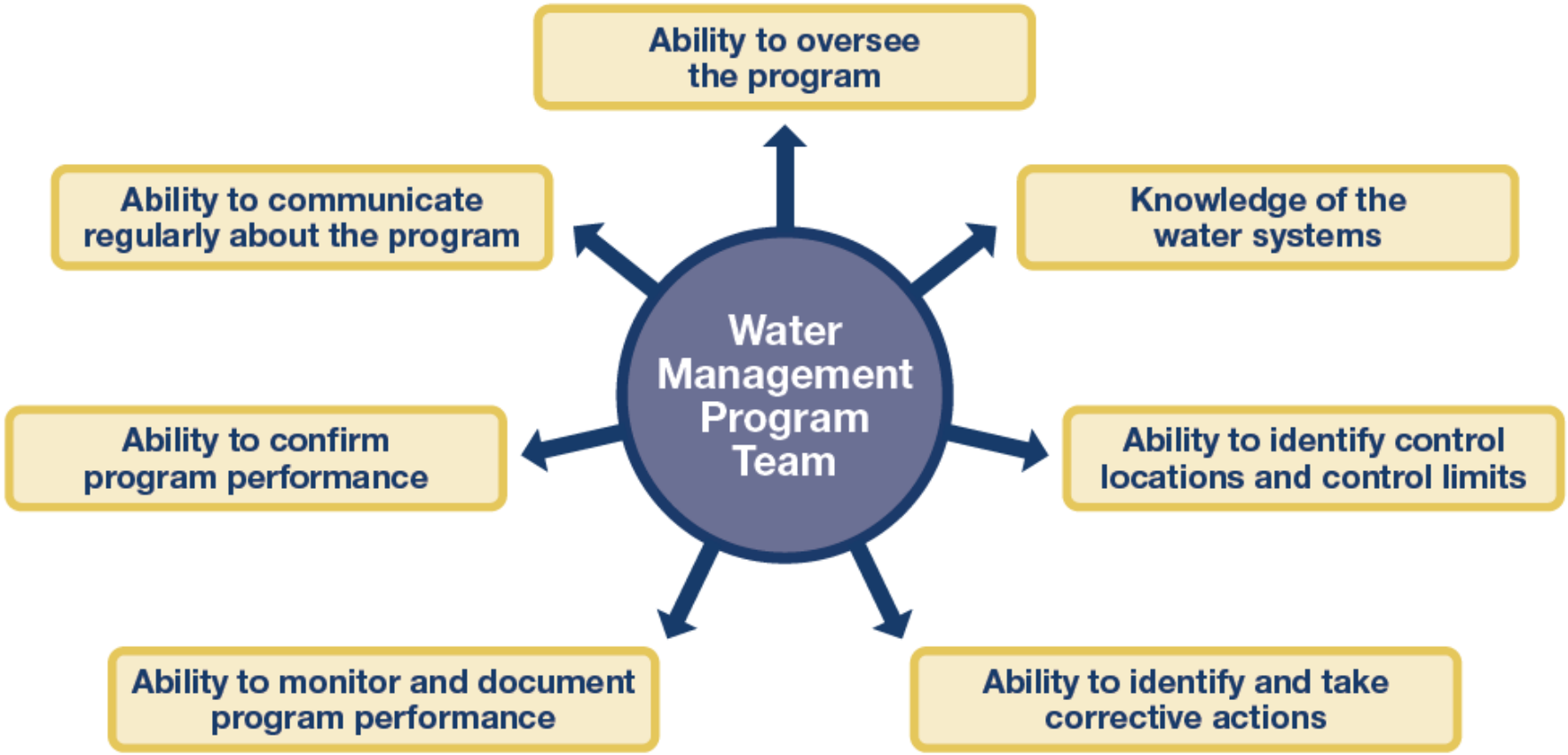
1. Identify your facilities water systems
2. Assess the risk of current water systems
3. Apply control measures to prevent growth and spread
4. Evaluate your control measures are effective and running as specified

Elements of a Water Management Program

https://www.cdc.gov/legionella/downloads/toolkit.pdf



1.Establish a Water Management Program Team



Water Management Team and Resources!

Team Members

- Biomedical/clinical engineering
- Environmental Health and Safety
- Environmental Services
- Epidemiologist
- Facilities and/or Plant Management
- Hemodialysis Nursing
- Infection Preventionist
- Risk Management
- Design & Construction, Architect

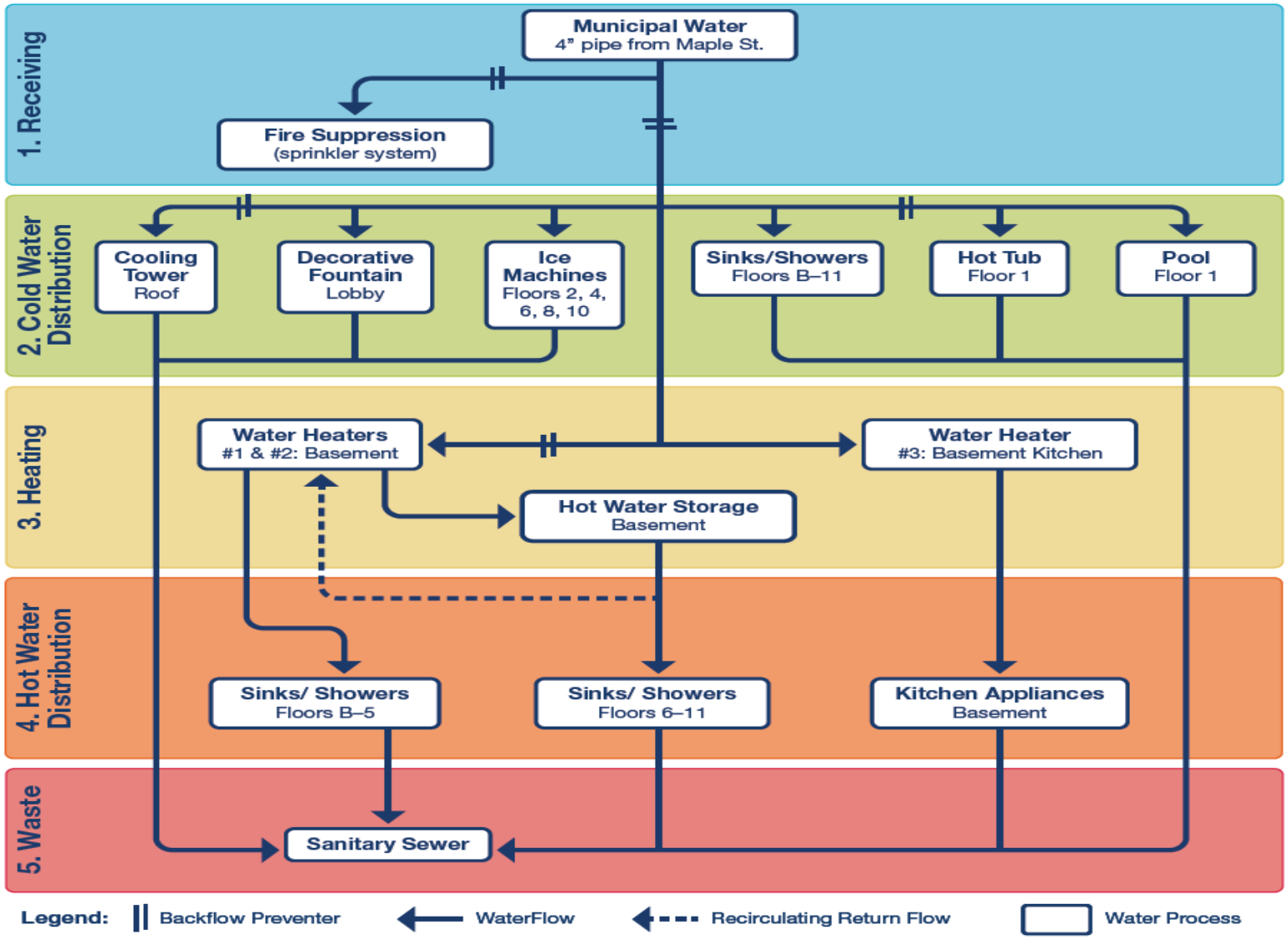
External support may include a consultant/expert is water systems and/or the Public Health Department

ANSI/ASHRAE Standard 188-2018, Legionellosis: Risk Management for Building Water Systems **establishes minimum legionellosis risk management requirements for building water systems.**

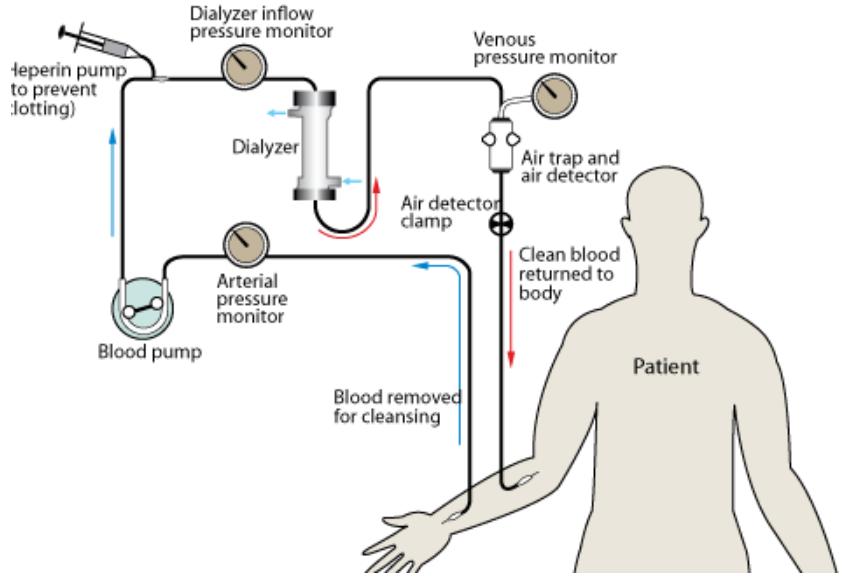
Role of IP

- Surveillance for diseases caused by waterborne pathogens
- Review and approve water system designs
- Substantiate vendor claims with reputable evidence to support
- Develop action thresholds and plans for system failures and waterborne pathogen detection in the system or humans
- Evaluate healthcare facilities polices/plans, thresholds for action and mitigation strategies
- Review and approve mitigation strategies
- Be a content expert for evidence based decision making

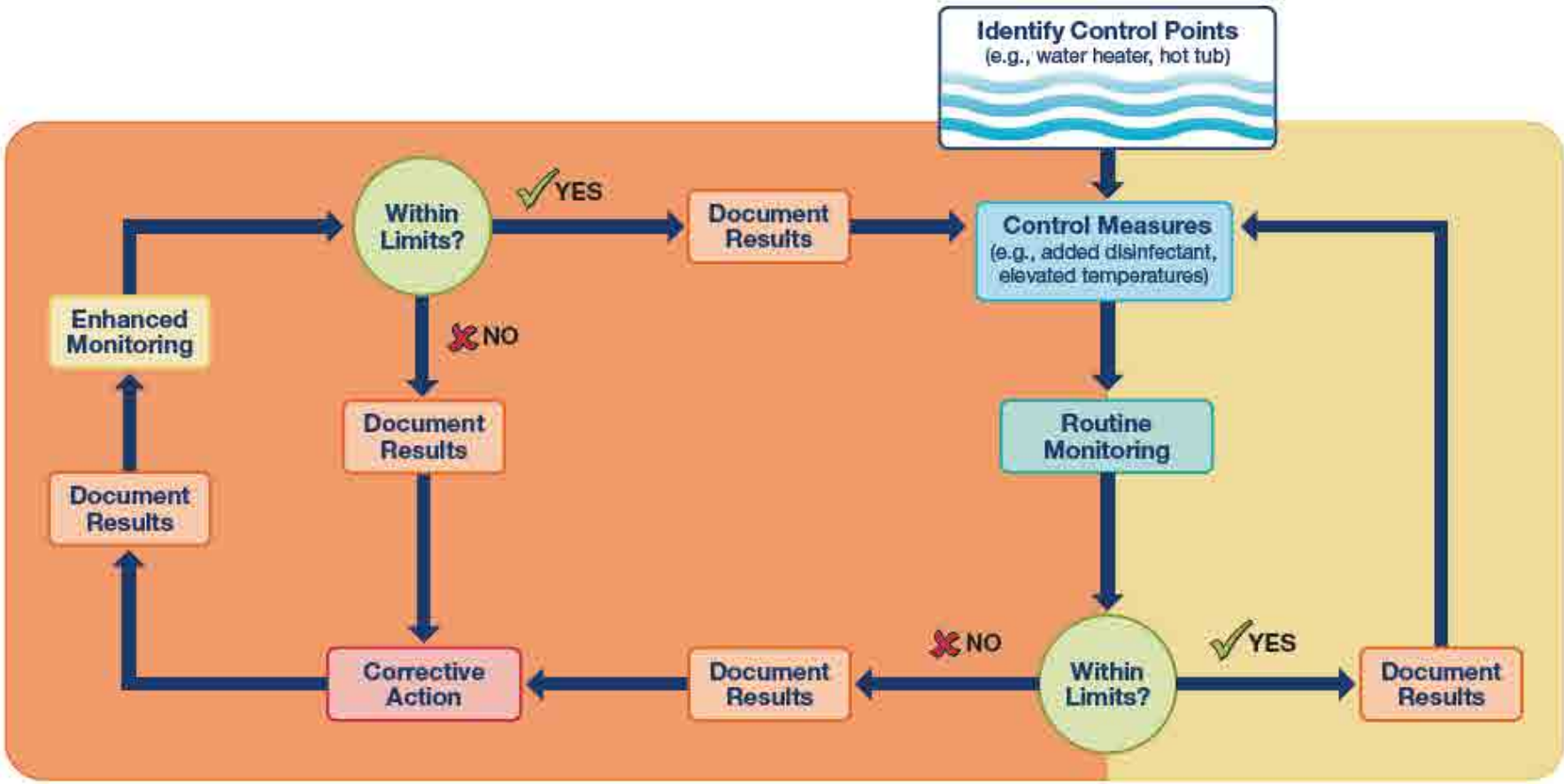
2. Describe Your Building Water Systems Using a Flow Diagram



3. Identify Areas Where Legionella Could Grow…



3. Control Measures & Corrective Actions: The Basics

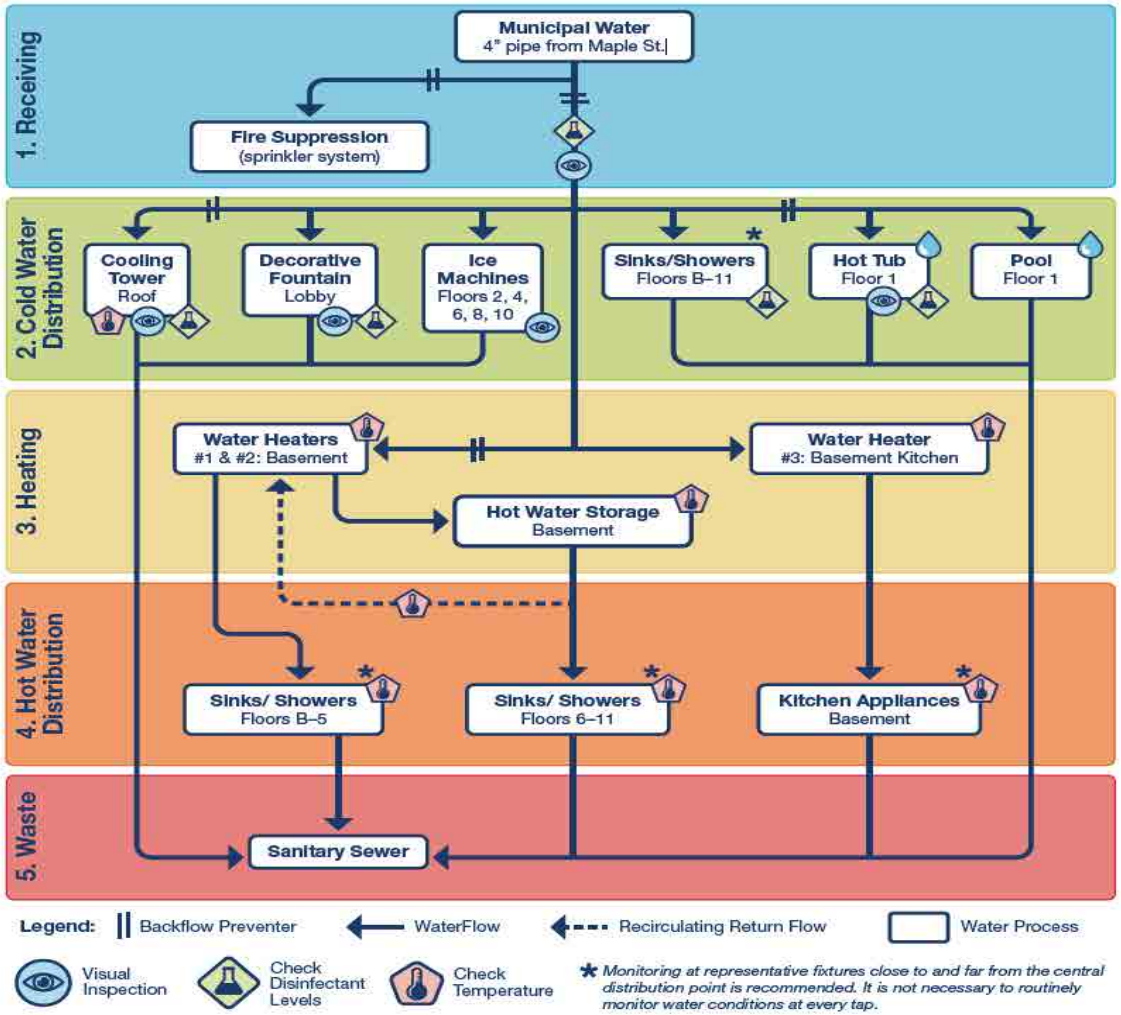


4. Decide Where Control Measures Should Be Applied

Examples:

- Water quality should be measured throughout the system to ensure that changes to promote *Legionella* growth (such as a drop in chlorine levels) are not occurring.
- Maintain water heaters at the appropriate temperatures.
- Decorative fountains should be kept free of debris and visible biofilm.
- Disinfectant and other chemical levels in cooling towers and hot tubs should be continuously maintained and regularly monitored. Surfaces with any visible biofilm (i.e., slime) should be cleaned.

4. Decide How to Monitor Your Control Measures



5. Establish Ways to Intervene When Control Limits Are Not Met

Example 3 from toolkit

- During the weekly inspection of the cooling tower, M discovers that leaf litter has accumulated in the reservoir.
- Upon further investigation, she finds a panel has become dislodged, allowing windblown debris to enter.
- After replacing the panel and skimming out the debris, M checks disinfectant levels and performs a heterotropic plate count as an indicator of water quality.
- She documents her actions in her log book. Makes a note to check disinfectant levels for one week to make sure cooling tower remains within control limits. She reviews actions with her supervisor.

Importance of HPC counts:

High HPC counts indicate ideal conditions for bacterial regrowth and should be corrected. Bacterial regrowth can lead to pipe corrosion, encourage slime growth, increase the need for disinfectants, cause foul-tasting water, and harbour secondary respiratory pathogens (ex. *Legionella)*. Thus, HPC can be used as a marker for the underlying causes of some aesthetic problems (WHO, 2002).

HPC (heterotropic) Testing

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What are the health effects associated with HPC levels?

At an international meeting of experts in Geneva, Switzerland, it was concluded that heterotrophic bacteria in drinking water is not a health concern to the general public. However, some bacteria present in a heterotrophic population are opportunistic pathogens that could infec individuals with weakened immune systems.

"Heterotrophic bacteria belonging to the following genera have been associated with opportunistic infections: *Acinetobacter, Aeromonas, Chryseobacterium (Flavobacterium), Klebsiella, Legionella, Moraxella, Mycobacterium, Serratia, Pseudomonas,* and *Xanthomonas*. These organisms have been mainly associated with nosocomial (hospital acquired) infections, including wound infections, urinary tract infections, post-operative infections, respiratory infections, and infections in burn patients."

Culture plate

SimPlate for HPC

6. Make Sure the Program Is Running as Designed & Is Effective

- Verification: Are we doing what we said we would do?

Your program team should establish procedures to confirm, both initially and on an ongoing basis, that the water management program is being implemented as designed.

- Validation: Is our program actually working?

Now that you have a water management program, you need to be sure that it is effective. Your program team should establish procedures to confirm, both initially and on an ongoing basis, that the water management program effectively controls the hazardous conditions throughout the building water systems.

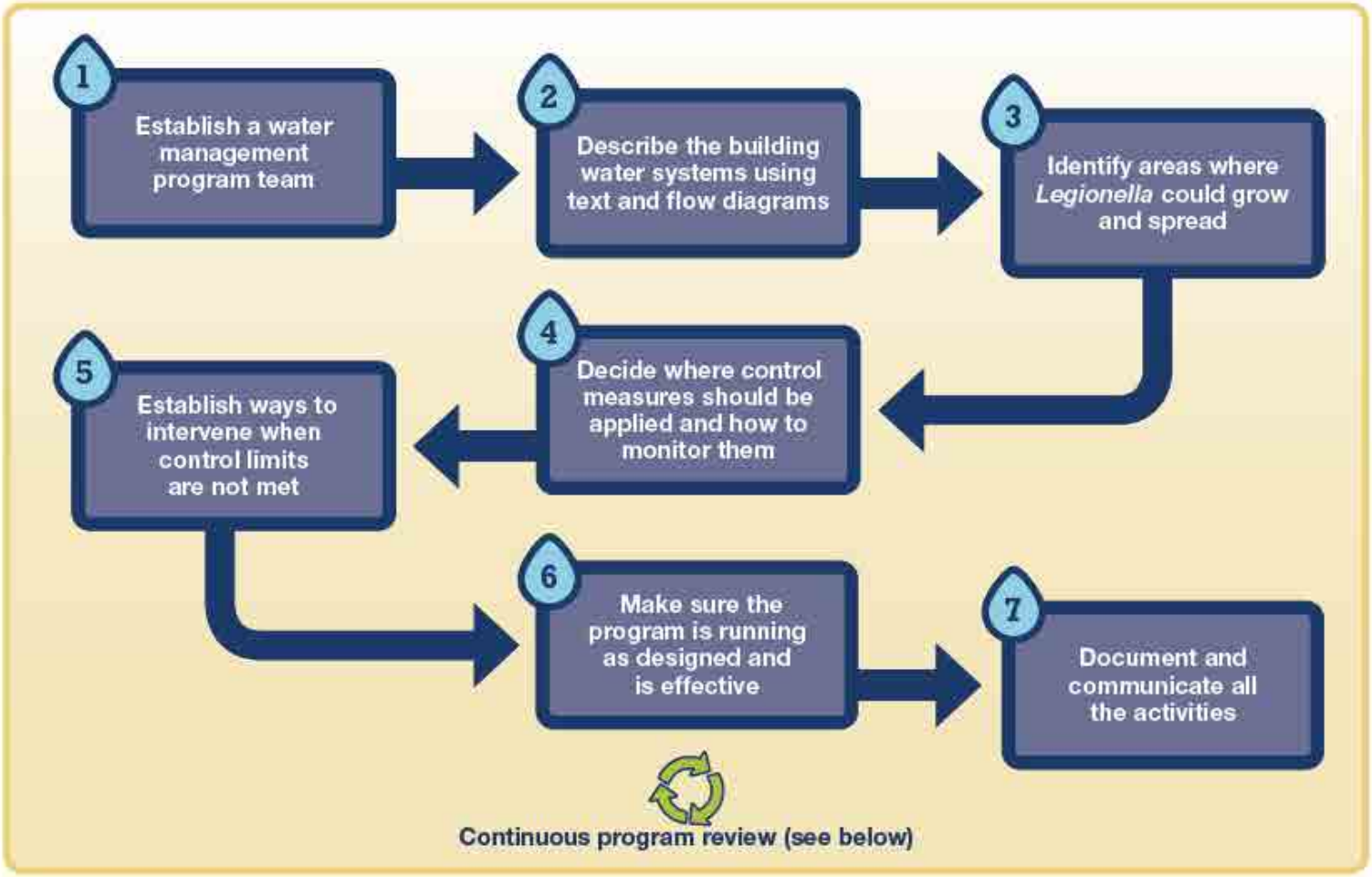
7. Document & Communicate All the Activities of Your Water Management Program

- Documentation: Now that you have done all of the work required to create your water management program, write it down. This information will be important to improve your program and if you or others want to review your records.

- Communication: You have worked hard to develop your water management program and you have carefully documented all aspects of it. Resist the temptation to put it on a shelf and walk away. Use this communication as an opportunity to identify strategies for improving the management and efficiency of your water systems.

Elements of a Water Management Program

https://www.cdc.gov/legionella/downloads/toolkit.pdf



Environmental testing for Legionella

- If indicated, should occur at a commercial Environmental Legionella Isolation Techniques Evaluation (ELITE) labhttps://wwwn.cdc.gov/elite/Public/MemberList.aspx

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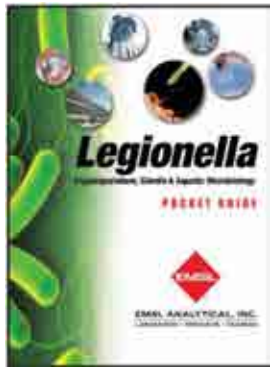
- Technical assistance with sampling during a HAI or cluster investigation is available thru AK Epi 269-8000

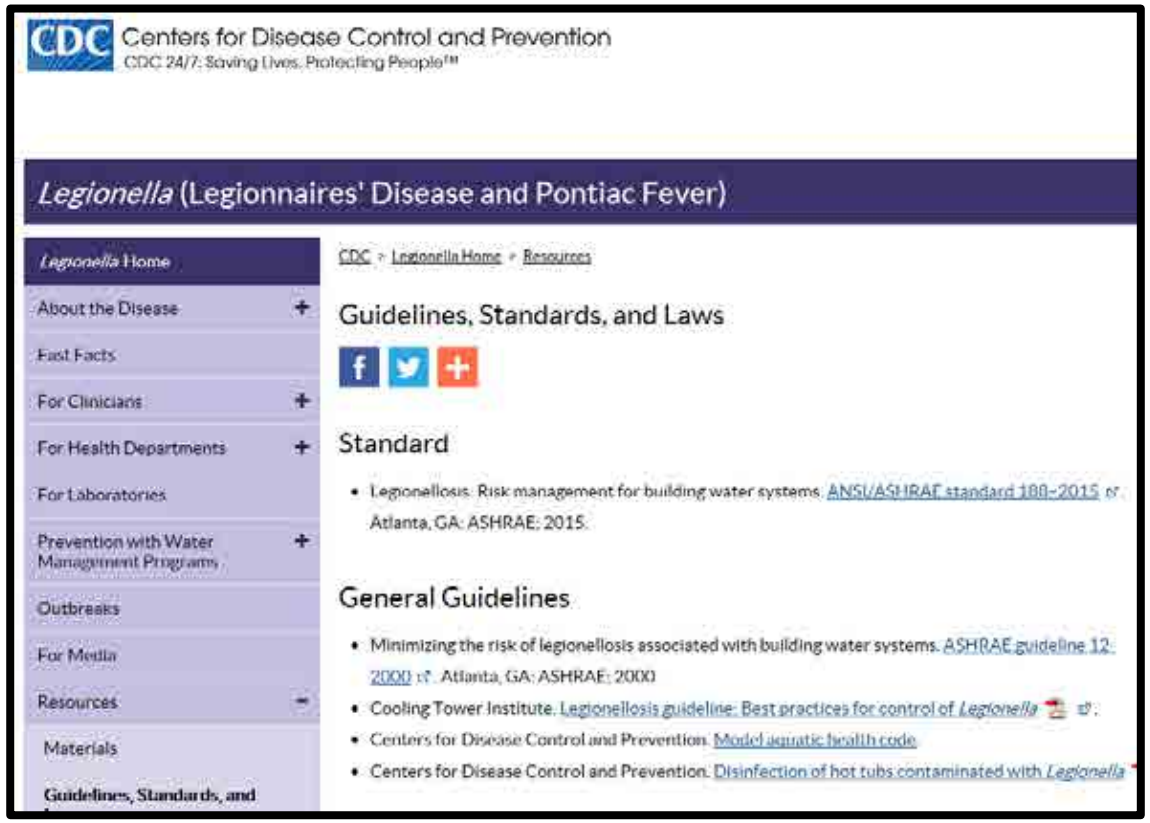


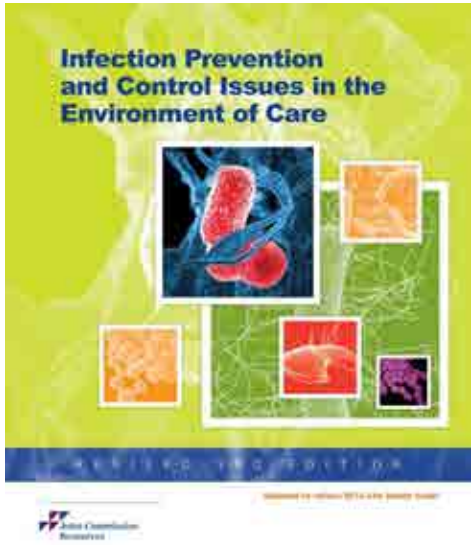
https://www.emsl.com/Services.aspx?action=list&ServiceCategoryID=254

Report to Health Department

https://www.youtube.com/watch?v=xeFa2P2rddE

https://www.cdc.gov/legionella/resources/guidelines.html





New! *Infection Prevention & Control Issues in the Environment of Care*
Our newest book offering, *Infection Prevention and Control Issues in the Environment of Care, Revised Third Edition*, is designed to help IPs and physical environment professionals collaborate to create an effective IPC program by properly managing the physical environment.

Thank-you!

Questions?

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