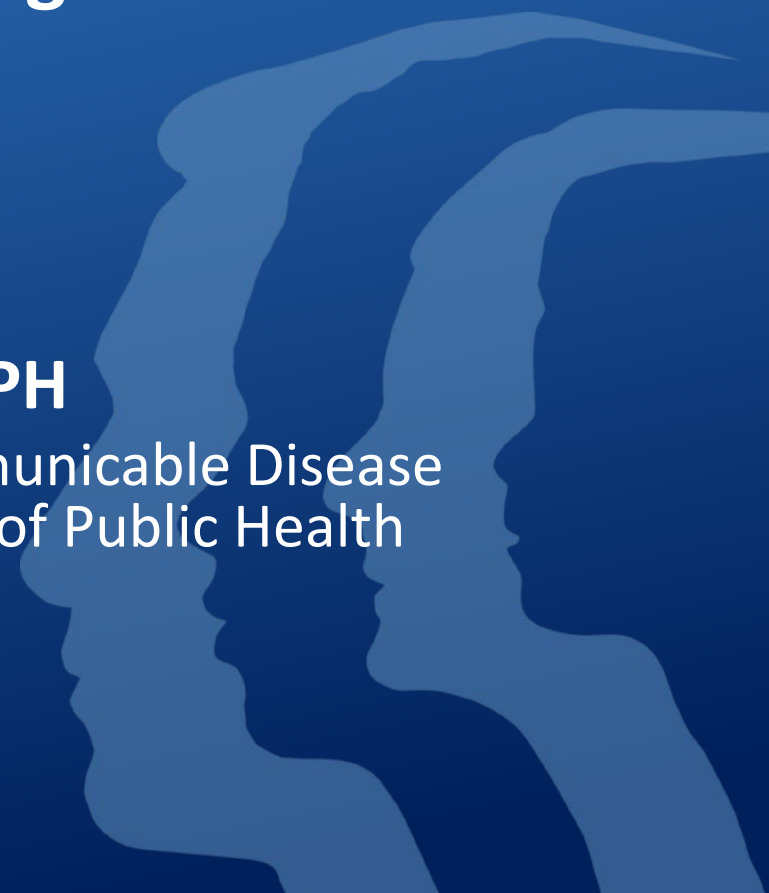




# Epidemiology of Legionnaires' Disease in Skilled Nursing Facilities

**Rebecca Lee, MPH**

Epidemiology Analyst, Acute Communicable Disease Control, LA County Department of Public Health



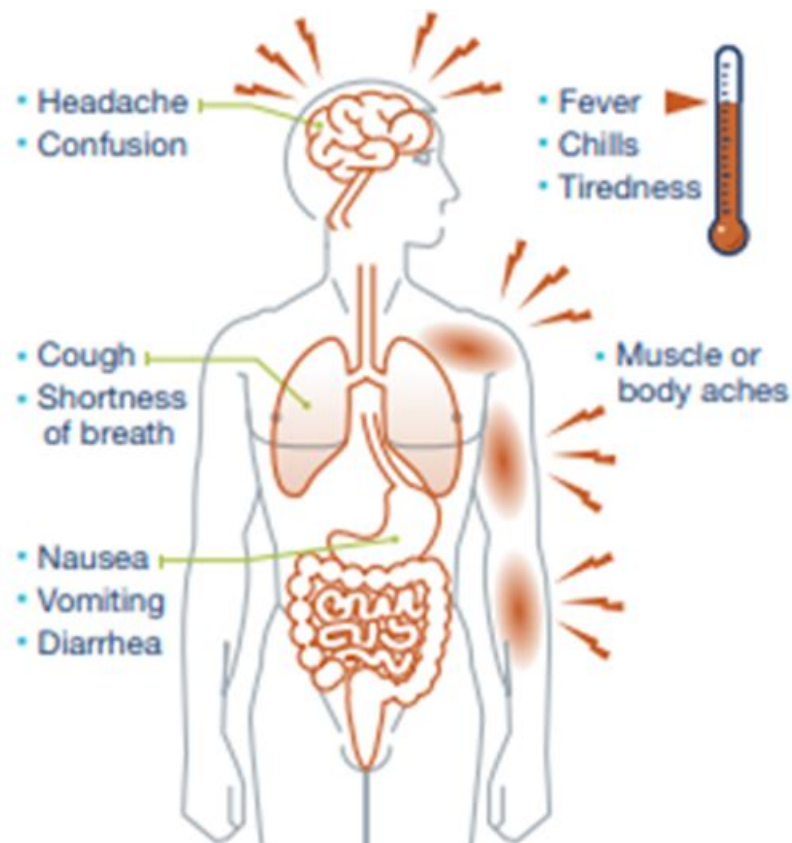
# What is *Legionella*?

- Gram-negative bacteria
- Can live and grow on water, soil, and biofilm
- More than 60 different *Legionella* species.
  - ***L. pneumophila***: ~90% of Legionnaires' disease cases in U.S.
- Generally does not affect healthy people.



# What is Legionnaires' Disease (LD)?

- A serious type of pneumonia (lung infection).
- Up to 14% of people exposed can get LD.
- Illness onset begins 2-10 days after exposure.
- Healthcare-associated LD is deadly for 1 in 4 people who gets it.



# Overview of LD's Transmission Pathway:

**1**

**ENTER BUILDING  
WATER SYSTEM**



**2**

**AMPLIFY IN IDEAL  
GROWTH  
CONDITIONS**



**3**

**SPREAD VIA  
AEROSOLS**



**4**

**INFECT  
SUSCEPTIBLE  
PATIENTS**



# How can *Legionella* enter your building water system?



- Biofilm disruptions in the water system can dislodge *Legionella*.
- Examples:
  - Constructions
  - Water main breaks
  - Changes in water pressure

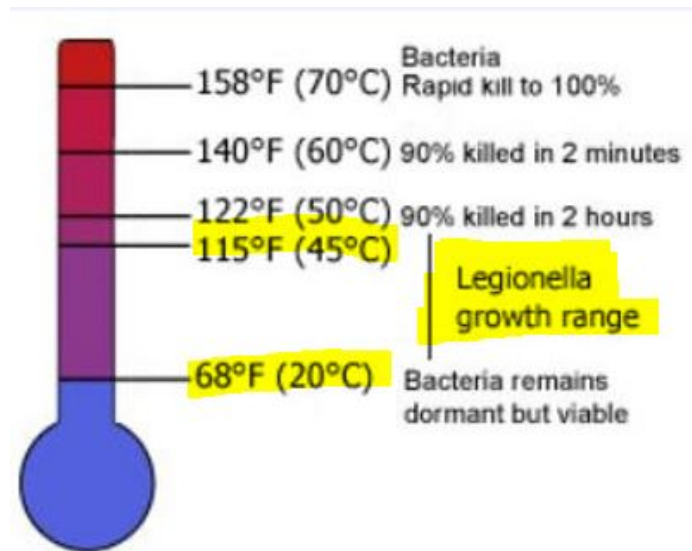


# What are the conditions that help *Legionella* grow faster?



## Ideal growth conditions:

- Danger Zone: 77-108°F
- Biofilm
- Sediments
- Inadequate disinfectant
- pH outside ideal disinfectant range (~6.5-8.5)





# How are people exposed to *Legionella*?



- Patients can acquire LD by **breathing in aerosolized water** containing *Legionella*.
- Less commonly, aspiration of contaminated water.

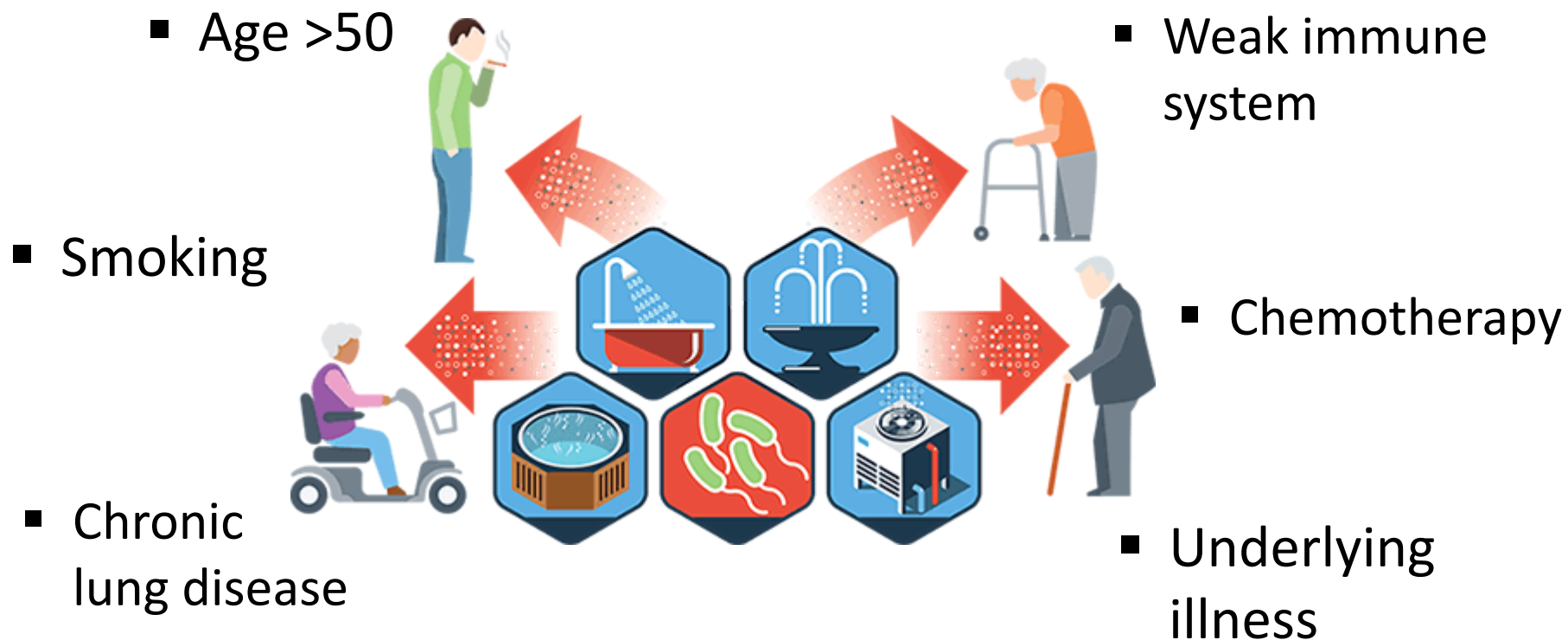
## Common Types of Exposures:

- Showerheads, faucets
- Cooling towers
- Hot tubs
- Decorative fountains



# Who is At Risk?

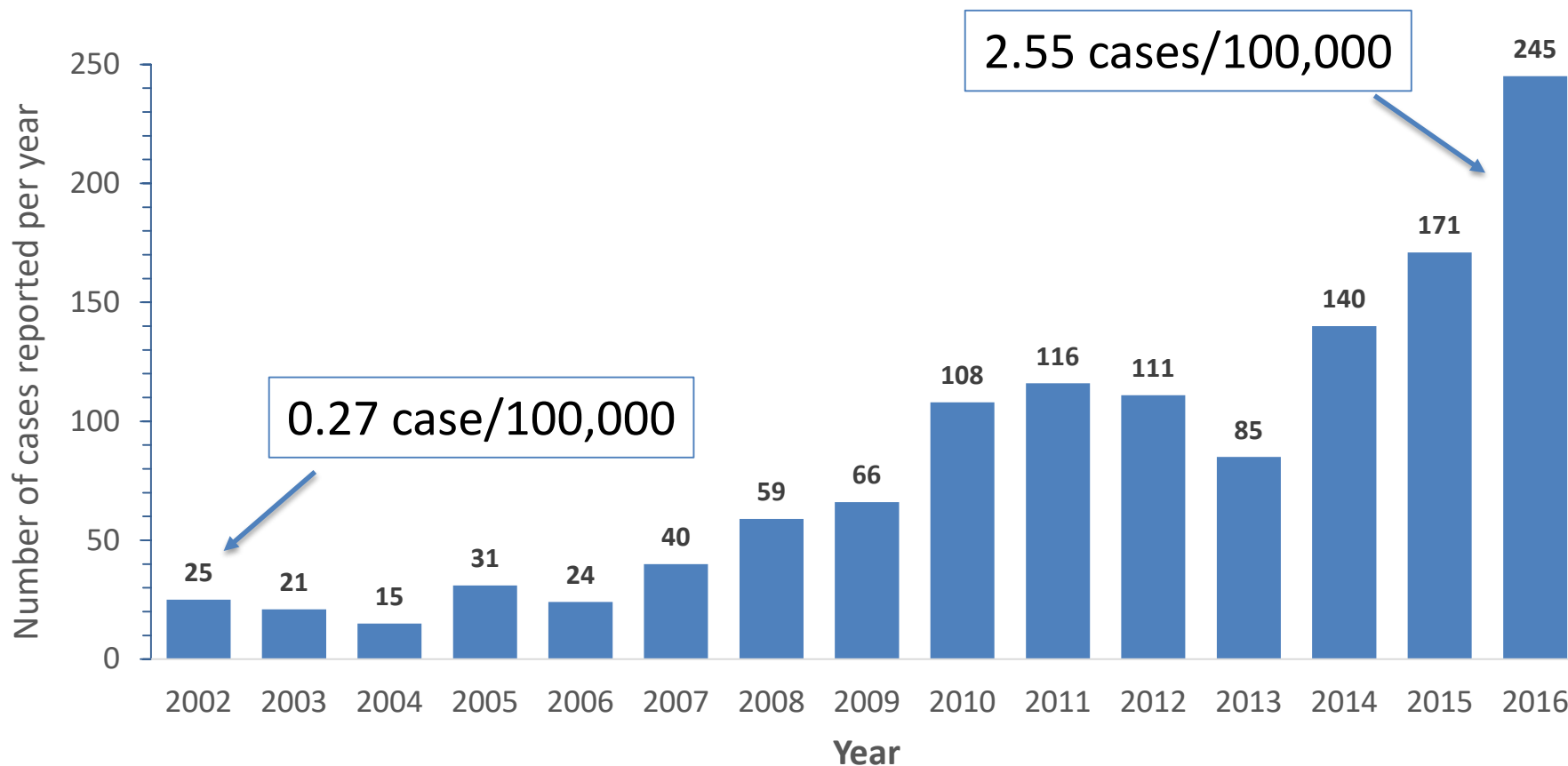
## Susceptible patients:





# Legionellosis cases --- LA County, 2002-2016

- Annual number of Legionellosis cases **increased ten-fold** within the last decade.



# Why is the number of reported cases increasing?

- Increased susceptibility of the population
  - Aging U.S. population
  - More people on immunosuppressing medications
- More *Legionella* in the environment
  - Warmer temperatures
  - Aging infrastructure
- Improved diagnostic capability
  - Urine antigen test availability
- Increased awareness and reporting



# *Legionella* Surveillance in LA County

- Legionellosis is a **mandatory reportable disease** in LA County.
- Lab reports with positive *Legionella* test results are directly sent to LA County Department of Public Health.
- **All suspected & confirmed cases must be reported** to local public health department.
- Department of Public Health investigates reported cases and outbreaks in healthcare facilities.



## Definition of healthcare-associated LD

- **Definite** case if patient was hospitalized or resided at one or more skilled nursing facilities (SNFs) during **the entire 2-10 day** incubation period prior to symptom onset.
- **Possible** case if patient was hospitalized or resided at one or more SNFs for **a portion of the 2-10 day** incubation period prior to symptom onset.



## When does public health investigate healthcare-associated LD?

- $\geq 1$  case of **definite** healthcare-associated LD is identified.
- $\geq 2$  cases of **possible** healthcare-associated LD is identified within 12 months of each other at same facility.

## Who should be tested for *Legionella* in SNFs?

- Majority of SNF residents are likely to have *L. pneumophila* risk factors.
  - E.g. Age >50, diabetic, lung disease
  - Routine testing likely to be more effective than risk factor-based screening.
- Consider routine *Legionella* testing in any patient with suspected pneumonia.
  - Including patients with acute respiratory symptoms who will be started on empiric antibiotic.



## Why test patients for *Legionella*?

- Obtain etiologic diagnosis.
  - Inform antibiotic therapy
    - Minimize emergence of antimicrobial resistance
  - Reduce costs and adverse effects associated with additional diagnostic evaluation for an etiologic agent
- Identifying LD cases can inform facility to investigate sources of exposure to protect other patients.
  - Can help prevent additional cases

## How to test for *Legionella*?

- Preferred Diagnostic Approach:
  - Lower respiratory tract secretion culture
  - Urine antigen test (UAT)
    - Both samples should be obtained concurrently.
- Other Diagnostic Approaches:
  - Paired serology
  - Direct Fluorescent Antibody Stain
  - Polymerase Chain Reaction
    - Not preferred because they have lower sensitivity, technically difficult, and are not widely available.

## Respiratory culture for *Legionella*

- Lower respiratory secretions (e.g. induced sputum)
- Must culture specimens on Buffered Charcoal Yeast Extract agar (or other appropriate media for *Legionella* diagnosis).
- **Advantages:**
  - Detects all species & serogroups
  - Able to compare clinical & environmental isolates
- **Disadvantages:**
  - Slow (>5 days to grow)
  - Affected by antibiotic treatment
  - Requires BCYE agar
- Sensitivity: 20-80%, Specificity: 100%

## UAT

- Detects *L. pneumophila* serogroup 1 (Lp 1) but other undetected species/serogroups are still pathogenic.
  - Patients may still have *Legionella* even with a (-) UAT result.
- Antigen can be present for months.
  - Should not be ordered in asymptomatic persons.
- **Advantages:**
  - Rapid test
  - Same day results
- **Disadvantages:**
  - Only for Lp1
  - Unable to compare molecular and environmental isolates
- Sensitivity: 70-100%, Specificity: 95-100%

# Why are we focusing on LD in SNFs?

- SNFs have complex water systems that are at risk for *Legionella* introduction and amplification.
- Most SNF residents have risk factors for LD.
- Many SNF residents stay multiple days—greater duration of exposure compared to general population
- Morality is high for healthcare-associated LD (~25% of cases die).

1

**ENTER BUILDING  
WATER SYSTEM**

2

**AMPLIFY IN IDEAL  
GROWTH  
CONDITIONS**

3

**SPREAD VIA  
AEROSOLS**

4

**INFECT  
SUSCEPTIBLE  
PATIENTS**



# Legionnaires' Disease is Preventable

- LD is preventable with good Water Management Program (WMP)
- WMP **identify hazardous conditions** and take steps to **minimize the growth and transmission** of *Legionella* and other waterborne pathogens in building water systems.
- Centers for Medicare & Medicaid Services issued WMP requirement in 2017 (updated in 2018):  
“Develop and adhere to policies and procedures...that reduce the risk of growth and spread of *Legionella* and other opportunistic pathogens in water.”





## Summary

- **1 in 4 patients** with healthcare-associated Legionnaires' disease die.
- **Diagnostic testing** is essential to identify *Legionella*.
- Legionnaires' disease is preventable with an ASHRAE-compliant **WMP**.



# Questions?

Rebecca Lee, MPH  
Email: [rlee2@ph.lacounty.gov](mailto:rlee2@ph.lacounty.gov)  
Phone: (213)240-7941





# DEVELOPING A WATER MANAGEMENT PROGRAM (WMP) TO PREVENT LEGIONELLA GROWTH

Jeremy Macleod

Industrial Hygienist

Skilled Nursing Facility Outreach Program





## What is a Water Management Program?

- It is a logical documented system to manage water safety
- It requires an understanding water systems
- It requires assessment of how and where bacteria grow
- It will implement controls to destroy or limit the growth of the bacteria
- The WMP monitors and documents all actions
- It is unique to your building



## Why a WMP in a Skilled Nursing Facility?

- Your clients
- Extended stays
- Complex water systems
- It is a 'Centers for Medicare & Medicaid Services'  
*requirement*





## How are water systems contaminated?

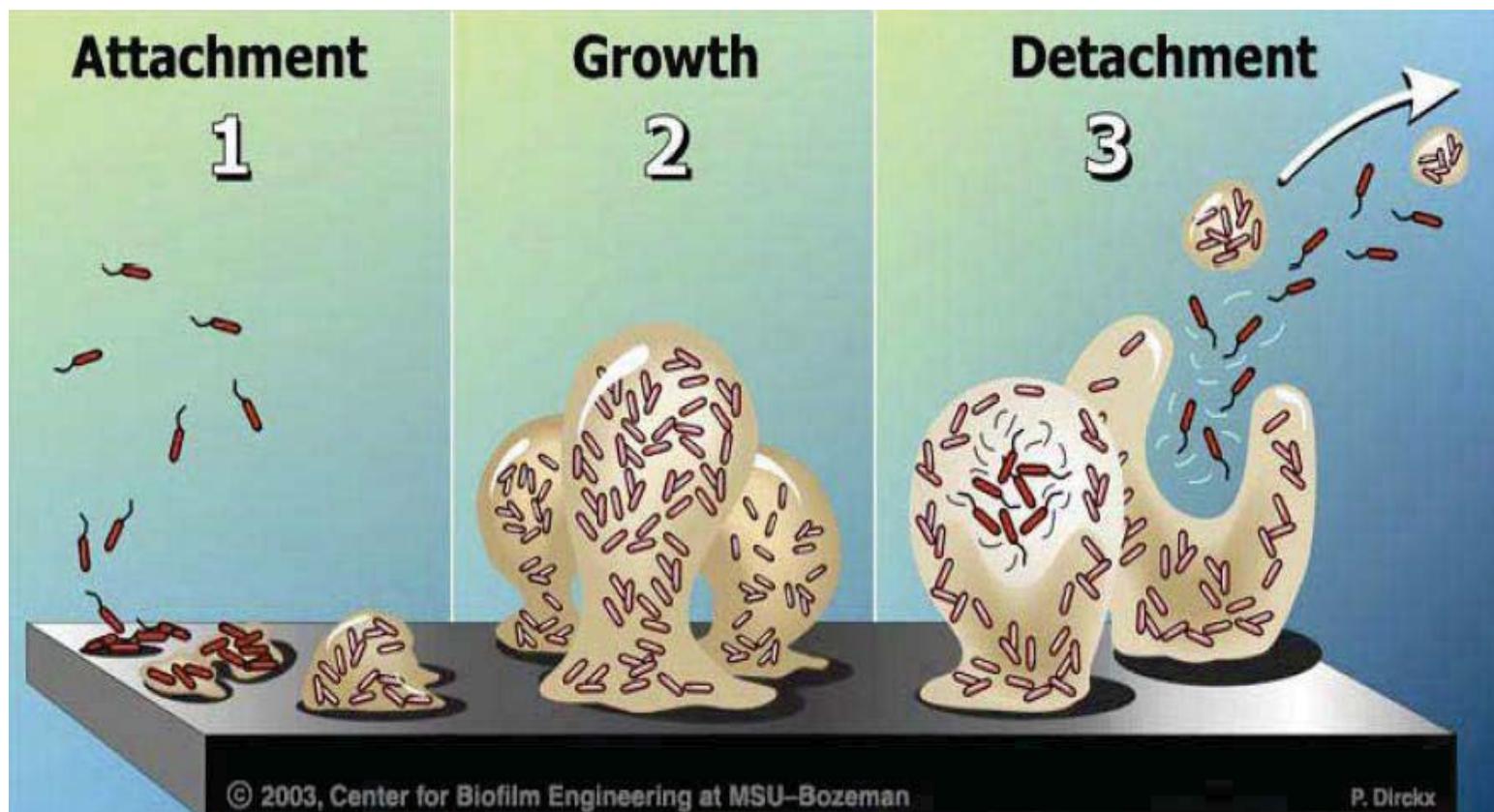
- *Legionella* is in the environment
- Breaks in the main supply pipework
- In-house or external construction work
- Wind-blown debris
- Animals



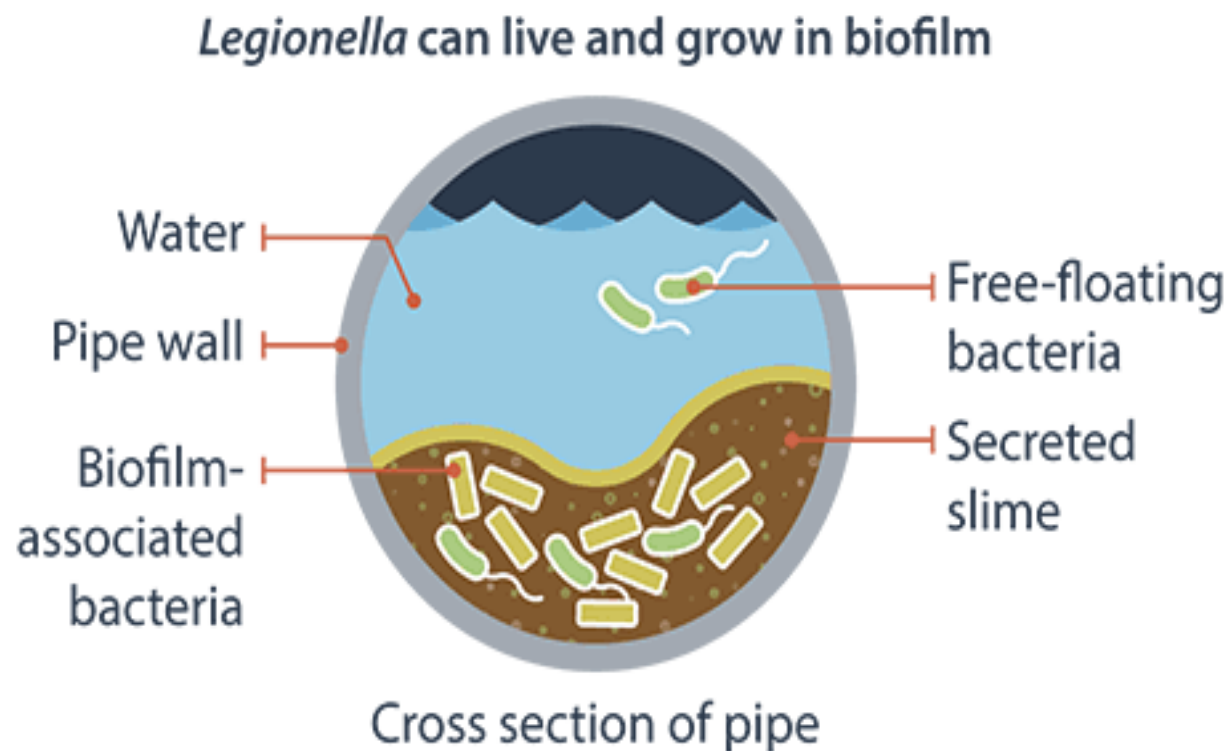
## Conditions for growth in water

- Temperature - between 77° & 108 °F
- Harborage – biofilms, protozoans, scale, sediment, dead legs
- Stagnation – dead legs; ‘off-peak’; water efficiency features
- Inadequate disinfection
- Disinfection deactivation when pH is low or high

## *Legionella* growth within a biofilm



## A cross section of pipework



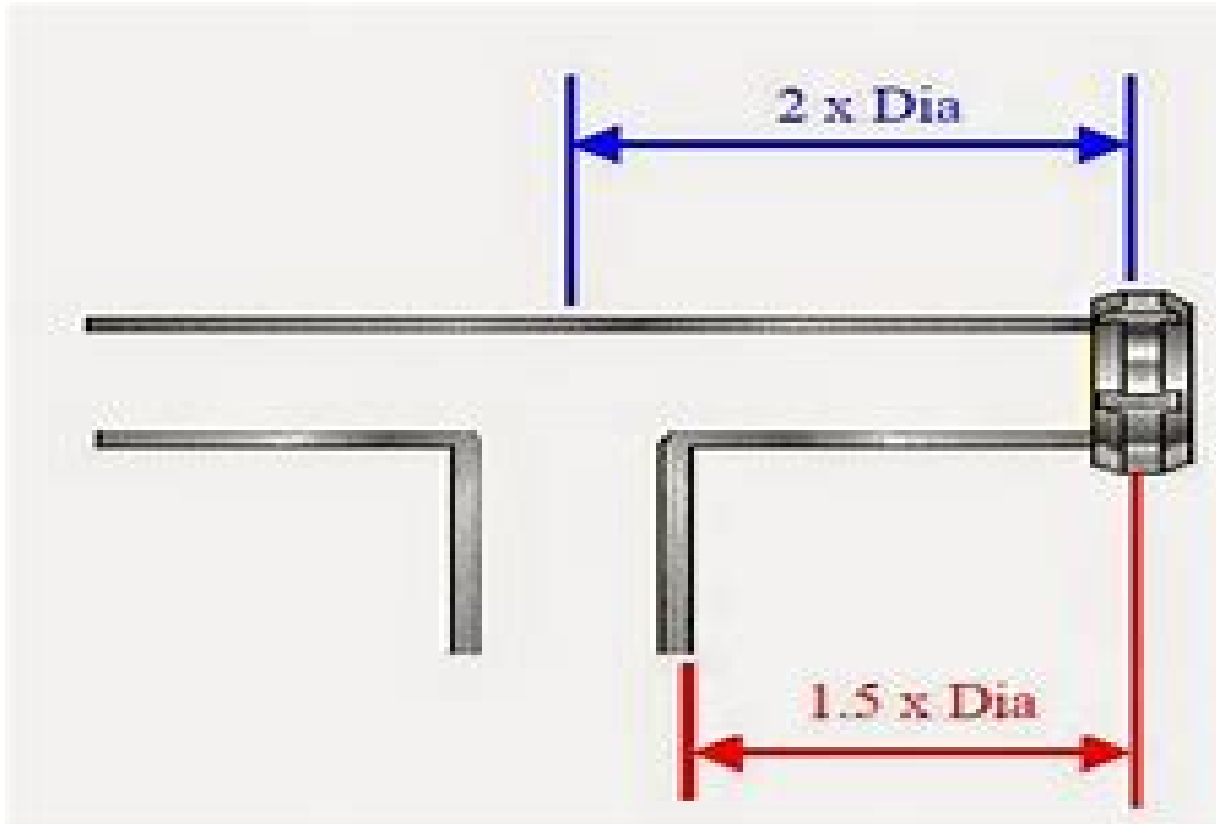


## *Legionella* sites of growth

- Potable *and* non-potable water systems
- Hot *and* cold water
- Storage tanks
- Cooling towers
- Filters, pipes, valves and fittings
- Ice machines
- Aerators
- Showers, fountains and eye wash stations
- Medical devices using water

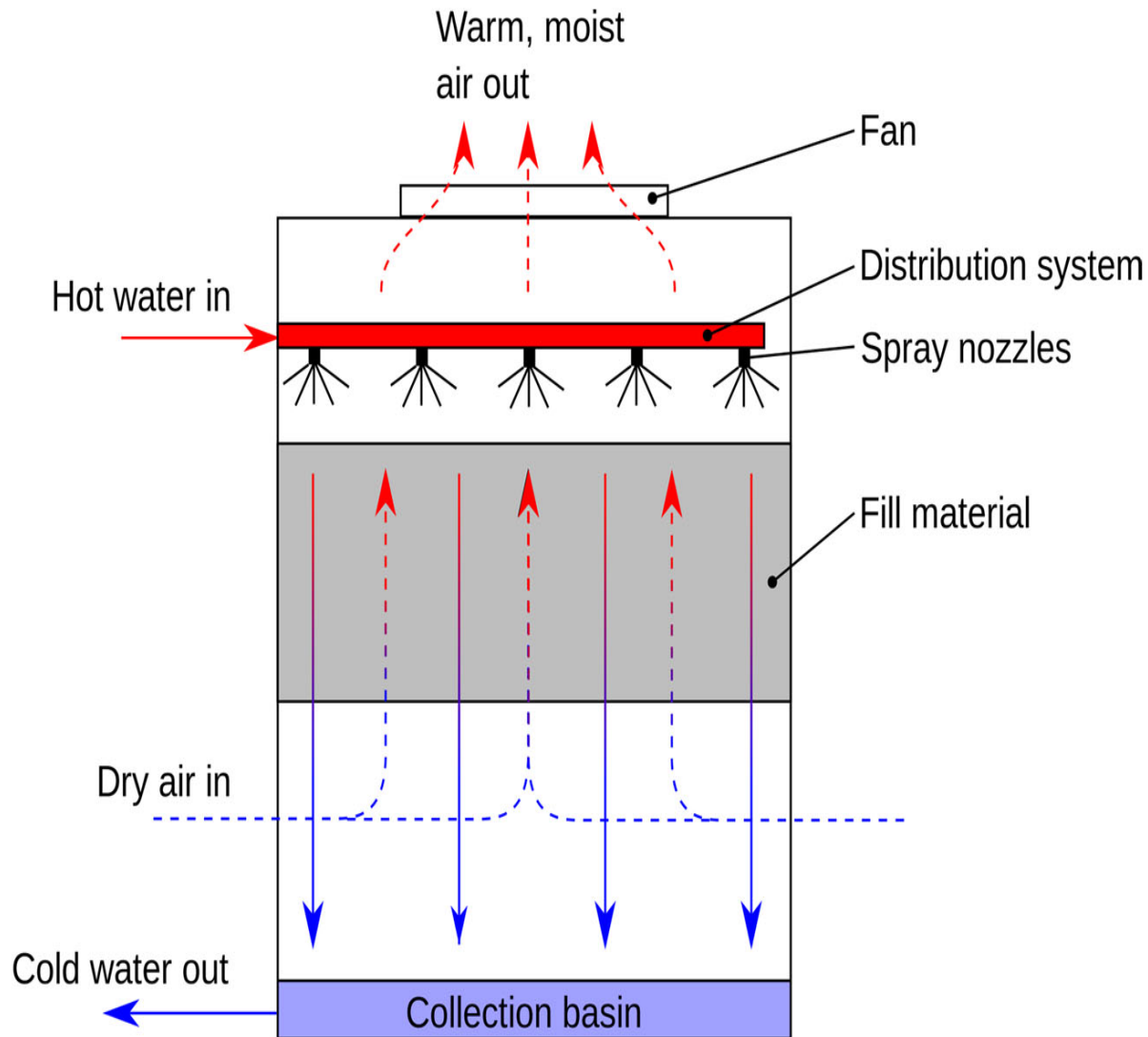
... and many more!

## Example: A Short Dead Leg





# HOW COOLING TOWERS WORK







## Regulation and guidance

- CMS *'Requirement to reduce Legionella risk in healthcare facility water systems to prevent cases and outbreaks of Legionella Disease'. QSO -17 -30 Hospitals/CAHs/NHs Revised 07.06.2018*
- ASHRAE 188 Standard 2018 and Guideline 12 – 2000.  
*188 Originally published June 2015*

## A Water Management Program - 7 steps





## Step 1. Establish a WMP Team

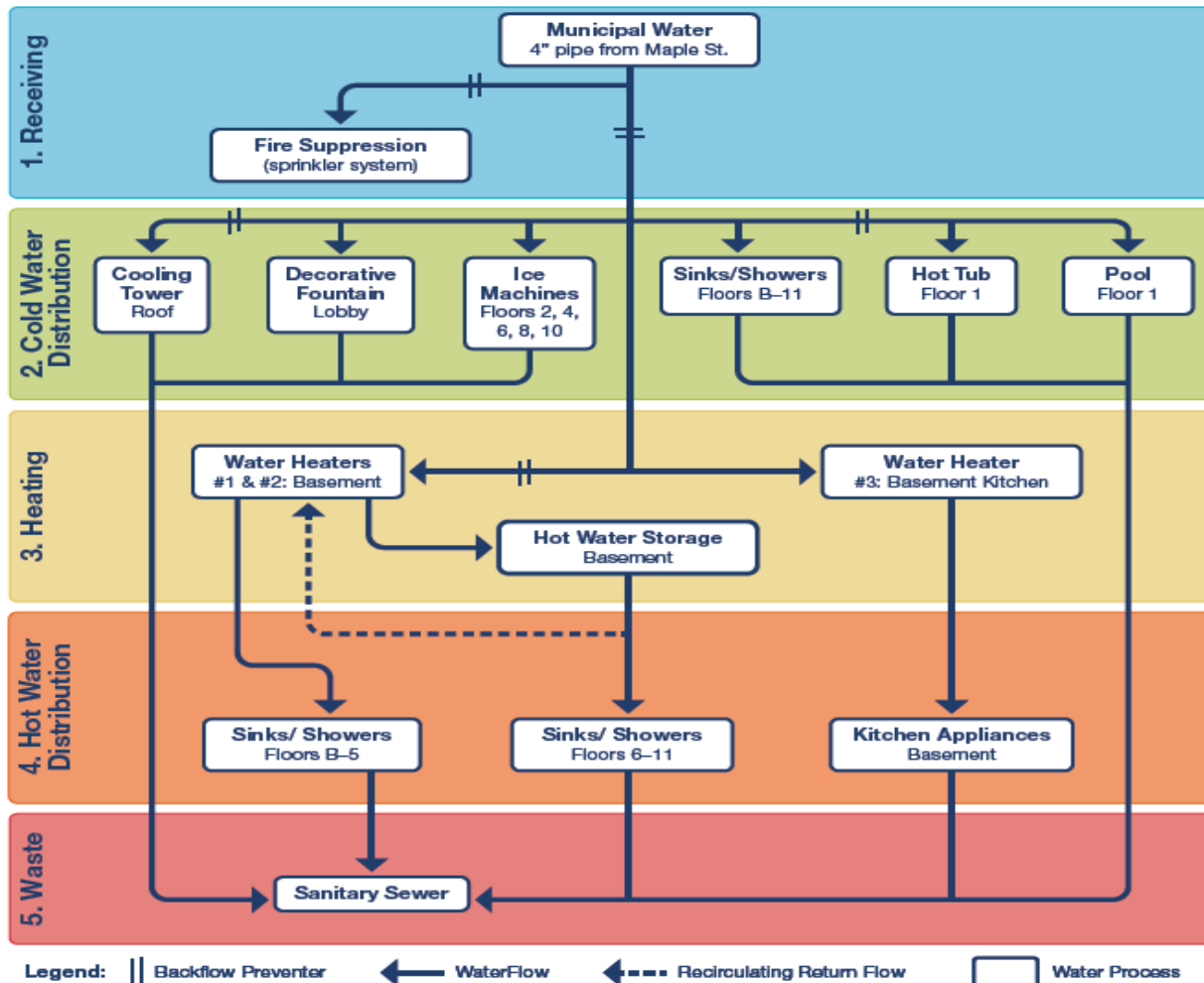
### Essential

- Business / building owner or administrator
- Water services / building facilities engineer
- Infection control specialist

### Additional

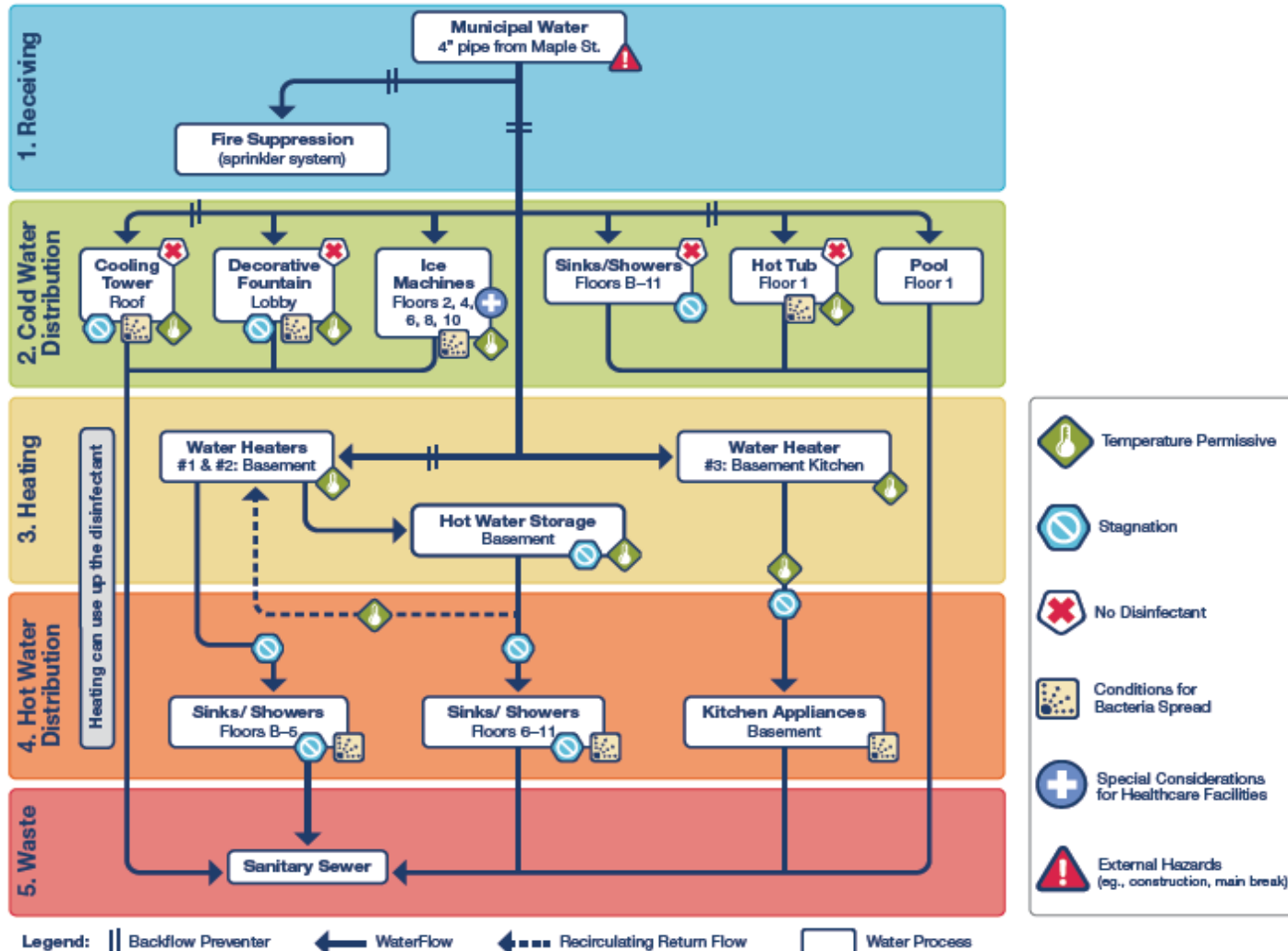
- Water treatment specialist
- OSHPD / EH / PH

# Step 2. Describe the building water systems in text & in flow diagrams





# Step 3. Identify areas where *Legionella* can grow and spread



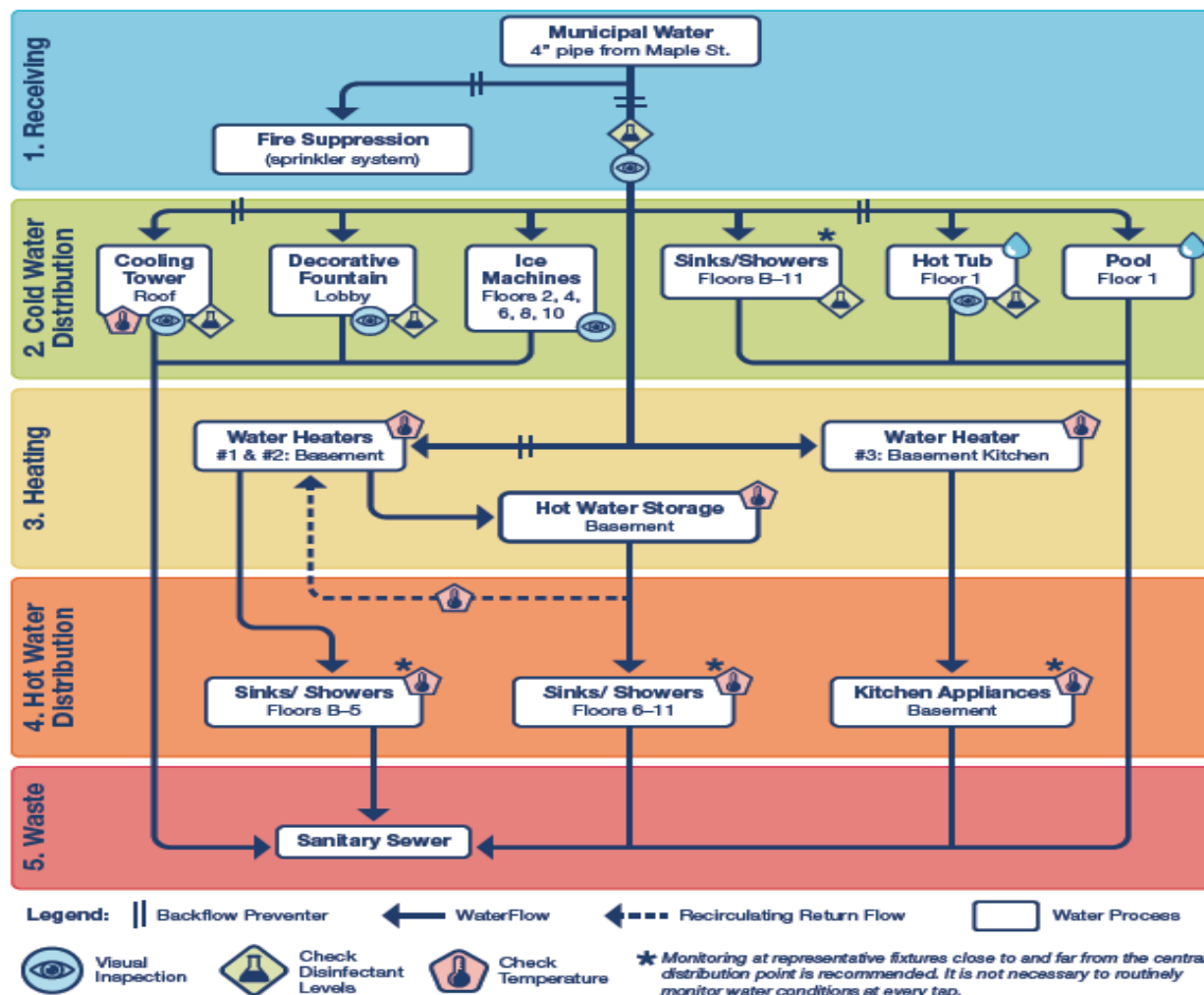
## Step 3. Identify areas where *Legionella* can grow and spread

### Example: Decorative Fountain



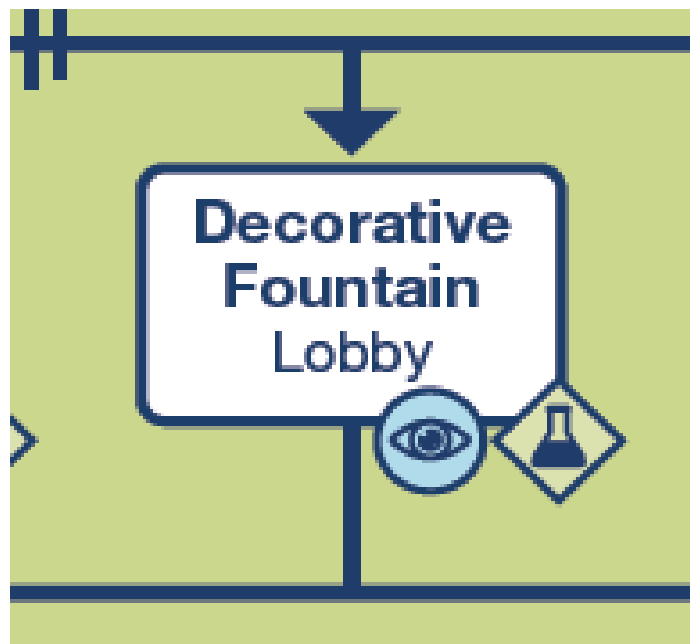


# Step 4. Decide where control measures should be applied and decide how to monitor



**Step 4. Decide where control measures should be applied and decide how to monitor**

**Example: Decorative Fountain**





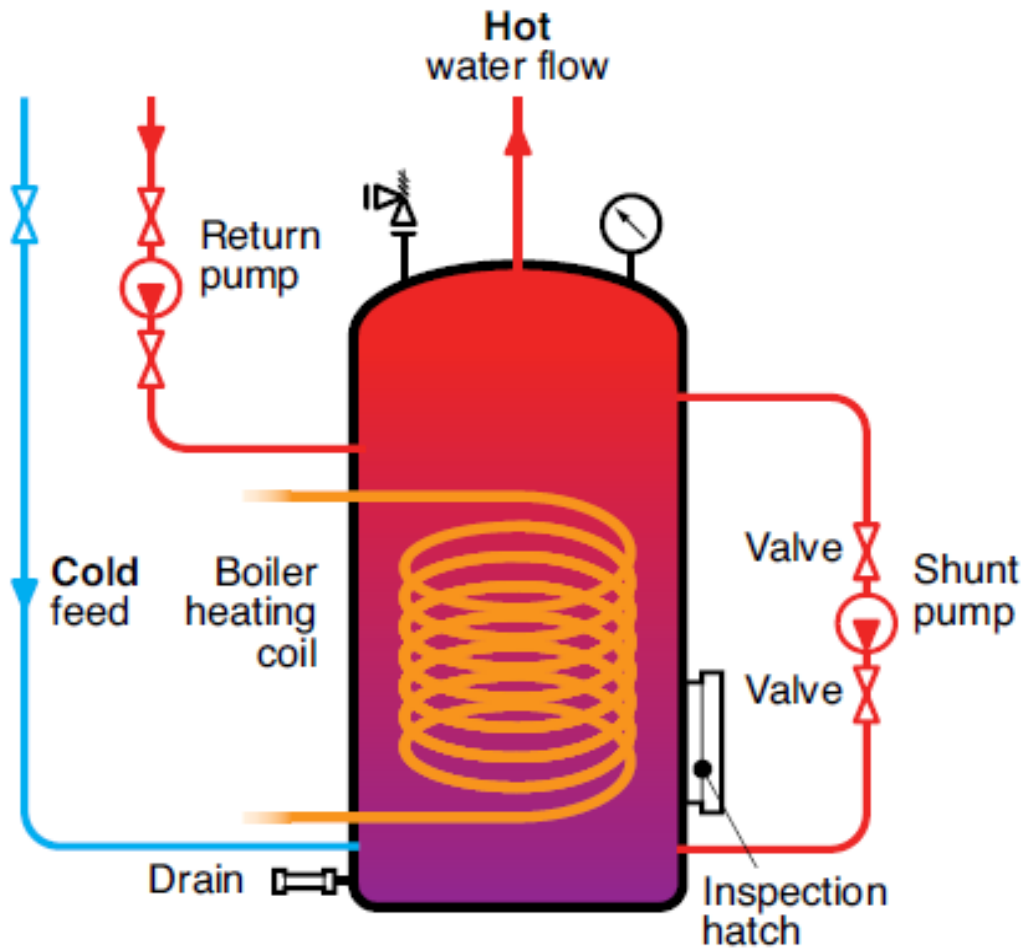
## Example – Hot Water System

### Part 1. The Boiler(s)

What control measures should we monitor

- Temperature >140 F
  - Check daily
- Stagnation (ensure no stratification)
  - Insulate or circulating pump
- Cleanliness
  - Remove sediment

# Hot Water Boiler





## Example – Hot Water System

### Part 2. Distribution

What control measures should we monitor

- Temperature @ 125 - 140 F
  - Taken near outlets; distal points
- Return line temperature
  - Just prior to boiler re-entry
- Stagnation
  - Empty / irregular use of rooms
- Cleanliness
  - Outlets



## Step 5 Example: Logbook

Sandringham Health Care										
Daily Log - Weekly										
Date	Time	Temp	Cl	pH	Quality	Notes				Signed

Temp: If below 140F reset thermostat and check temp in 2 hours. If still below 140F at recheck inform maintenance and line manager. Log results in notes.

pH: If below 6.5 or above 8.5 chemically dose as applicable and recheck. If still incorrect inform line manager. Log results in notes.

Chlorine: If Cl level is below 2.0 mg/l consult chart for correct top up dosing procedure. Recheck. If still incorrect inform line manger. Log results in notes.

Quality: If water looks cloudy or slimy follow cleaning and disinfection instructions. Log results in notes.

FOLLOW SPECIFIC WORK INSTRUCTIONS  
ENTER ACTUAL VALUES



Step 6. Make sure the Water Management Program is running as designed *and* is effective by:

## Verification

- Is the program being implemented?
- Scheduled checks?
- Who is this reported to?
- Remedial action?

## Step 6. cont.

### Validation

- Is the program effective?
- Confirms hazard control
- Environmental testing for *Legionella*
- Implement a testing protocol





## Environmental testing

- Examples of action limits

### Potable:

CDC & ASHRAE                      Guidance - dependent on WMP

AIHA & OSHA                      Guidance -  $\geq 10$  cfu/ml

VA Directive 1061                      Guidance - any positive

NY State DoH                      Legislation -  $\geq 30\%$  +ve outlets (health care fac's)

Gov France & Germany                      Legislation -  $\geq 1$  cfu/ml

## Non-potable:

CDC & ASHRAE	Guidance – dependent on WMP
AIHA & OSHA	Guidance – dependent on WMP
Gov France	Legislation - $\geq 1$ cfu/ml
Gov Germany	Guidance - $\geq 1$ cfu/ml
Canada	Legislation - $\geq 10$ cfu/ml

## Control measures for adverse results.

- Number of CFU's and Number of Outlets
- Disinfection by heat or chemicals. Flushing.



## Step 7. Document and communicate

- Responsibility
- Accountability
- Consultation
- Inform



## Suggested timeline

Week

1: Assemble your team

2/3: Describe the water systems in text and diagrams

4: ID where Legionella could grow and spread

5: Decide control measures and monitoring

6: Establish intervention when limits exceeded

7/8: Verify and Validate

9: Document

10: Make an appointment for a review



## Guidance and training resources

L A County Dept Public Health; ACDC; Legionella

<http://publichealth.lacounty.gov/acd/Diseases/Legion.htm>

ASHRAE 188 -2018, Legionellosis: Risk Management for Building Water Services

ASHRAE 12-2000, Minimizing the Risk of Legionellosis Associated with Building Water Systems. Both at :

<https://www.ashrae.org/technical-resources/standards-and-guidelines/guidance-on-reducing-the-risk-of-legionella>

V A Dir 1061, Prevention of Healthcare-Associated *Legionella* Disease and Scald Injury from Potable water Systems

[https://va.gov/VHApublishations/ViewPublication.asp?pub\\_ID+3033](https://va.gov/VHApublishations/ViewPublication.asp?pub_ID+3033)

CDC Prevent LD, Preventing Legionnaires' Disease: A Training on *Legionella* Water Management Programs

[https://www.cdc.gov/CDC legionella/nceh/ehs/elearn/prevent-LD-training.html](https://www.cdc.gov/CDC%20legionella/nceh/ehs/elearn/prevent-LD-training.html)

Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings <https://www.cdc.gov/legionella/WMPtoolkit>



## Consultants

Association of Water Technologies. [www.AWT.org](http://www.AWT.org)

HC Info. <https://hcinfo.com/home> (WMP templates)

## TNI Accreditation Bodies

<https://www.nelac-institute.org/content/NELAP/accred-bodies.php>

## AIHA/EMLAP

<https://www.aihaaccreditedlabs.org/LabAccreditationPrograms/EMLAP/Pages/default.aspx>

## ISO 11731:2017 – Accreditation Standard

## Staff

OSHA Technical Manual, Section III: Chapter 7 Legionnaires' disease

[https://www.osha.gov/dts/osta/otm/otm\\_iii/otm\\_iii\\_7.html](https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_7.html)



Final message:

*“Think water, think Legionella”*

Contact details for support and any questions:

[JMacleod@ph.lacounty.gov](mailto:JMacleod@ph.lacounty.gov)

Tel: 213 288 7214