

# Managing Water Risk in the “New Normal”

September 16, 2021 | 1:00 – 2:00 PM ET

**This webinar is being recorded.**

A copy of the presentation slides and recording will be sent to all webinar registrants.

**Questions may be submitted/upvoted via the Q&A box.**

# Today's Speakers

**Elizabeth Hannapel, MPH**

*Epidemiologist, Legionella Team*  
Centers for Disease Control &  
Prevention



**CDR Jasen Kunz, MPH, REHS**

*Environmental Health Officer*  
Centers for Disease Control &  
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**Eric Myers**

*Senior Technical Consultant*  
Nalco Water, An Ecolab Company



# Agenda

Preventing Legionnaire's Disease through Partnership and Guidance –  
Elizabeth Hannapel & Jasen Kunz

*Legionella* Risk Management Strategies are Essential for Reopening Buildings  
as Increased Incidents Are Experienced Across the United States – Eric Myers

Questions & Answers

# Preventing LD through Partnership and Guidance

Elizabeth Hannapel, MPH

CDR Jasen Kunz, MPH

Centers for Disease Control and Prevention

NACCHO

September 16, 2021



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

# Presentation Overview

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- Legionnaires' disease (LD) background
- COVID-19 impacts on water systems
- New *Legionella* prevention and control tools



# Legionnaires' Disease Background

# Legionnaires' Disease (LD) Each Year

- 11,000 US cases
- 1,000 deaths
- \$402M in healthcare costs
- \$835M lifetime economic burden

Baker-Goering M, Roy K, Edens C, Collier S. Economic Burden of Legionnaires' Disease, United States, 2014. *Emerg Infect Dis.* 2021 Jan;27(1):255-257.

Collier SA, Deng L, Adam EA, Benedict KM, Beshearse EM, Blackstock AJ, Bruce BB, Derado G, Edens C, Fullerton KE, Gargano JW, Geissler AL, Hall AJ, Havelaar AH, Hill VR, Hoekstra RM, Reddy SC, Scallan E, Stokes EK, Yoder JS, Beach MJ. Estimate of Burden and Direct Healthcare Cost of Infectious Waterborne Disease in the United States. *Emerg Infect Dis.* 2021 Jan;27(1):140-149.



# Legionnaires' Disease

- First described following an American Legion convention in Philadelphia in 1976
- Infection with *Legionella* bacteria
- Acute onset of lower respiratory illness 2-14 days after exposure
- Characterized by severe pneumonia and usually requires hospitalization
  - Deadly for 1 in 10 people infected
  - Deadly for 1 in 4 who get it from a healthcare facility
- Other types of legionellosis:
  - Pontiac fever: milder respiratory illness which self-resolves
  - Extrapulmonary: rare, e.g., endocarditis or wound infection





# From *Legionella* to LD

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



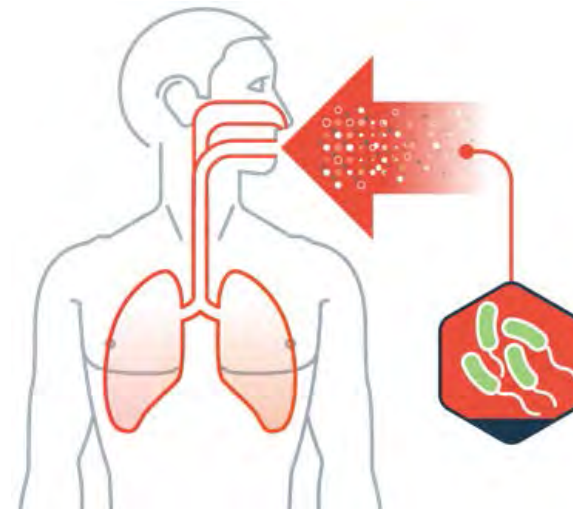
Internal and external factors can lead to *Legionella* growth in building water systems



# From *Legionella* to LD

Water containing *Legionella* is aerosolized through devices

Susceptible people contract LD by inhaling aerosolized water droplets or by aspiration of drinking water containing the bacteria

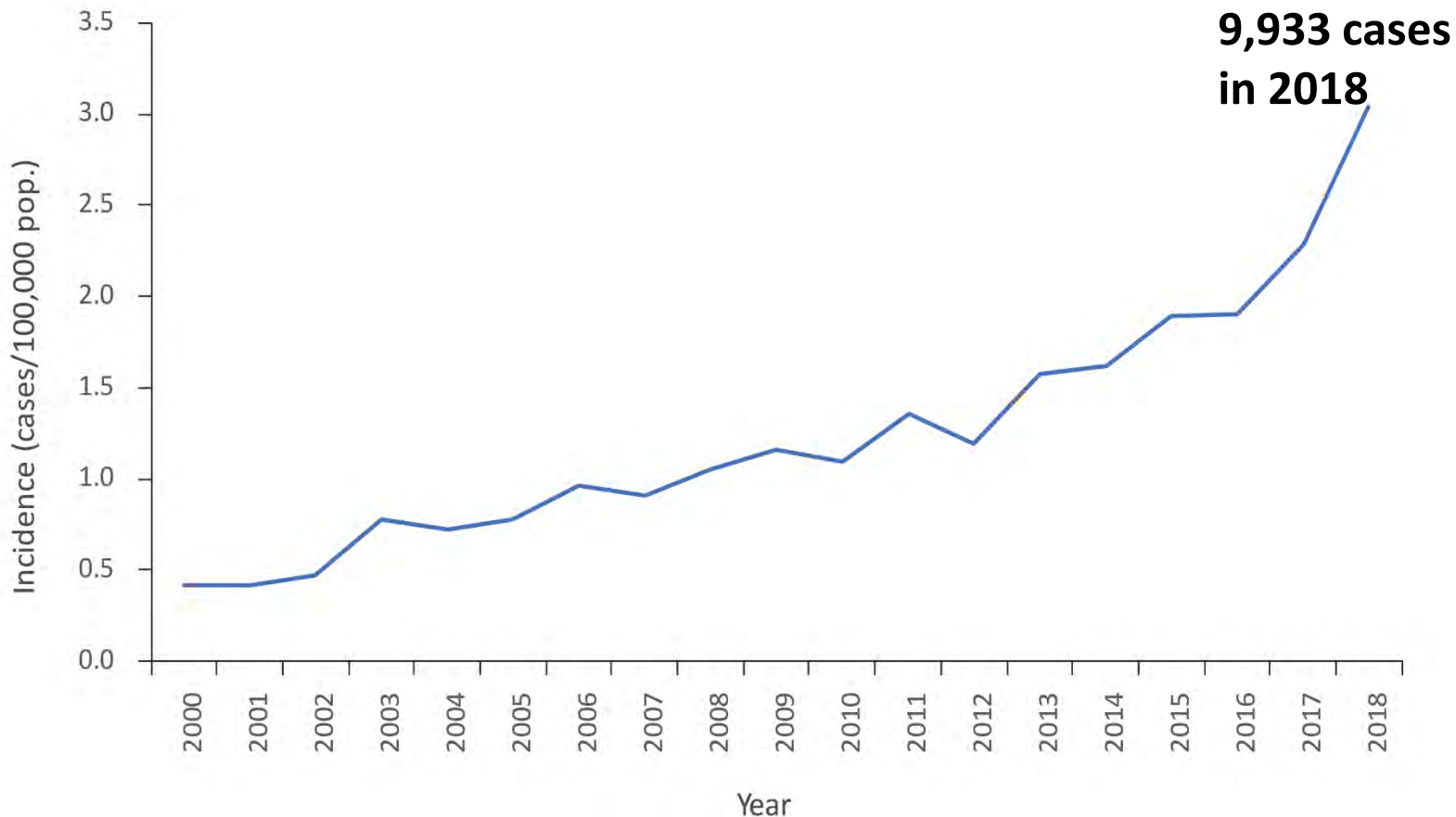


# Who Gets LD?

## Persons at increased risk include those with:

- Age  $\geq$ 50 years
- Smoking (current or historical)
- Chronic lung disease (e.g., emphysema or COPD)
- Immune system disorders due to disease or medication
- Systemic malignancy
- Underlying illness (e.g., diabetes, renal failure, or hepatic failure)
- Recent travel with an overnight stay outside of the home
- Recent stay in a healthcare facility
- Exposure to hot tubs

# Increasing LD Incidence in the US



It's estimated that there were 2.3 cases for every one confirmed Legionnaires' disease case in 2014.

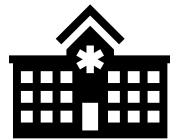
Collier SA, Deng L, Adam EA, et al. Estimate of Burden and Direct Healthcare Cost of Infectious Waterborne Disease in the United States. *Emerging Infectious Diseases*. 2021;27(1):140-149.

**The rate of reported cases increased 9 times from 2000–2018**

# Changes in Epidemiology

## Potential to reduce LD incidence


- Reduction in travel overall
- Reduction in healthcare exposures



## Potential to increase LD incidence

- Changes in travel accommodation preferences
- Increases in recreational water exposure
- Increases in gardening and other activities
- **Exposure to systems with stagnant water**





# **COVID-19 Pandemic Impacts on Water Systems**

# COVID-19 Pandemic Impacts on Building Water Systems and Devices

- Pandemic dramatically impacted building occupancy
  - Lodging industry suffered historically low occupancy rates for 2020 (44%) (-33.3% from 2019)
  - Office real estate impacted by enhanced teleworking
  - Some schools and universities shifted to online learning or offer in-person and online options

# What Is Being Done to Address the Concern?

- Guidance issued to address reopening buildings after prolonged shutdown or reduced operation from

- CDC and EPA
- Numerous public health departments
- Nongovernment organizations
- Private sector

**RESTORING WATER QUALITY IN BUILDINGS FOR REOPENING**

**CHECKLIST**

Building and business closures for weeks or months reduce water usage, potentially leading to stagnant water inside building plumbing. This water can become unsafe to drink or otherwise use for personal or commercial purposes. EPA recommends that building owners, building managers, and businesses take steps to flush the building's plumbing before reopening.

*Flushing involves opening taps and letting the water run to remove water that has been standing in the interior pipes and/or outlets. The flushing time can vary by the plumbing configuration and type of outlet being cleared.*

**1 BEFORE FLUSHING BUILDINGS**

- Contact your water utility about local water quality and to coordinate maintenance activities.
- Check information from your local public health department for any local requirements for reopening.
- Follow appropriate regulations and policies for worker safety and health.

**2 STEPS FOR FLUSHING BUILDINGS**

- Review how water moves through your building, from the street to each point of use.
- Inspect the plumbing.
- Maintain any water treatment systems (e.g., filters, water-softeners) following manufacturer's instructions.
- Ensure the hot water system is operating as specified.
- Flush the service line that runs from the water main to the building.
- Flush the cold water lines.
- Drain and clean water storage facilities and hot water heaters.
- Flush the hot water lines.
- Flush, clean, and maintain devices connected to the plumbing system following manufacturer's instructions.

*Consider checking water quality parameters to verify that fresh water is being flushed through the entire plumbing system.*

**3 OTHER ACTIONS TO CONSIDER**

- Notify your building occupants of the status of the water systems and the flushing program.
- Limit access to or use of the water as an appropriate cautionary phase.
- Determine if proactive disinfection/heat treatment is necessary.
- Develop a water management program.

For more information, please visit [EPA.GOV/CORONAVIRUS](https://www.epa.gov/coronavirus)



# 8 Steps to Minimize *Legionella* Risk Before Your Business or Building Reopens

- Step 1: Develop a comprehensive water management program (WMP)
- Step 2: Ensure your water heater is properly maintained and the temperature is correctly set
- Step 3: Flush your water system
- Steps 4–7: Clean and maintain
  - Decorative water features
  - Hot tubs
  - Cooling towers
  - Safety equipment
- Step 8: Maintain your water system

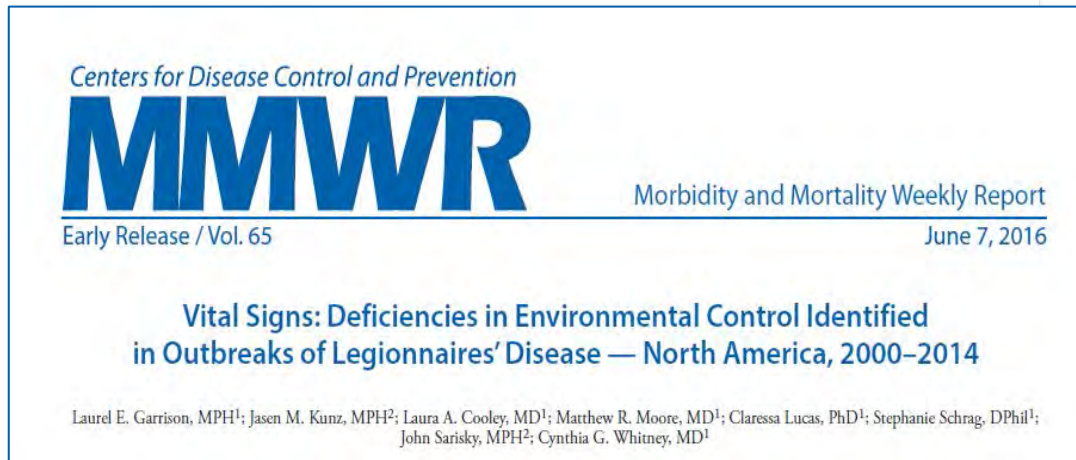




# ***Legionella* Prevention and Control Tools**

# Review of Building-Associated Outbreaks

- Inadequate water management programs can increase the risk of LD




microorganisms



Communication

## A Methodology for Classifying Root Causes of Outbreaks of Legionnaires' Disease: Deficiencies in Environmental Control and Water Management

Benjamin R. Clopper<sup>1,2,\*</sup>, Jasen M. Kunz<sup>2,\*</sup>, Simone W. Salandy<sup>2</sup>, Jessica C. Smith<sup>3</sup>, Brian C. Hubbard<sup>2</sup> and John P. Sarisky<sup>2</sup> 

**CDC investigations show 9 out of 10 outbreaks were caused by problems preventable with more effective water management**

<sup>1</sup> Garrison LE et al. *MMWR*. 2016;65(22):557–61.

<sup>2</sup> Clopper BR et al. *Microorganisms*. 2021;9(1):89.

# What Do We Know about Source Attribution?

2021: CDC analyzed data from 41 building-associated outbreaks (2000–2019)<sup>1,2</sup>

- Common settings
  - Hotels (37%)
  - Long-term care facilities (24%)
  - Hospitals (22%)
  - Other (e.g., industrial facility, resort cabins) (17%)
- Common sources
  - Showers and faucets
  - Cooling towers
  - Hot tubs
  - Decorative fountains
  - Industrial equipment

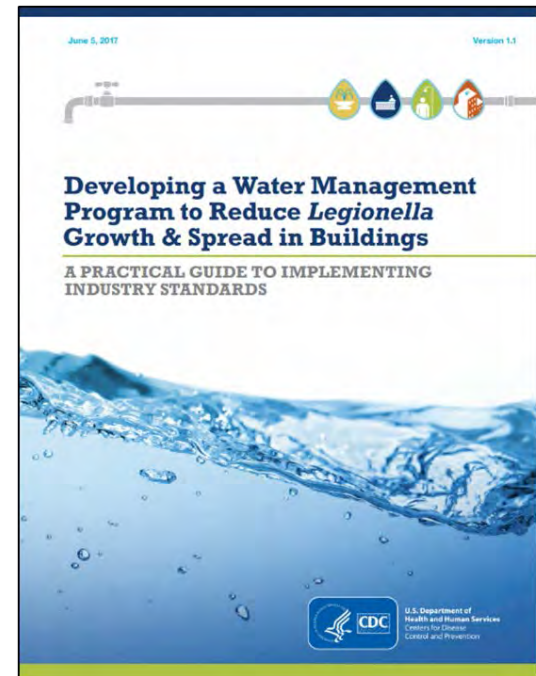


<sup>1</sup> Garrison LE et al. *MMWR*. 2016;65(22):557–61.

<sup>2</sup> Clopper BR et al. *Microorganisms*. 2021;9(1):89.

# CDC *Legionella* Water Management Program Toolkit

- Translates ASHRAE Standard 188 into plain language for wider audiences
  - Public health professionals
  - Building managers
  - Healthcare facilities
- Is a step-by-step guide to creating a water management program
  - Control measures and corrective actions
  - Healthcare-specific guidance



# PreventLD Training

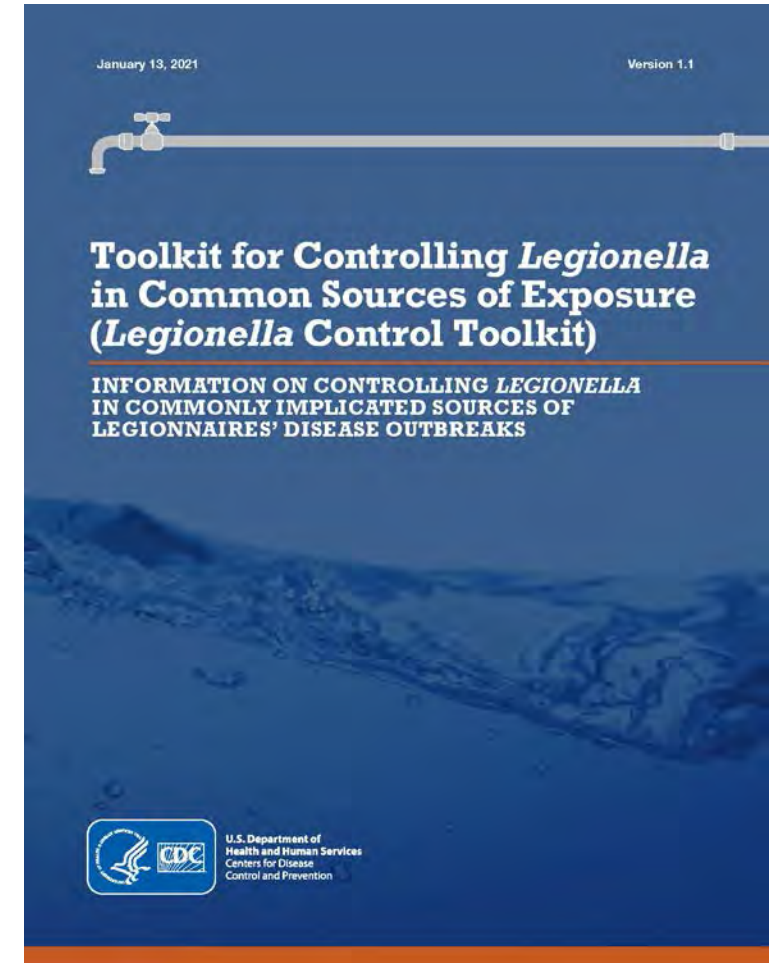
- CDC WMP training on how to reduce risk for *Legionella* in facilities
- Helps WMPs align with ASHRAE 188
- Is free and available online
  - [www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html](http://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html)
  - [www.train.org](http://www.train.org)



**Includes templates and other practical resources**

# *New:* CDC Toolkit for Controlling *Legionella* in Common Sources of Exposure

- Help evaluate hazardous conditions associated with building water systems and devices
- Implement *Legionella* control measures per ASHRAE Guideline 12-2020
- Complement existing resources for WMPs
- Support environmental assessments conducted during public health investigations



<https://www.cdc.gov/legionella/wmp/control-toolkit/index.html>

# New: Modules

- Five modules provide system-specific information
  - Potable water, cooling towers, decorative fountains, hot tubs, and other devices
- One module has information about routine testing for *Legionella*

**Routine Testing for *Legionella***

**Purpose**

Use this document to:

1. Help analyze hazards and establish *Legionella* control measures per ASHRAE Guideline 12-2020
2. Complement existing resources for testing, sampling, and water management programs (WMPs)
3. Support environmental assessment during public health investigations

*Testing for public health investigations must always be performed in conjunction with the authority having jurisdiction (AHJ). The below guidance is for routine testing only.*

**Testing Objectives**

Testing may be useful for routine and non-routine purposes, such as:

- Establishing a baseline measurement for performance indicators
- Validating a WMP
- Evaluating potential growth and transmission sources
- Confirming success or failure of remedial treatment
- Investigating potential sources of environmental exposure for persons with disease

Routine testing may be particularly beneficial for certain types of facilities, such as:

- Facilities that house or treat individuals at increased risk for Legionnaires' disease (e.g., senior communities, outpatient clinics)
- Facilities unable to meet control limits consistently
- Facilities with a history of associated Legionnaires' disease cases

**Sample Collection**

1. Perform an environmental assessment to identify areas with increased risk of *Legionella* growth and spread. Use the STAR principle (Sediment and biofilm, Temperature, water Age, and disinfectant Residual) to help assess risk.

*Before sampling, consider how results will be used in the broader context of a water management program.*

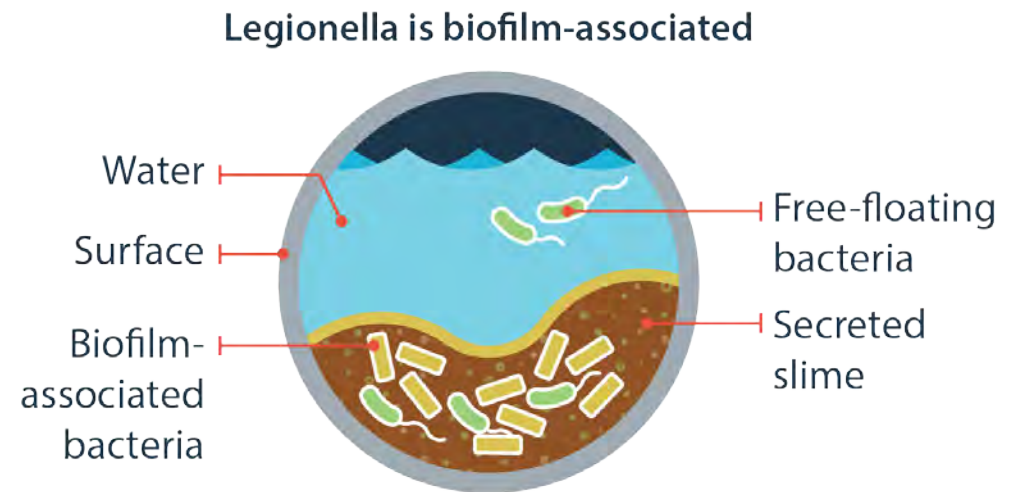
Legionella Control Toolkit      Routine Testing      Page F1

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



# *New:* Modules Built Around Growth Factors

- Each system-specific module is built around key factors that affect *Legionella* growth:
  - Sediment and biofilm
  - Temperature
  - Water age
  - Disinfectant residuals



# New: Control Measures Table

*Legionella* Control Measures for Hot Tubs and Whirlpool Spas

Water Parameter	Control Measure	Recommendations*		
Sediment and Biofilm	Cleaning frequency	Vigorously scrub all surfaces each time tub is drained		
Temperature	Control limits	Hot tubs operate within <i>Legionella</i> 's favorable growth range (77–113°F). Additional measures are required to control <i>Legionella</i> . Water should not exceed 104°F for health and safety reasons.		
Age	Bather load, frequency of use	Water replacement frequency (days) = (Spa volume/3)/avg. # users per day†		
Disinfectant Residual	Control limits	pH: 7.2–7.8†	Free chlorine: 3–10 ppm†	Bromine: 4–8 ppm†

# *New:* Routine Testing Module

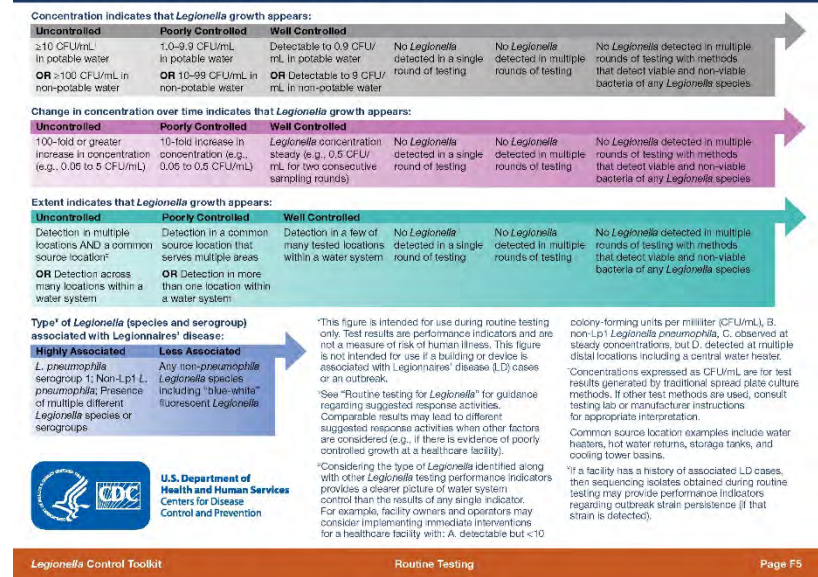
- Contains practical information
  - Values for performance indicators
  - Multifactorial approach to understanding test results
  - Graphic to help assess how well-controlled a water system is for *Legionella* based on testing results



# New: Routine Testing Module Continued

- Routine Testing Module
  - Concentration
  - Change in concentration over time
  - Extent of detection
  - Type of *Legionella*

Figure 1. Routine *Legionella* testing: A multifactorial approach to performance indicator interpretation<sup>a,b</sup>



## Extent indicates that *Legionella* growth appears:

Uncontrolled	Poorly Controlled	Well Controlled			
Detection in multiple locations AND a common source location <sup>†</sup> <b>OR</b> Detection across many locations within a water system	Detection in a common source location that serves multiple areas <b>OR</b> Detection in more than one location within a water system	Detection in a few of many tested locations within a water system	No <i>Legionella</i> detected in a single round of testing	No <i>Legionella</i> detected in multiple rounds of testing	No <i>Legionella</i> detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any <i>Legionella</i> species

# Partnership Is Key to WMP Implementation

- Multistakeholder efforts are needed to reduce incidence and burden of Legionnaires' disease
- Requires efforts of
  - Environmental health, epidemiology, and laboratory science
  - Building owners and managers
  - Industry
  - Risk managers and insurance companies
  - Legal counsel

# Resources

- **CDC Building Reopening Guidance:** [www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html](https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html)
- **EPA Guidance for Maintaining or Restoring Water Quality in Buildings with Low or No Use:** <https://www.epa.gov/coronavirus/information-maintaining-or-restoring-water-quality-buildings-low-or-no-use>
- **Toolkit for Controlling *Legionella* in Common Sources of Exposure:** <https://www.cdc.gov/legionella/wmp/control-toolkit/index.html>
- **Toolkit: Developing a Water Management Program to Reduce *Legionella* Growth and Spread in Buildings:** <https://www.cdc.gov/legionella/wmp/toolkit/index.html>
- ***Legionella* Environmental Assessment Form:** <https://www.cdc.gov/legionella/downloads/legionella-environmental-assessment.pdf>
- **PreventLD Training:** <https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html>
- **Preventing Waterborne Germs at Home:** <https://www.cdc.gov/healthywater/drinking/preventing-waterborne-germs-at-home.html>
- **ASHRAE Guideline 12:** <https://www.ashrae.org/technical-resources/standards-and-guidelines/guidance-on-reducing-the-risk-of-legionella>
- **AWWA, IAPMO, Responding to Water Stagnation in Buildings with Reduced or No Water Use:** <https://www.awwa.org/Portals/0/AWWA/Government/20201001FrameworkforBuildingManagersFINALDistCopy.pdf>

# Questions?



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

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

# MANAGING WATER RISK IN THE “NEW NORMAL”

*Legionella* risk management strategies are essential for reopening buildings as increased incidents are experienced across the United States

**NACCHO**

*September 16, 2021*

**Eric Myers**

*Sr. Technical Consultant  
Nalco Water, An Ecolab Company*





# AGENDA

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- **Managing *Legionella* Risk During Low- or No-occupancy and Prior to Re-occupancy**
  - Potable Water
  - Cooling Towers
  - Decorative Water Features
- **Importance of Water Management Programs**

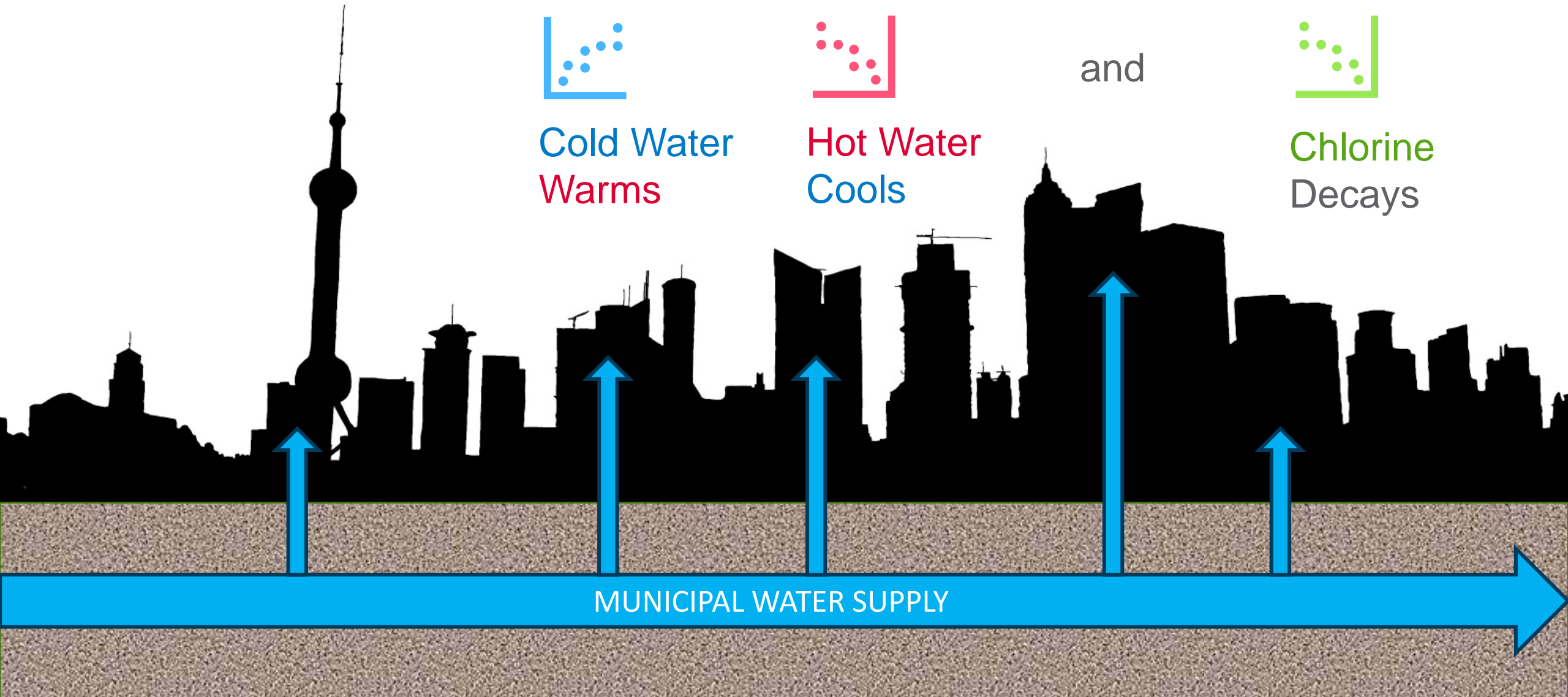
# QUESTIONS TO CONSIDER

## As people return and we get “Back to Business”

- How have I managed my water systems while we’ve been in a low- to no-occupancy state?
- Which water management activities have I considered or perhaps overlooked?



# Reduced Water Use Can Cause Water Age Conditions



Cold Water  
Warms



Hot Water  
Cools

and



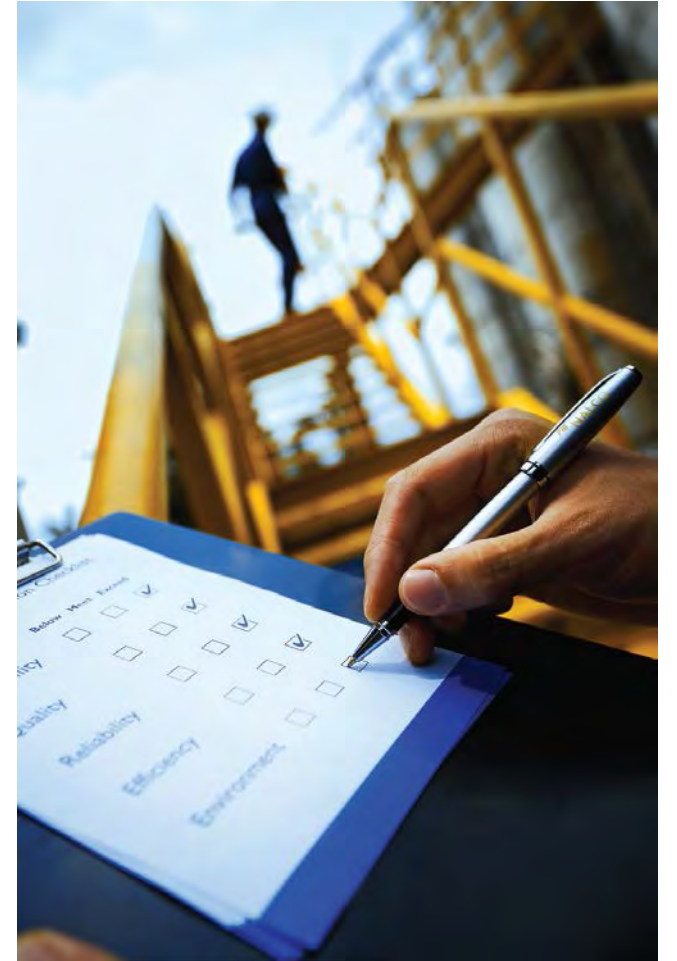
Chlorine  
Decays

MUNICIPAL WATER SUPPLY

# CDC - Steps to Minimize *Legionella* Risk Before Your Business or Building Reopens <sup>1</sup>

- Develop a comprehensive water management program (WMP)
- Ensure your water heater is properly maintained and the temperature is correctly set
- Flush your water system
- Clean and maintain
  - Decorative water features
  - Hot tubs
  - Cooling towers
  - Safety equipment
- Maintain your water system

Source: 1) <https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html>



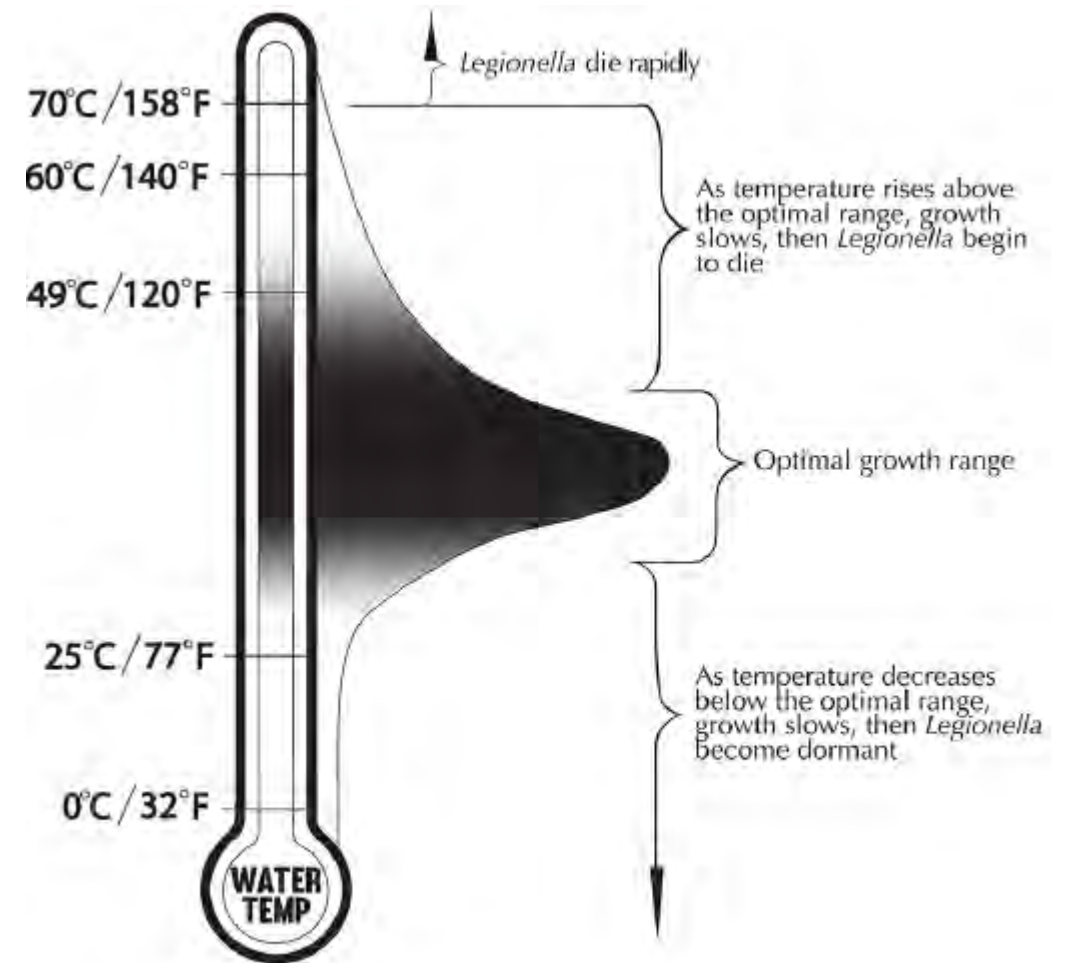
# WATER TEMPERATURES

Why?



Water heaters set too low can allow *Legionella* growth

- General Growth range:  
**77 - 113°F (25 - 45°C)**
- Optimum Growth Range:  
**85 - 108°F (30 - 42°C) | Peaks at 95-99°F (35-37°C)**
- Growth slows and begin to die:  
**113 - 120°F (45 - 49°C)**



Temperature effects on survival and growth of *Legionella* in laboratory conditions.

Source: Image from ASHRAE Guideline 12-2020, Sec. 4.2.2.2 Growth, Figure 1.

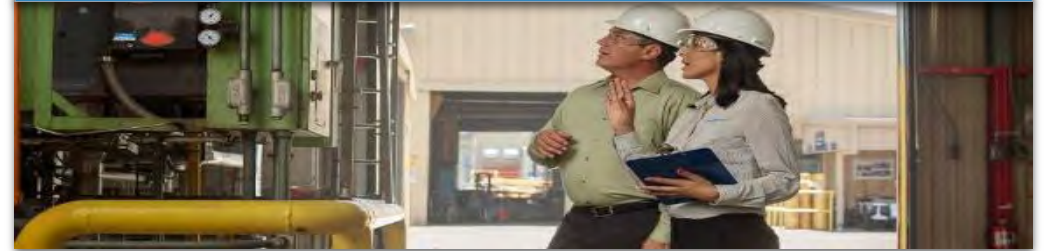
# WATER TEMPERATURES

## Recommendations



- **“Keep it Hot”**
  - Store at or above 140°F (60°C)
  - Deliver up to the outlet at or above 120°F (49°C)
  - Implement scald control measures
- Ensure all maintenance is carried out per manufacturer’s instructions or by professionals <sup>1</sup>

## Actions

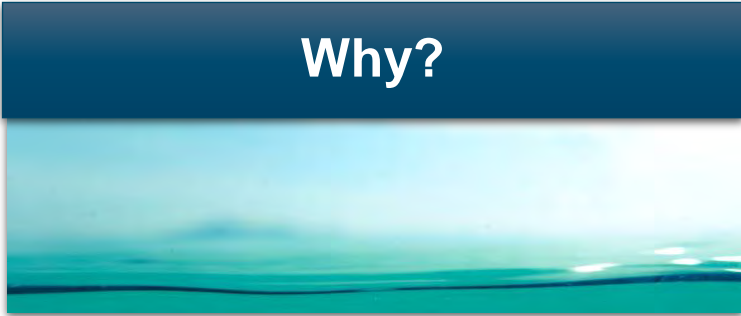


- Check and document system water temperatures weekly and adjust as necessary
- Contact your engineering support for proper next steps if system parameters appear to be out-of-range.

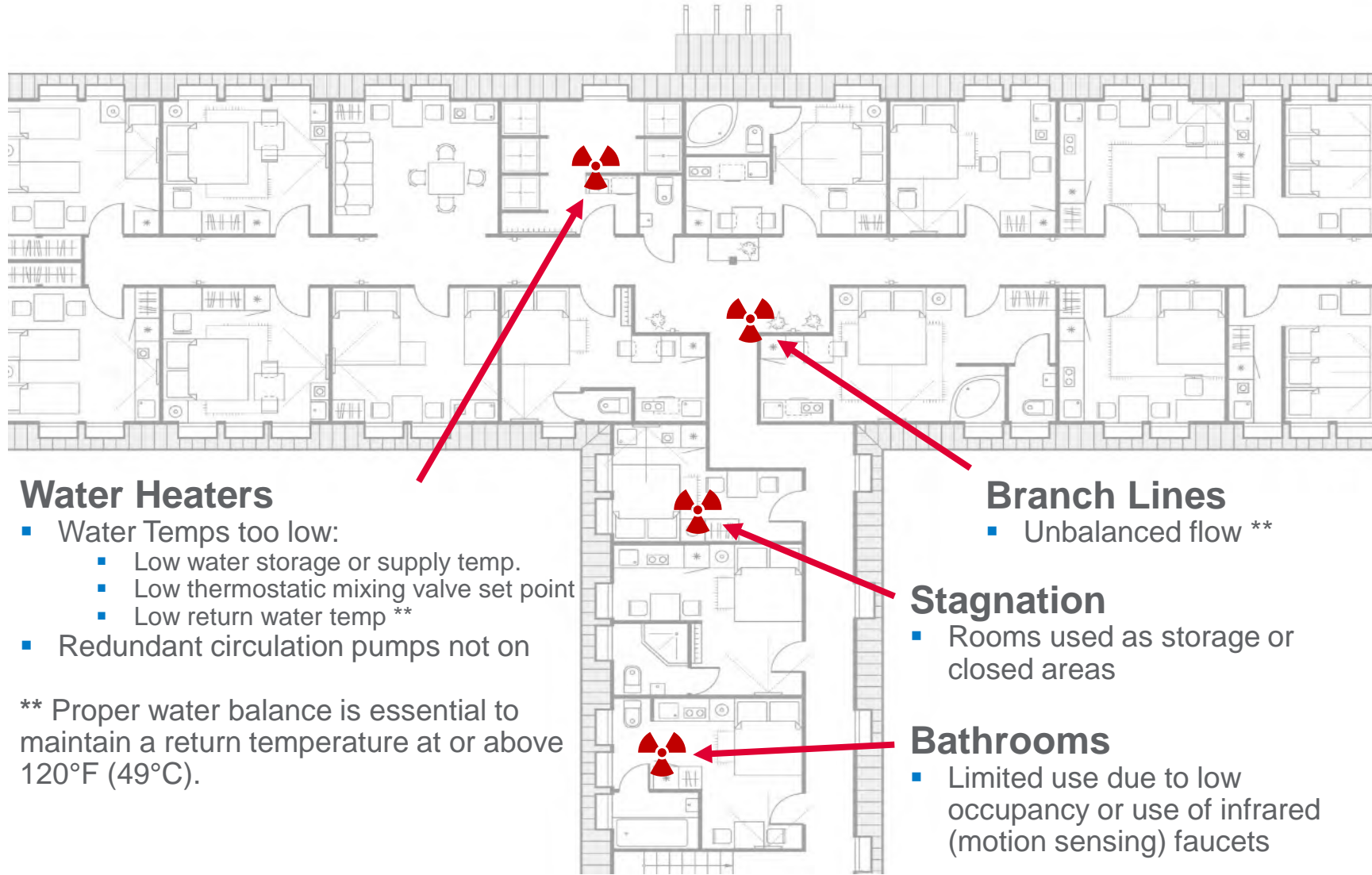
Source: 1) <https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html> ; Temp Image by Gerd Altmann from Pixabay

# POTENTIAL ISSUES

## Why?



- Stagnant water can allow *Legionella* growth
- Especially if sections of the building have been closed



### Water Heaters

- Water Temps too low:
  - Low water storage or supply temp.
  - Low thermostatic mixing valve set point
  - Low return water temp \*\*
- Redundant circulation pumps not on

\*\* Proper water balance is essential to maintain a return temperature at or above 120°F (49°C).

### Branch Lines

- Unbalanced flow \*\*

### Stagnation

- Rooms used as storage or closed areas

### Bathrooms

- Limited use due to low occupancy or use of infrared (motion sensing) faucets

# FLUSH YOUR WATER SYSTEM

## Recommendations

**Flush hot and cold water through all end points (e.g., showers, sink faucets, toilets) <sup>1</sup>**

**Good = Bi-Weekly | Best = Weekly**

- Faucets, tubs, showers heads, shower wands
  - Cold 5 minutes at full flow
  - Hot 5 minutes at quarter flow
- Drinking water fountains 5-10 minutes; and change filters if installed
- Toilets (1x = Good; 2-3x = Best);  
*depends on pipe run / GPF*

### Target 3-10 fps

- Public restroom sinks and toilets
- Fitness centers
- Associate locker rooms
- Utility closets
- Kitchens/pantries
- Meeting spaces

## Actions



- Flush water outlets to avoid water age conditions:
  - Easy for anyone to flush
  - Complicated to schedule/track
- Follow your WMP guidance
- Consult your WMP provider to discuss when it's appropriate to stop flushing

Source: 1) <https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html>



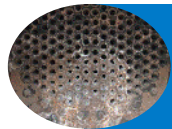
# COOLING TOWERS



# HEALTH & PERFORMANCE STRATEGY

## performance

based strategy



Scale



Corrosion



Microbiological

Maximizing asset life cycle and operating efficiencies

## health + performance

based strategy



Follow a WMP

Monitor *Legionella*

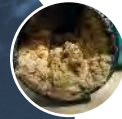
On-Line Disinfection

Off-line Clean & Disinfect

Managing health risks associated with owning and operating an “at risk” water system

# COOLING TOWER SYSTEM

## Potential Issues



Scale and mineral sludge



Corrosion



Micro-bio (biofilm/slime)



High energy costs (poor heat transfer)



Water treatment & equipment difficulties



Water quality testing problems

# COOLING TOWER CLEANING & DISINFECTION

## On-line Tower Disinfection

- Once a year (Mid-Season)
- Proactive biocide adjustments to ensure disinfection

## Off-line Tower Cleaning & Disinfection

- Twice a year
- Comprehensive with pre & post disinfection

**Dangerous – Use safety trained service technicians**  
(PPE, confined space, following OSHA guidelines etc.)

Before Cleaning



After Cleaning



# DECORATIVE WATER FEATURES



# CLEAN & MAINTAIN

## Why?



- Features can allow the right conditions for *Legionella* growth (stagnation & temperature)
- Water becomes aerosolized when the feature is flowing

## Recommendations



- Follow recommended manufacturer guidelines for cleaning and disinfection <sup>1</sup>
- Ensure the feature is free of visible slime or biofilm <sup>1</sup>

## Actions



- If feature is shut-down:
  - Keep it shut-down until a decision is made to resume 'normal' operation
- If feature is running:
  - Maintain water treatment (like a swimming pool) and document

Source: 1) <https://www.cdc.gov/coronavirus/2019-ncov/php/building-water-system.html>

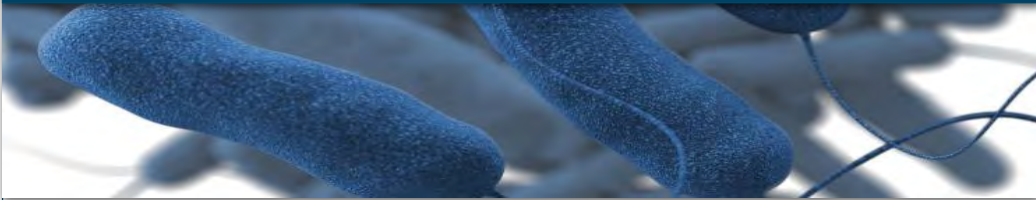
# WATER MANAGEMENT PROGRAMS

*REDUCES RISK*



# WATER MANAGEMENT PROGRAMS

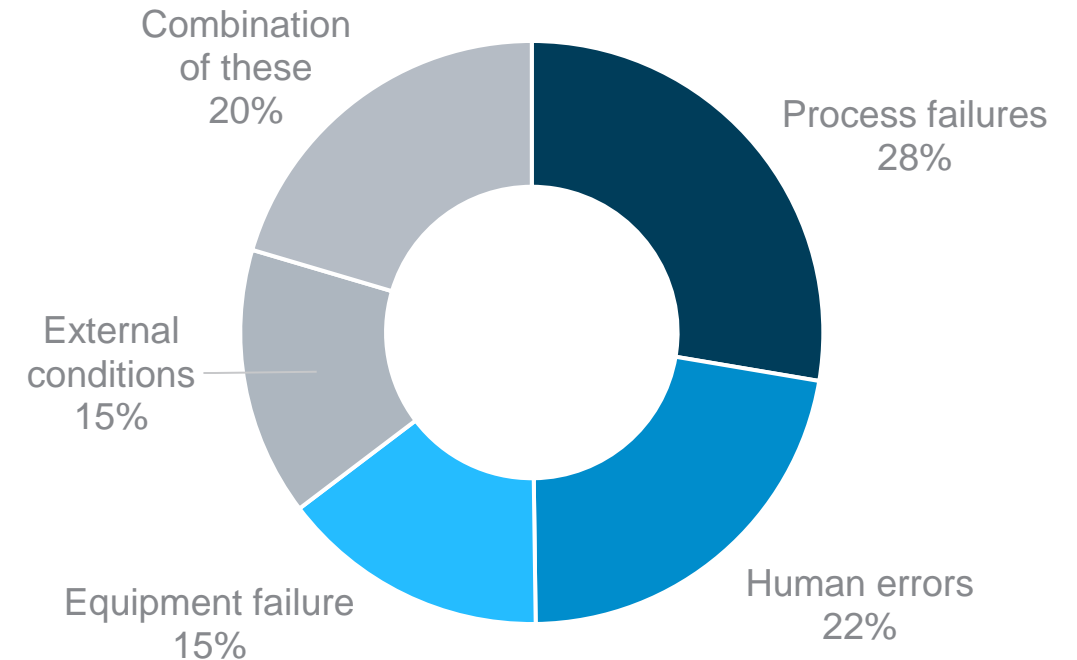
## Why?



- Inadequate WMPs can increase the risk of Legionnaires' Disease <sup>1</sup>
- CDC – Investigations show that 9 out of 10 outbreaks were caused by problems preventable with more effective water management <sup>1</sup>

Sources: CDC - Garrison LE et al. *MMWR*. 2016;65(22):557-61

Outbreaks have occurred because of <sup>1</sup>



**A trusted water treatment provider can assist with these deficiencies**



# WATER MANAGEMENT PROGRAMS

## Recommendations & Actions



**Consult an expert like Nalco Water to help you develop a water management program**

- Review ASHRAE Standard 188-2021 for elements of a plan
- Start with a site risk assessment to identify at risk water systems and determine where control measures can be applied and monitored
- Review ASHRAE Guideline 12-2020 to help develop the strategies to manage risk
- Implement a consistent standard of care across your organization (e.g., Corporate wide & site level plans)



# OTHER STRATEGIES

Testing has proven to be **extremely important** upon reopening and during **low occupancy**  
Additional considerations if traditional WMP practices have not reduced *Legionella* risk (i.e., positives)



## Hyperchlorination

- Quick remediation step
- Inject high dose of chlorine, soak and flush
- Facility site personnel required to support flushing measures



## Short-Term Chlorination

- Continuous low-level water treatment with chlorine
- No disruption in water service for occupants



## Supplemental Disinfection

- Long term option
- Multiple option types available
- Leverage automation for monitoring and control

# FINAL TAKEAWAYS



Properties are going through a tremendous amount of change and challenges (regulations, insurance, labor)



Need to stay focused on managing *Legionella* risk as people return

- Domestic Water: “Keep it Hot” & “Keep it Moving”
- Cooling Towers: Start-Up Protocols, On-line Disinfection, Off-line Cleaning & Disinfection
- Decorative Water Features: Clean & Maintain



Water Management Programs are important now and long-term, where you should consider partnering with a trusted advisor or expert

# Questions?

Submit your question(s) for the panelists using the Q&A box!

Thank you for attending today's webinar!

You will receive a follow-up email with the presenting slides and recording.