Lessons Learned from Legionella Outbreak Investigations

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Disclosures

- ❑ I have no conflicts of interest or financial relationships to disclose.

Special Thank You!

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Objectives

- Define lessons learned to improve prevention strategies, including strengthening water management programs and enhancing facility partnerships.
- Describe actionable strategies to reduce future Legionella risk, based on real-world investigation findings and public health practice improvements.
- Define common environmental and system vulnerabilities (e.g., water management program gaps, infrastructure issues) discovered during Legionella investigations.

Background

Water Safety is Critical in Healthcare

- Water in healthcare facilities can harbor pathogens that cause illness in patients
- Patient susceptibility
  - Immunosuppression, cystic fibrosis, pre-existing lung disease
  - Non-intact skin or open wounds
  - Medical devices can transmit pathogens

Modes of Transmission of Waterborne Diseases

Water is Used Throughout Healthcare Facilities in Various Ways

- Facility: HVAC, cooling towers, fire suppression, irrigation
- Care: hygiene, medical products, medications, ventilators, neonatal isolettes, dental unit water uses
- Procedures: dialysis, surgery, burn wound debridement, ECMO
- Cleaning: medical device reprocessing, autoclaves, environmental cleaning
- Consumption: water, ice, food and food preparation

Photo: Dräger.com

[Modes of Transmission of Waterborne Diseases]

Opportunistic Pathogens of Premise Plumbing

- Gram negative bacteria
  - *Pseudomonas* spp.
  - *Legionella pneumophila (and other types of Legionella)*
  - *Burkholderia cepacia* complex
  - *Acinetobacter baumannii*
  - *Stenotrophomonas maltophilia*

- Non-fecal Coliforms
  - *Klebsiella* spp.
  - *Enterobacter* spp.
  - *Serratia* spp.

- Nontuberculous mycobacteria (NTM or Environmental)
  - *M. abscessus* clade
  - *M. avium* complex
- Fungi
  - Yeasts (Candida spp.)
  - *Aspergillus* spp.
  - *Fusarium* spp.

- Protozoa
  - *Acanthamoeba* spp.
  - *Naegleria* spp.

Opportunistic Pathogens of Premise Plumbing

London

10 now hospitalized in legionnaires' outbreak as health unit continues search for source

The health unit declared an outbreak on July 26

Kendra Seguin · CBC News · Posted: Aug 01, 2024 9:35 AM CDT | Last Updated: August 1

Second patient at St. Joseph's University Medical Center in Paterson infected with Legionella dies

By Eyewitness News

Wednesday, December 24, 2025

The Washington Post
Democracy Dies in Darkness

Deadly bacteria closes NICU for second time in months at Md. hospital

November 2, 2016

Dozens of Roper Hospital patients developed waterborne bacterial infection after surgery

BY LAUREN SAUSSER LSAUSSER@POSTANDCOURIER.COM

APR 13, 2018 UPDATED SEP 14, 2020

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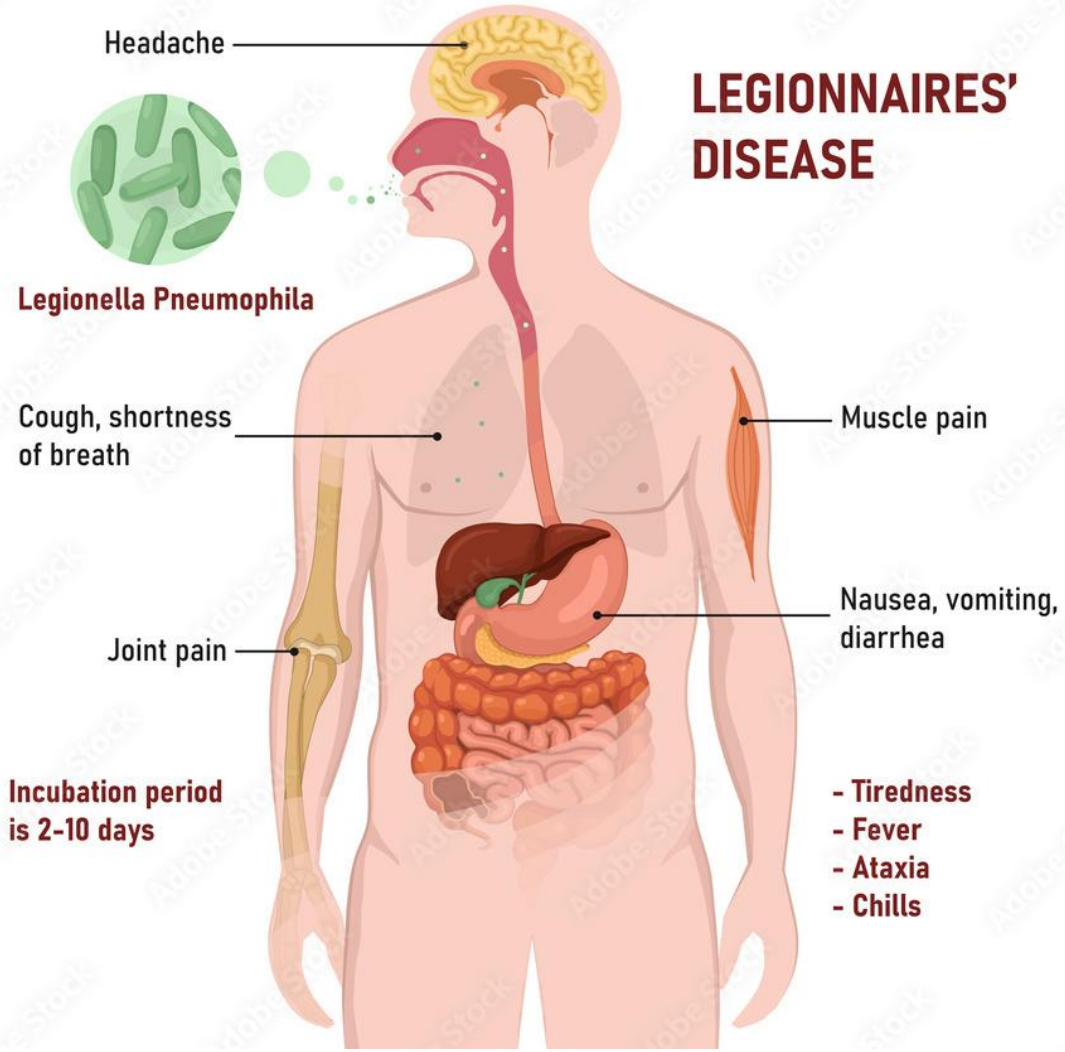
What is Legionella?



Adobe Stock | #504083936

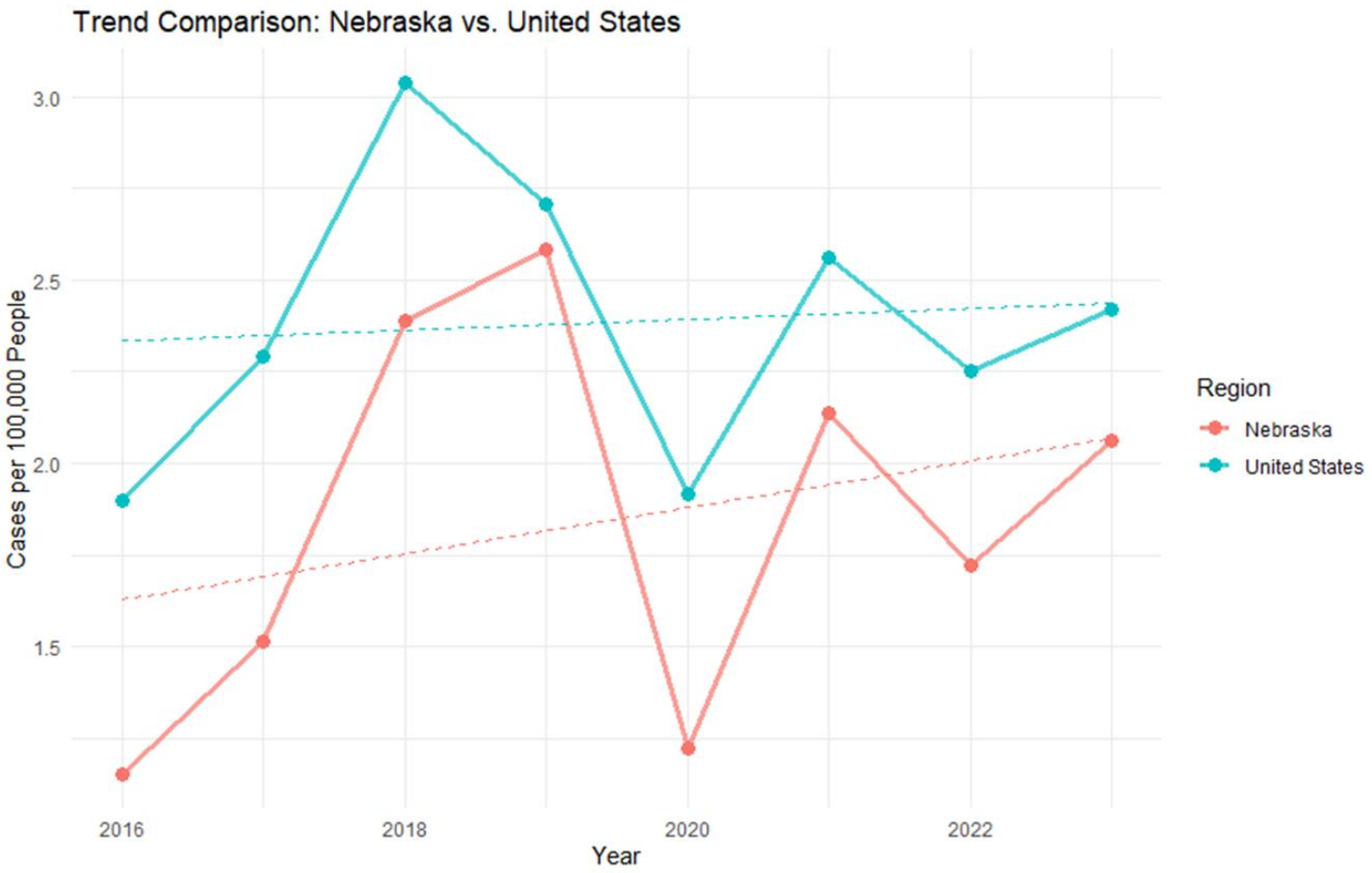
Legionella is a gram-negative bacilli naturally found in freshwater environments including lakes, rivers, ponds, etc.

- Currently, more than 60 species of legionella are recognized.
- *Legionella pneumophila* is most commonly associated with disease including:
  - 15 serogroups – *L. pneumophila* serogroup 1 is most common.
  - Other legionella species have been isolated as well but are not common.

Symptoms

- Legionnaires disease
  - cough, shortness of breath, fever, muscle aches, headaches
  - diarrhea, nausea, and confusion
- Pontiac fever
  - fever & muscle aches

Burden of Legionella - Nationally

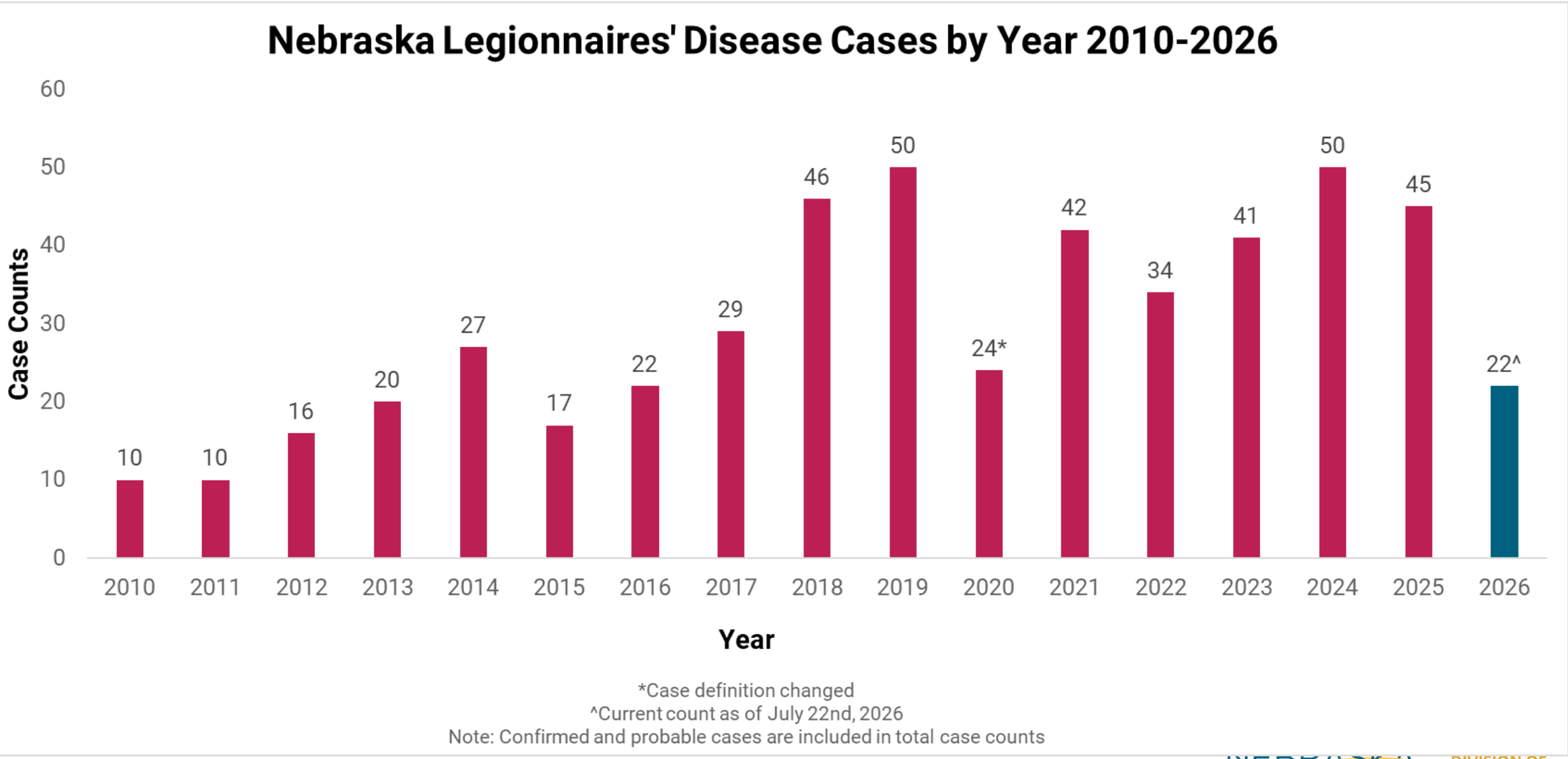


- Cases have been on the rise since 2000 nationally.
  - Legionnaires' disease is likely underdiagnosed with underestimation of true incidence.
- Mortality rate roughly 5-10%:
  - Can be as high as 40-80% in untreated immuno-suppressed cases.
    - 5-30% with appropriate management

[Estimate of Burden and Direct Healthcare Cost of Infectious Waterborne Disease in the United States]

[NNDSS Annual Summary Data 2016-2023 Request]

Burden of Legionella – Nebraska



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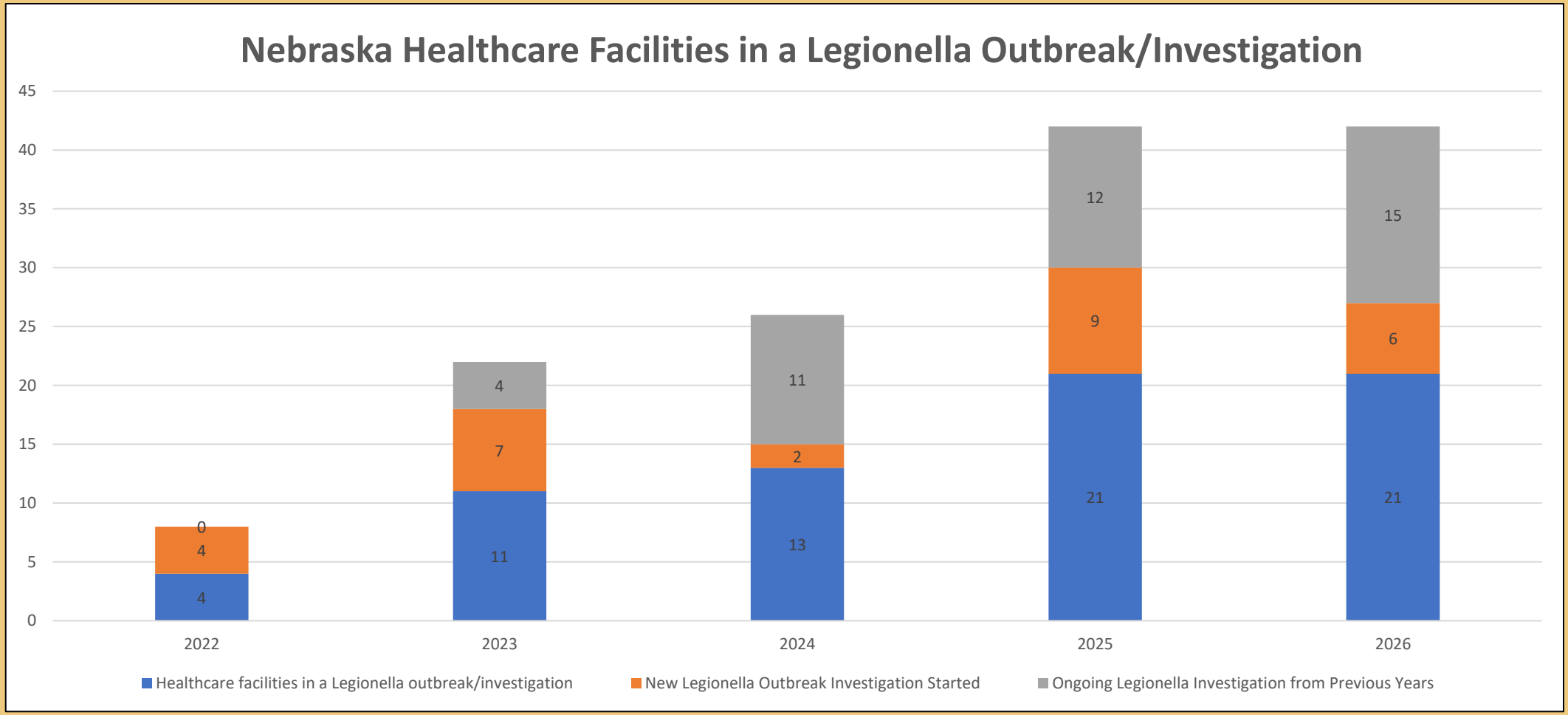
Numbers provided by Nebraska Electronic Disease Surveillance System (NEDSS)

Legionella Outbreak Criteria

- Legionella outbreaks are separated into community and healthcare*
  - Community outbreaks = two confirmed cases within a one-year span with identical/similar epidemiologically linked exposures
  - Healthcare outbreaks = one confirmed case with presumptive/possible exposure in a healthcare facility
    - **Presumptive HAI Legionella Case**: A case with ≥10 days of continuous stay at a healthcare facility during the 14 days before onset of symptoms
    - **Possible HAI Legionella Case**: A case that spent a portion of the 14 days before date of symptom onset in one or more healthcare facilities, but does not meet the criteria for presumptive healthcare-associated Legionnaires' disease

Heymann, D. L. (2022). Control of Communicable Diseases Manual. APHA Press, an imprint of American Public Health Association.
Defining Healthcare Facilities and Associated Cases

Healthcare-Associated Legionella



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Legionella Outbreak Mitigation Lesson: Understanding the Facility

Long-term Care Facilities

- Less equipped
  - Financially restricted
  - Less staff
- Less knowledgeable
  - More reliant on Public Health expertise
- Proximity to resources can be a challenge
- More likely to be without town-provided chlorination
- Higher chance of no Water Management Program (WMP)

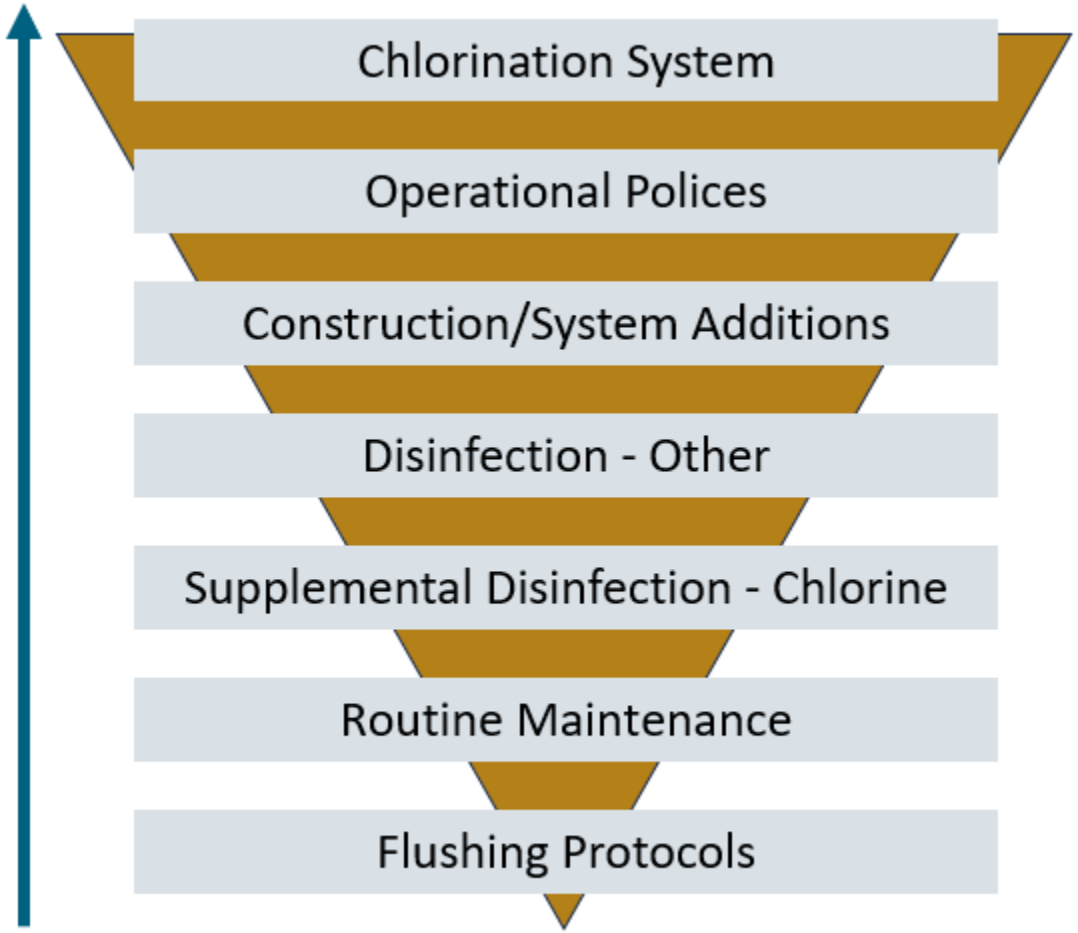
Acute Care/Hospitals

- Generally, more well-equipped
  - Less financial restriction
  - Better staffing
- More knowledgeable
  - Usually due to IP presence
- Proximity to resources generally better
- More likely to be with town-provided chlorination
- Lesser chance of no WMP

Legionella Outbreak Lessons Learned

- Tiered response approach
- Best remediation options are:
  - Safest
  - Least regulated
  - Most cost efficient
  - Simplest to implement

More Expensive
More Regulated
Higher Implementation Difficulty
Less Safe

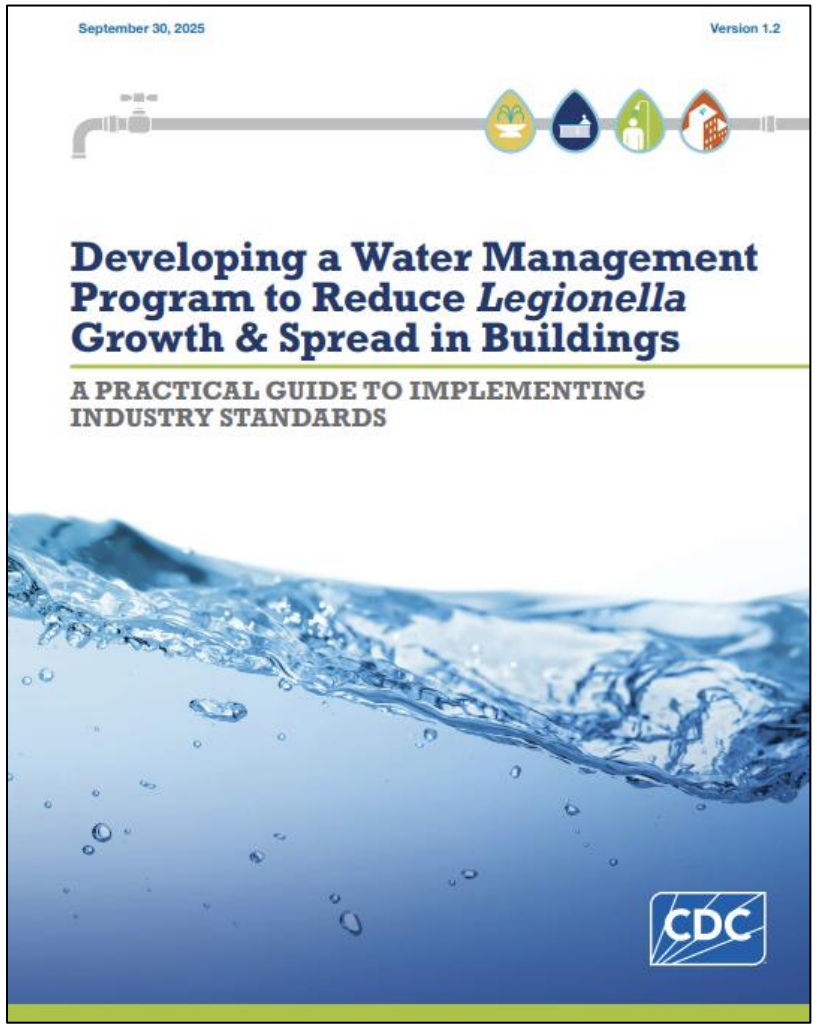


- <u>Important to keep facility financial abilities in mind – but patient/resident risk minimization is #1 priority</u>

Lesson 1:

Infection Preventionist aren’t always being included on the Water Management Team (but they should be!)

Who Should be on Your Water Management Team?



[CDC Toolkit: Developing a water management program to reduce *Legionella* growth and spread]

Establish a Water Management Program Team

1

Certain skills, described in the diagram below, are needed to develop and implement your water management program. These skills would typically be provided by a combination of people, some of whom may have multiple skills (examples shown below).

Healthcare Facilities

The team should also include:

- Someone who understands accreditation standards and licensing requirements
- Someone with expertise in infection prevention
- A clinician with expertise in infectious diseases
- Risk and quality management staff

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- Equipment or chemical suppliers
- Contractors/consultants (e.g., water treatment professionals)
- Certified industrial hygienists
- Microbiologists
- Environmental health specialists
- State and local health officials

- Someone with expertise in infection prevention
- A clinician with expertise in infectious diseases
- Risk and quality management staff

In some cases, you may need to train your in-house personnel or hire professionals with specific experience in *Legionella* bacteria in building water systems.

Who Should be on Your Water Management Team?

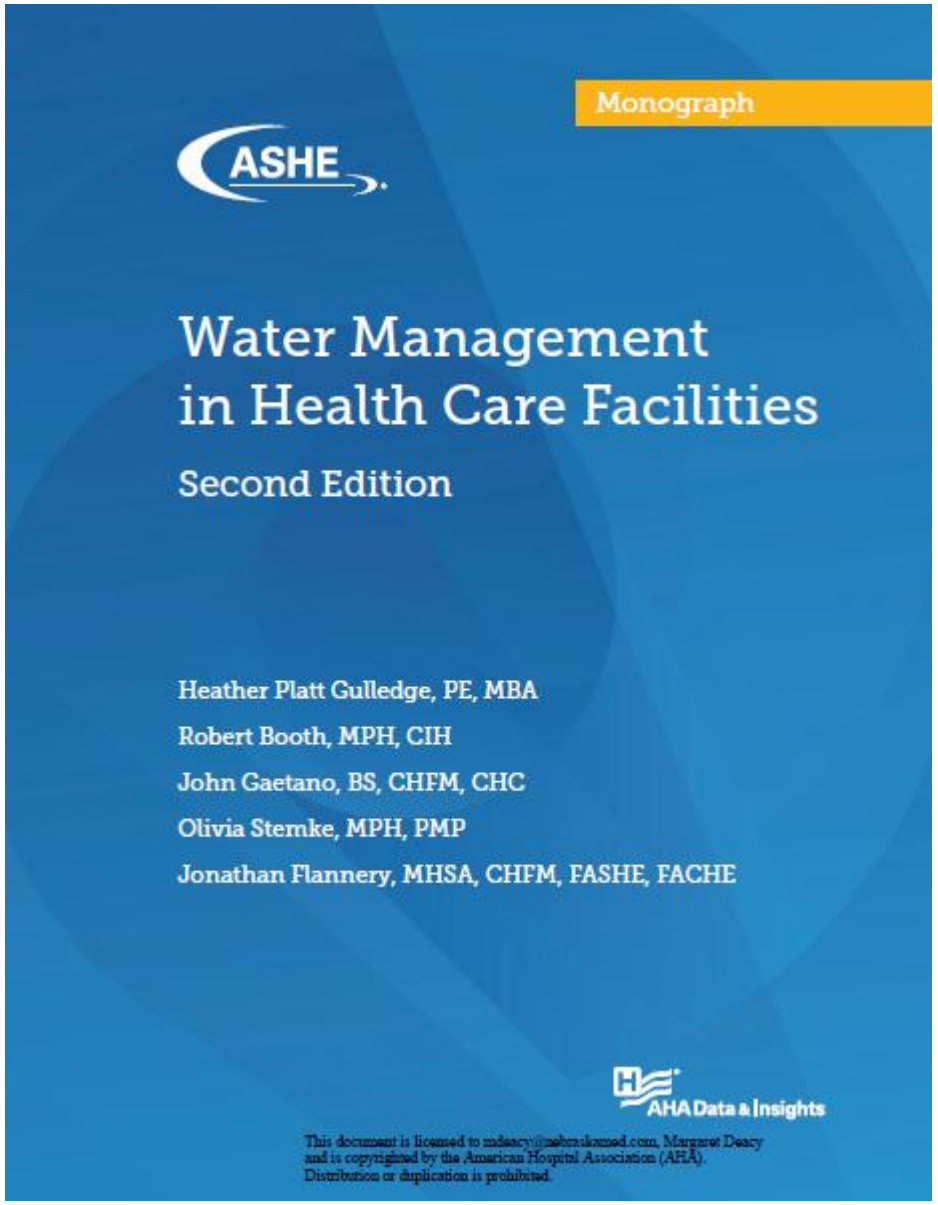
Team membership should include the following roles:

- Executive
- Facilities Manager
- Infection Preventionist/Epidemiologist

Additional Considerations:

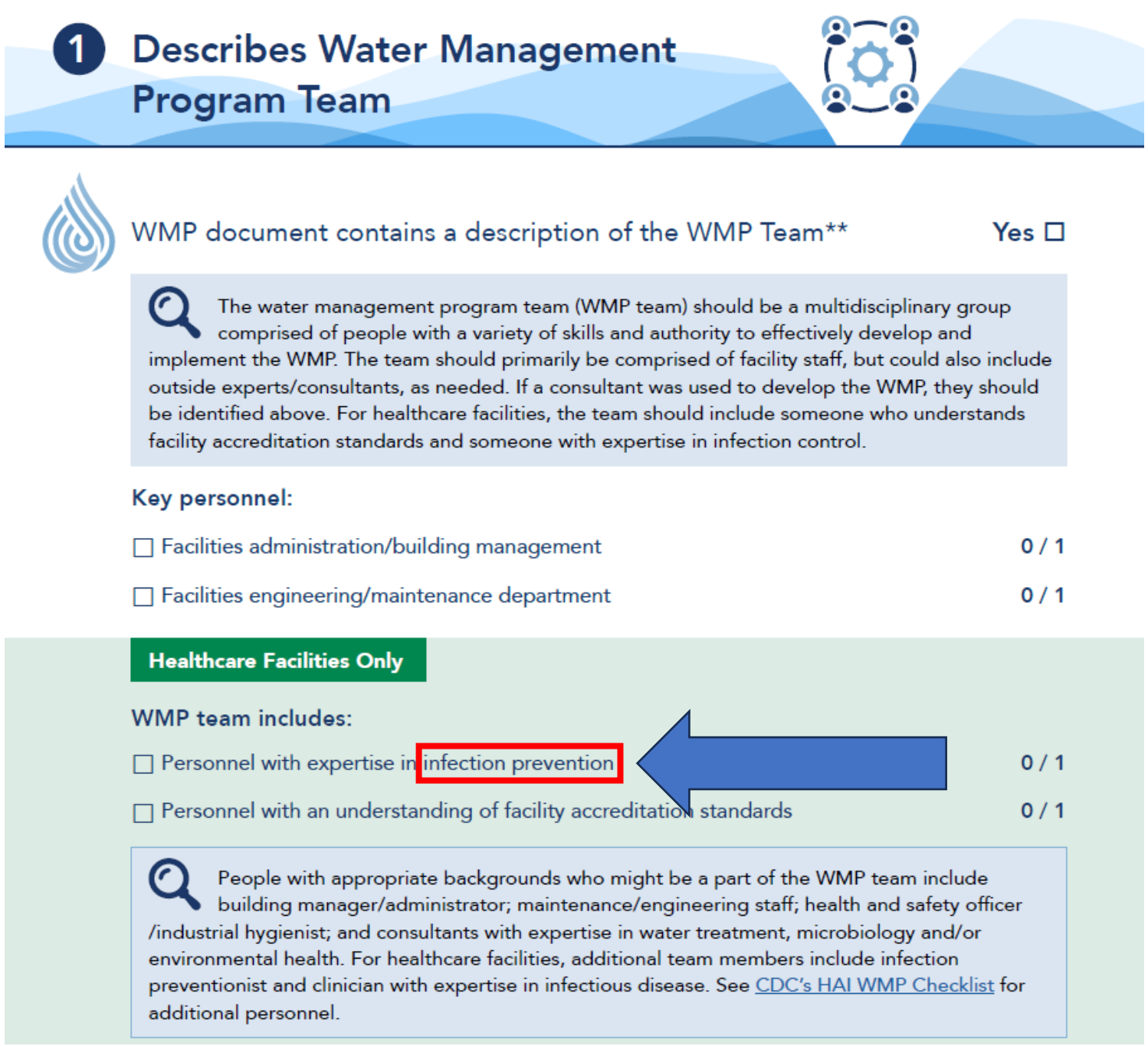
- Nursing Management
- Occupational Health and Environmental Safety Management
- Representatives from Affected Areas
- Others as indicated

One of the most important aspects of an effective water management program is creating a functioning team

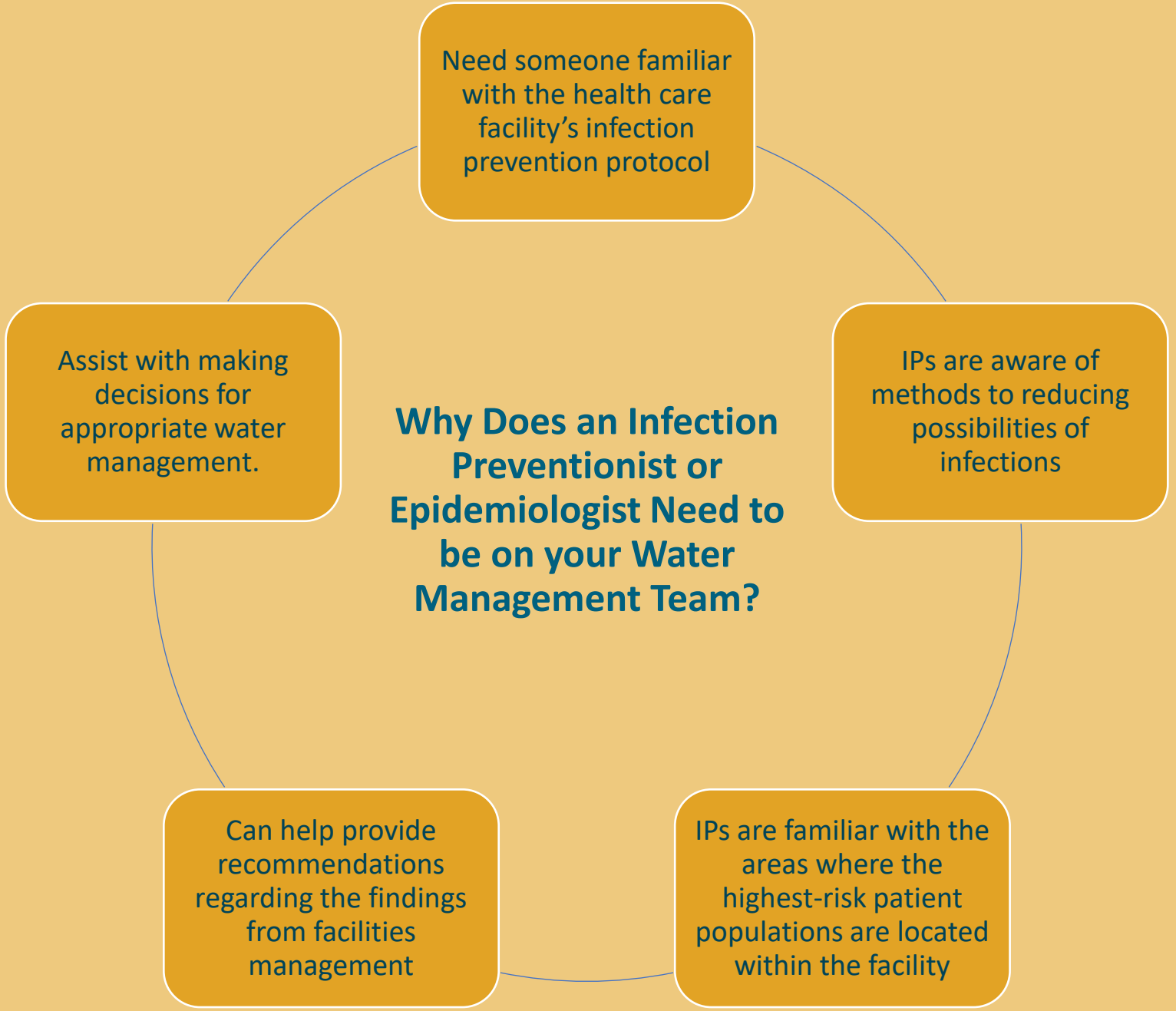


American Society for Health Care Engineering (ASHE). *Water Management in Health Care Facilities*. 2nd ed. American Hospital Association; 2024

Who Should be on Your Water Management Team?



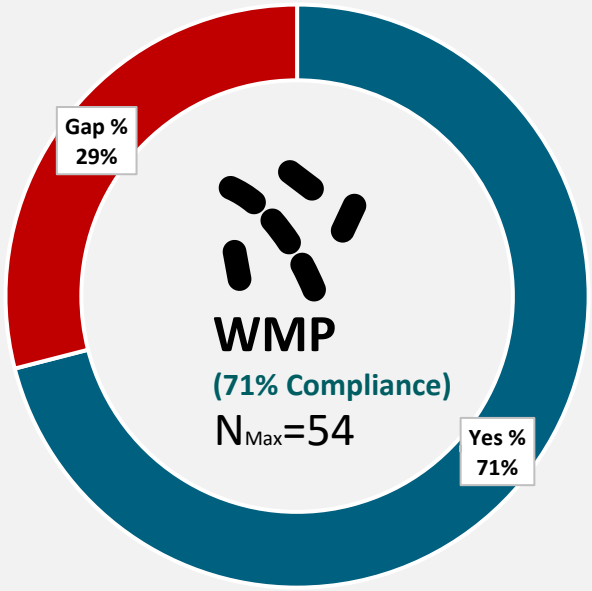
CSTE Water Management Program (WMP) Evaluation Tool

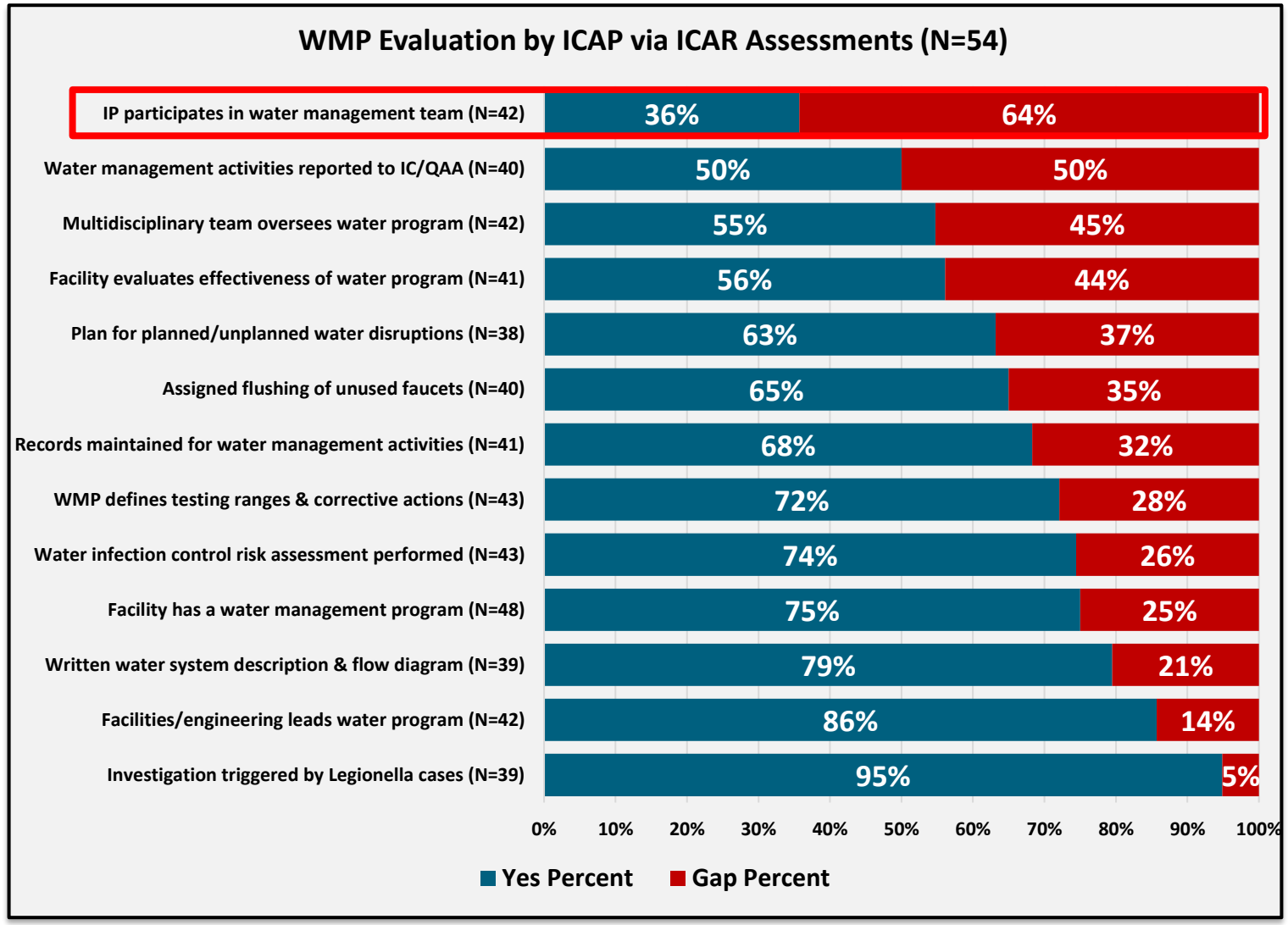


American Society for Health Care Engineering (ASHE). *Water Management in Health Care Facilities*. 2nd ed. American Hospital Association; 2024

WMP Evaluation: ICAP LTCF ICAR Assessments

Overall Performance





- Excludes N<15
- Date Range: 6/22-7/26

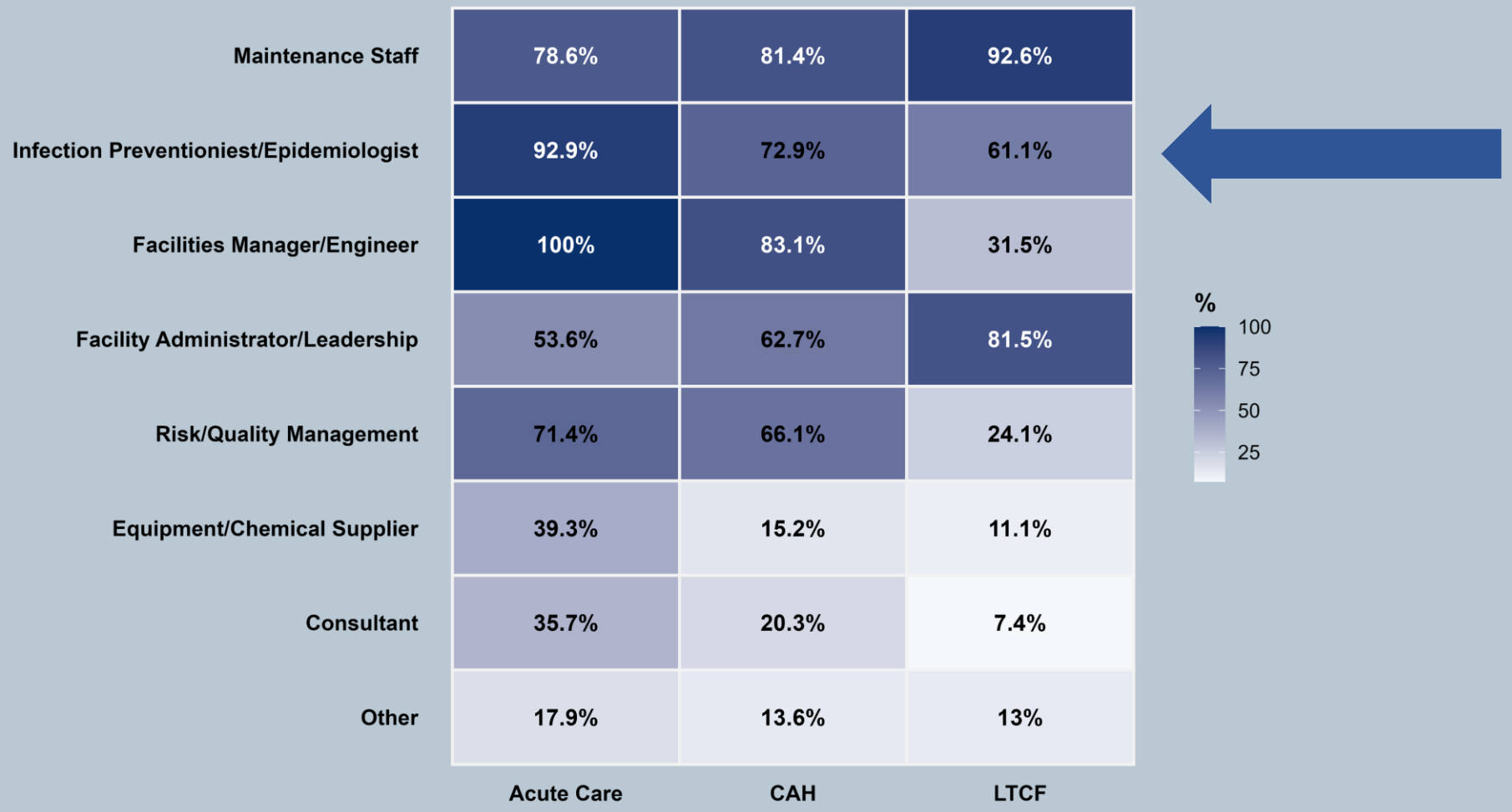
[Infection Control Assessment and Response (ICAR) Tool for General Infection Prevention and Control (IPC) Across Settings Module 11: Water Exposure Facilitator Guide]

Nebraska Healthcare Facilities- 2024 NHSN Annual Survey

Water Management Program (WMP) Practices

Water Management Team Composition

Percent of facilities reporting each role by facility type

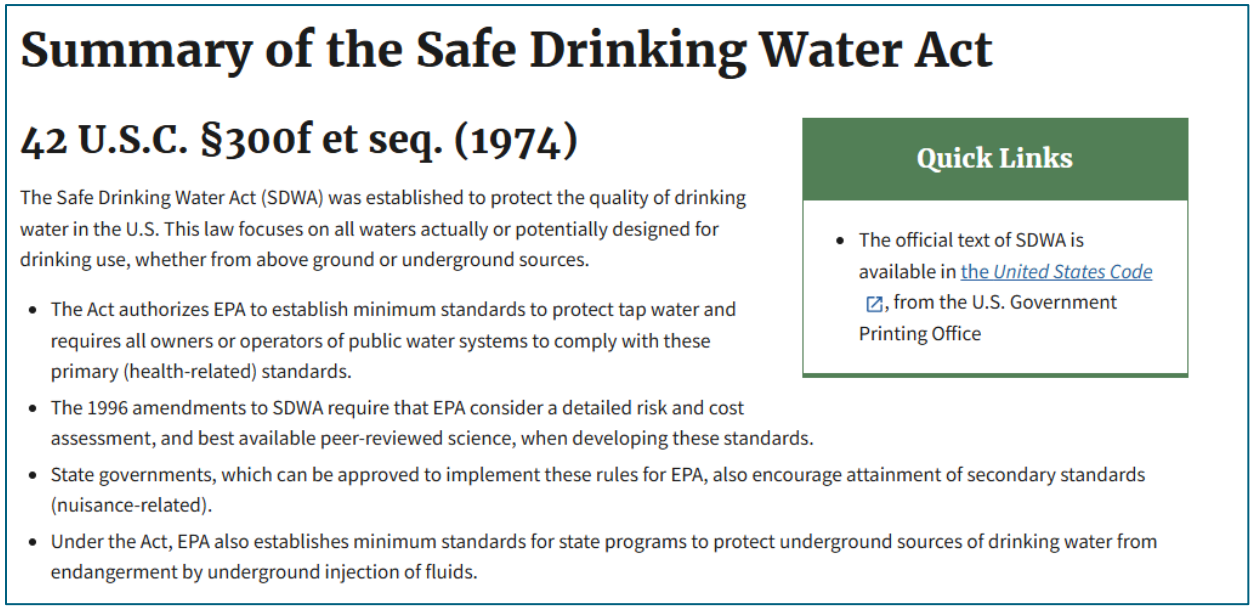


Pavlovsky, L. L., Teran, J., & Ashraf, M.S. (2026, June 2). Assessment of Facility Water Management Program (WMP) Practices: Analysis of 2024 NHSN Annual Survey Data from Nebraska Healthcare Facilities. [poster session]. CSTE Annual Conference 2026, Boston, Massachusetts.

Data source is from NHSN Annual Survey 2024.

Lesson 2:
Water isn't Always Disinfected

Drinking Water Standards and Regulations: An Overview



Summary of the Safe Drinking Water Act

42 U.S.C. §300f et seq. (1974)

The Safe Drinking Water Act (SDWA) was established to protect the quality of drinking water in the U.S. This law focuses on all waters actually or potentially designed for drinking use, whether from above ground or underground sources.

- The Act authorizes EPA to establish minimum standards to protect tap water and requires all owners or operators of public water systems to comply with these primary (health-related) standards.
- The 1996 amendments to SDWA require that EPA consider a detailed risk and cost assessment, and best available peer-reviewed science, when developing these standards.
- State governments, which can be approved to implement these rules for EPA, also encourage attainment of secondary standards (nuisance-related).
- Under the Act, EPA also establishes minimum standards for state programs to protect underground sources of drinking water from endangerment by underground injection of fluids.

Quick Links

- The official text of SDWA is available in the *United States Code*, from the U.S. Government Printing Office

The ***National Primary Drinking Water Regulations*** are water quality standards and water treatment rules set by EPA.

Utilities must follow these regulations. The water quality standards and treatment techniques limit the levels of more than 90 contaminants (such as harmful germs and chemicals) that can get into tap water.

The ***National Secondary Drinking Water Regulations*** are guidelines to help utilities manage tap water issues that are **not** related to health. These can include taste, color, or smell issues.

Utilities are not required to follow these water quality standards for the 15 chemicals listed. These contaminants do not make people sick if they are in water at the levels in the standards. However, they can cause water to look, taste, or smell bad at these levels.

Drinking Water Standards and Regulations: An Overview
Summary of the Safe Drinking Water Act

Drinking Water

Home / Drinking Water and Water Wells Division / **Drinking Water**

Nebraska's Drinking Water Program is dedicated to safe drinking water for all of Nebraska's public water consumers. We work together with water systems, communities, and other state and federal partners to ensure we have reliable and safe drinking water.

Nebraska Drinking Water Program

What is it that we do?

From department engineers who approve construction projects, to field staff who inspect water systems, and water specialists who monitor water testing, we ensure that public water consumers have drinking water that meets all state and federal standards. This could not be accomplished without the cooperation and dedication of the operators of Nebraska's public water systems and other partners from the Nebraska Rural Water Association, MAP, the Nebraska Chapter of the American Water Works Association, and the League of Municipalities.

What are the types of public water systems?

Community Water Systems — cities, towns, and villages

Non-Transient Non-Community Water Systems — schools, office buildings, and hospitals, if they have their own well. They serve people on a temporary basis, a non-transient population.

Transient Water Systems — gas stations, rest areas, hotels, and restaurants, if they have their own well. They serve people who are just passing through, a transient population.

Nebraska Drinking Water

Drinking Water

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Nebraska Drinking Water Monitoring and Compliance

About Monitoring & Compliance

The Monitoring & Compliance section ensures that public water systems comply with the Nebraska Safe Drinking Water Act, which is derived from the Federal Safe Drinking Water Act, that sets safe standards for contaminants in drinking water. This includes over 1,300 public water systems in Nebraska, serving approximately 80% of the people in the state. Monitoring & Compliance ensures compliance with requirements for over 90 potential drinking water contaminants. When necessary, this section provides guidance and issues enforcement actions to help a system return to compliance. Below is a group list of contaminants that are monitored:

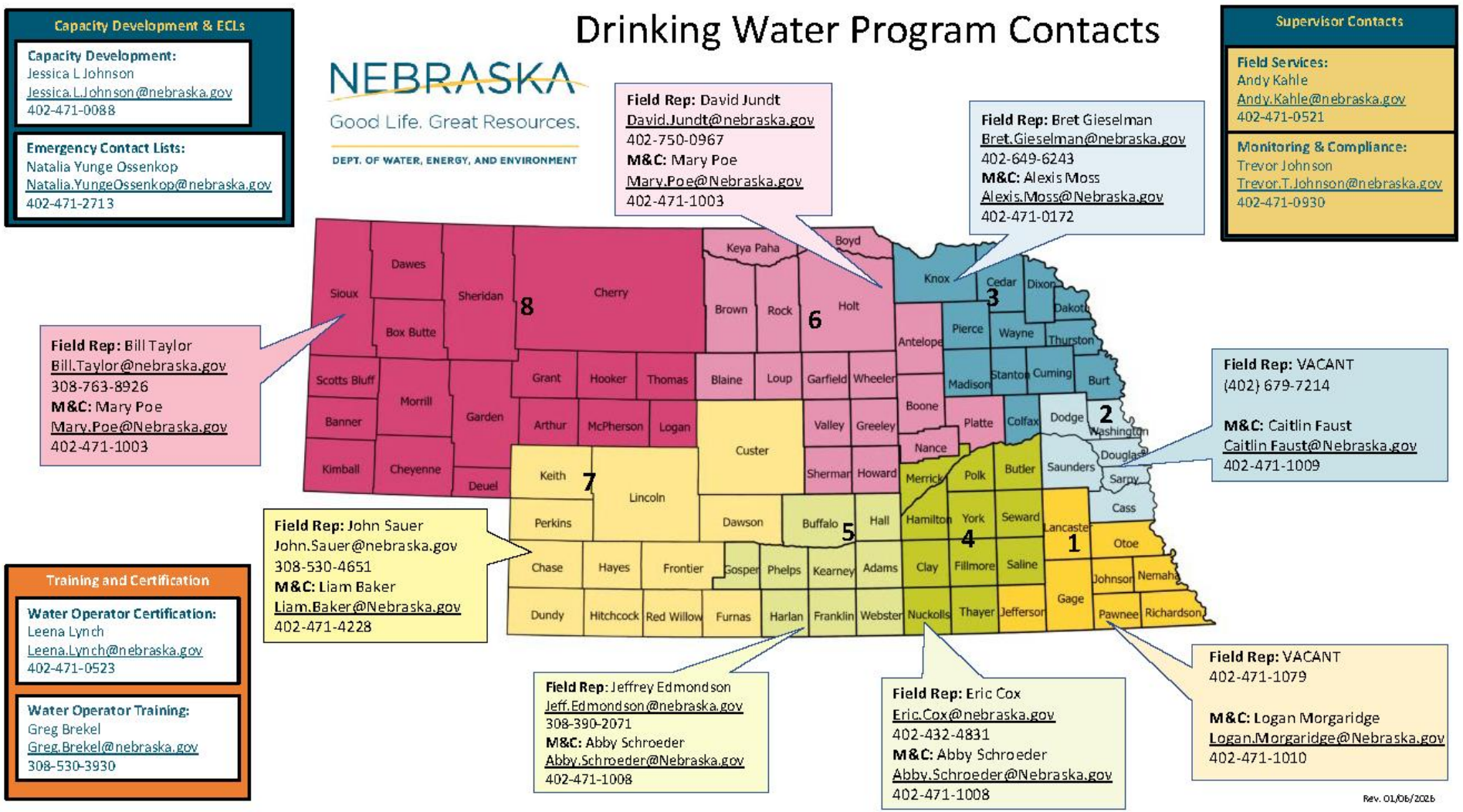
- Nitrate - fertilizers
- Coliform bacteria (including E.coli) - bacteria
  - Seasonal Public Water Systems
- Lead and Copper – service lines/plumbing
- Lead and Copper Revised Rule - lead line inventory
- Volatile Organic Chemicals (VOCs) – chemicals used in manufacturing
- Synthetic Organic Chemicals (SOCs) – pesticides and herbicides
- Inorganic Chemicals - naturally occurring contaminants in Nebraska's geologic formation
- Disinfection byproducts (DBPs) – systems that disinfect
- Radionuclides – naturally occurring radiologic decay from Nebraska's geologic formation
- Surface Water Treatment – systems that use lakes or rivers as their primary water supply

* PFAS in Public Water Supply Systems

A program specialist is assigned to each of eight regions within the state. Please contact your regional compliance officer if you need regulatory assistance. See the map below for the contact information in your area.

Drinking Water Monitoring & Compliance

Nebraska Drinking Water Monitoring and Compliance



Title 179- Public Water Systems

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DEPARTMENT OF HEALTH AND HUMAN SERVICES

TITLE 179, PUBLIC WATER SYSTEMS

EFFECTIVE 03-18-2025

Available at: https://dwee.nebraska.gov/sites/default/files/titles/Title%20179%20Effective%2003-18-2025.pdf

Municipal Water Disinfection

Chlorine
A disinfectant that kills germs in water.

Switching to chlorine
Water pipes can grow a slimy layer of germs (called a biofilm). This layer helps protect the germs from being killed by disinfectants. Utilities may temporarily switch from chloramine to chlorine disinfection to help remove this slime layer.

Chloramine
A group of chemical compounds that contain chlorine and ammonia. The type of chloramine used to kill germs in drinking water is called monochloramine.

Switching to chloramine
Chlorine gets used up quickly in water. Sometimes there is not enough chlorine left to keep killing germs by the time the water reaches your tap. Utilities may switch to chloramine because it can keep killing germs in water pipes longer than chlorine.
Chloramine also makes fewer disinfection byproducts than chlorine.

Disinfection byproducts are chemicals made when chlorine or chloramine come into contact with dirt or other materials in water. At high enough levels, disinfection byproducts can cause health problems over time.

Chlorine or chloramine levels up to 4 milligrams per liter (mg/L), or 4 parts per million (ppm), are considered safe in drinking water. These low levels kill harmful germs and are unlikely to make people sick

About Water Disinfection with Chlorine and Chloramine

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Towns without Chlorine Disinfection

- Common practice in rural areas
- Creates more favorable conditions for many different bacteria to grow
- Makes remediation more difficult
  - Facilities can't just chlorinate with over-the-counter bleach
  - Facilities face increased emphasis on:
    - Sediment
    - Temperature
    - Water Age
- Hyperchlorination less favorable to achieve results
  - Potential for superheating as a replacement strategy
    - Opens facility to increased scalding opportunities

Safe Drinking Water Search for the State of Nebraska

<< Return

This search allows you to retrieve Safe Drinking Water data from the SDWIS database in Envirofacts. You may select among five possible search options: water system name, county name, city name, population served, and/or system status.

Disclaimer: Some data may have been entered into SDWIS without a "county name" or "city name". In those cases, you will either need to search by "Water System Name" (check your water bill for that information), or create a STATE search (click on the "Search" button without any other entries), and select your water system from that list.

Water System Search

Enter a complete or partial Water System Name. If a partial name is entered, select the "Beginning With" or "Containing" criteria.

Water System Name:

(•) Beginning With ( ) Exact Match ( ) Containing

County Search

Use the pull-down menu to select the name of the county. EPA does not have county information for all water systems and a search by county may not produce all systems within that county. Only counties with at least one associated water system are listed.

County Name:

SDWIS Links

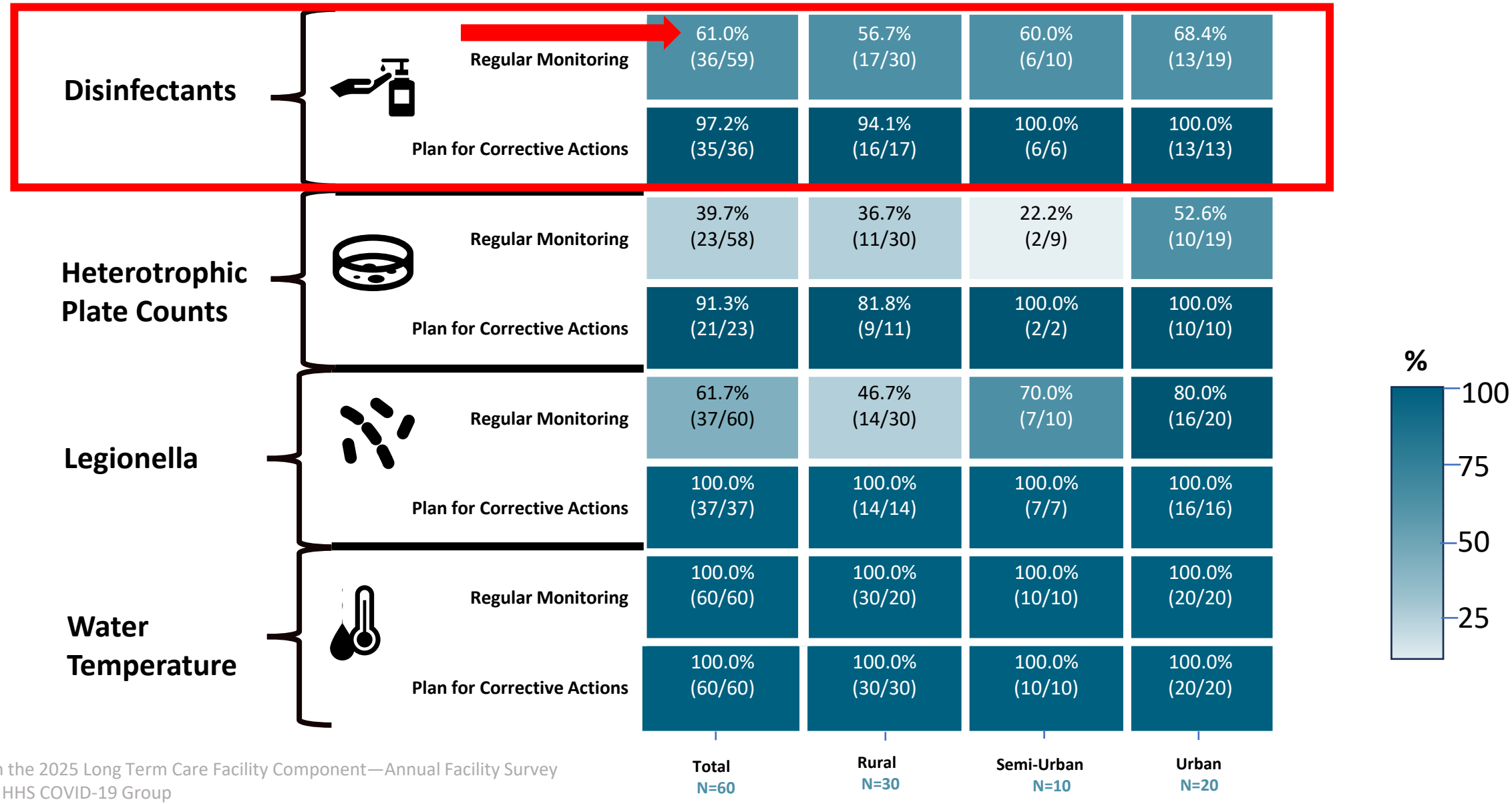
- Overview
- Search
- Model
- Law
- SDWIS Search User Guide
- Contact Us
- Office of Ground Water and Drinking Water Home

System Data Searches

- Multisystem
- BR
- Brownfields/Cleanups
- Cleanups
- ECHO/IDEA
- FRS
  - Organization Search
- Greenhouse Gas
- ICIS-AIR
- ICIS-NPDES

Safe Drinking Water Search for the State of Nebraska

NHSN LTC Core Water Management Indicators
Compliance Rates and Sample Sizes (n/N) by Geographic Group



Data is from the 2025 Long Term Care Facility Component—Annual Facility Survey
NE Dept. of HHS COVID-19 Group

Mitigation with Disinfection

Utilizing Municipal Disinfectant:

- Simplest and safest approach for a facility
- Reduces regulation burden
- Most cost-effective approach
- Communication and understanding with municipal is critical
  - Good working relationship can help should remediation be needed

Supplemental Disinfection:

- Must use EPA-approved disinfectants
  - Chlorine, chloramine, etc.
- Chemicals must be NSF (National Sanitation Foundation) 60 certified for potable use
  - Can’t just add bleach to your system
- Least cost-effective approach with increased risk
  - **Facility may become a public water system (PWS) and therefore subject to Nebraska Department of Environment and Energy (NDEE) regulations**
- Requires more hands-on data management and monitoring

EPA regulations prohibit chlorine levels above 4.0 PPM in potable drinking water

Disinfection Documentation

Documentation Considerations:

- Control locations
- Control range (0.20-4.0 ppm)
- Monitoring method (manual testing)
- Frequency measure needs to be monitored
- Corrective actions and how documentation is stored

Buildings with supplemental disinfection	Type of system (e.g., chlorine, chlorine dioxide, copper-silver)	Date installed	Describe any maintenance in the past year
Building A	chlorine dioxide	01/2015	Biannual cleaning and service. Consultant checks chemical levels 1x/week

Component	Response
Type of water system used	Ex: public, facility-owned well, public-owned well
Name of water supplier	
Water supplier contact information	
Type of disinfection system	Ex: chlorine, monochloramine
Has water treatment changed in the last 6 months? If yes, explain.	Ex: No
Have there been any pressure drops, boil water advisories, or water disruptions in the past 6 months? If yes, explain.	Ex: No

CSTE Water Management Program Template

Filtering & Flushing

- Used to reduce water age and stagnation
- Considerations:
  - Inorganic elements and compounds can create scale
    - More abundant if source is well water
    - Scale makes biofilm growth more possible
  - Filtration helps prevent inorganic accumulation
  - Flushing replaces old turbid water with new oxidized water
    - Moves residual disinfectant
  - Effective flushing can be minutes to hours – depending on system factors

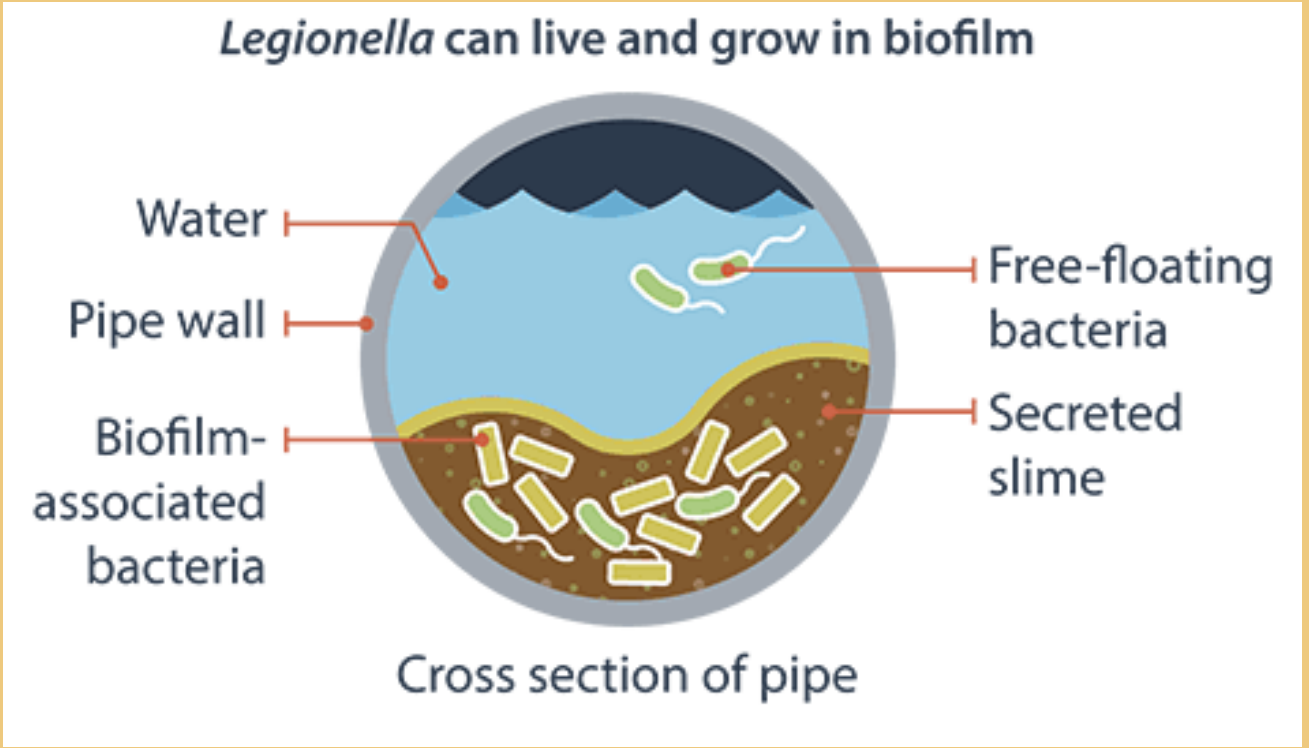


Image from: Public Health Strategies for Legionella Control

CSTE Water Management Program Template

Date	Time	Staff Initials	Room Number	Floorplan Style	Hot Flush?	Cold Flush?	Toilet Flush?	Cleaned?

Flushing Documentation

Documentation Considerations:

- Control locations (faucets, showers, etc.)
- Control range (10-15 minutes or based on disinfectant numbers)
- Monitoring method (manual or automated)
  - Special considerations (vacant areas)
- Frequency measure needs to be monitored
- Corrective actions and how documentation is stored

CSTE Water Management Program Template

Lesson 3:

Water Management Programs aren't being followed

(or don't exist)

Water Management Program

[Facility Name]

[Facility Address]

[Facility Phone Number]

Updated [Date]

General Building

Construction/Water Service Event Documentation

Component	Response
Name of new or affected building	
Date construction/event began	
Completion date/expected completion date	
Date water service began or was restarted	
Relationship to existing potable water system	
Number of stories involved	
Was temporary water service provided to the construction area? If yes, explain.	
Was jackhammering or piledriving used?	
Did the potable water change in terms of taste and/or color?	
Before occupying any new/remodeled area, was a commissioning/walk-thru process undertaken?	
Do you have a Standard Operating Procedure for shutting down, isolating, and refilling/flushing water service areas that were impacted?	
In the past 6 months, have there been any interruptions of service, potable water malfunctions, or nearby water main breaks or repairs?	

Facility Building Description

Building Name	Ex: Building 1	Ex: Building 2
Address/Location		
Year built		
Number of floors		
Number of water risers		

99

Total capacity	
Usual temperature setting	
What is the maximum hot water temperature at the point of delivery permitted by state/local regulations?	
Are hot water temperatures ever measured at the points of us? If yes, use Table 23 to record.	

Potable Water System Monitoring

Component	Response
Are cold water temperatures ever measured at the points of use? If yes, use Table 23 to record.	
Do you have a supplemental disinfection system? If yes, use Table 24 to describe.	
Are potable water disinfectant levels ever measured at the points of use? If yes, use Table 23 to record.	
Are potable water pH levels ever measured at the points of use? If yes, use Table 23 to record.	
Do you perform routine flushing of the water system?	
Do you perform routine *Legionella* testing?	

Potable Water System Monitoring Frequency

Activity Title	Description of Service	Frequency (e.g. daily, weekly, monthly, quarterly, annually)
System Flushing		
Temperature Monitoring		
Disinfectant Monitoring		
pH Monitoring		
Legionella Testing		

101

[CSTE WATER MANAGEMENT PROGRAM TEMPLATE]

Importance of Water Management Programs (WMP) for Legionella Prevention

- Water management programs identify hazardous conditions and take steps to minimize the growth and transmission of Legionella and other waterborne pathogens in building water systems.
  - They are crucial and the main component in addressing Legionella in facility water systems

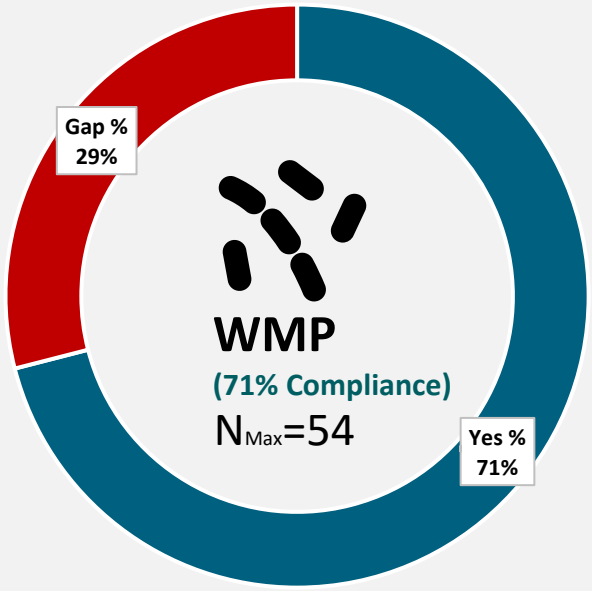
- Nebraska ICAP assessments incorporate WMP evaluations*:
  - 25% of LTCFs assessed did not have a WMP in place
  - 72% of WMPs had specific testing protocols and acceptable control measure ranges
    - Includes testing documentation and corrective actions taken

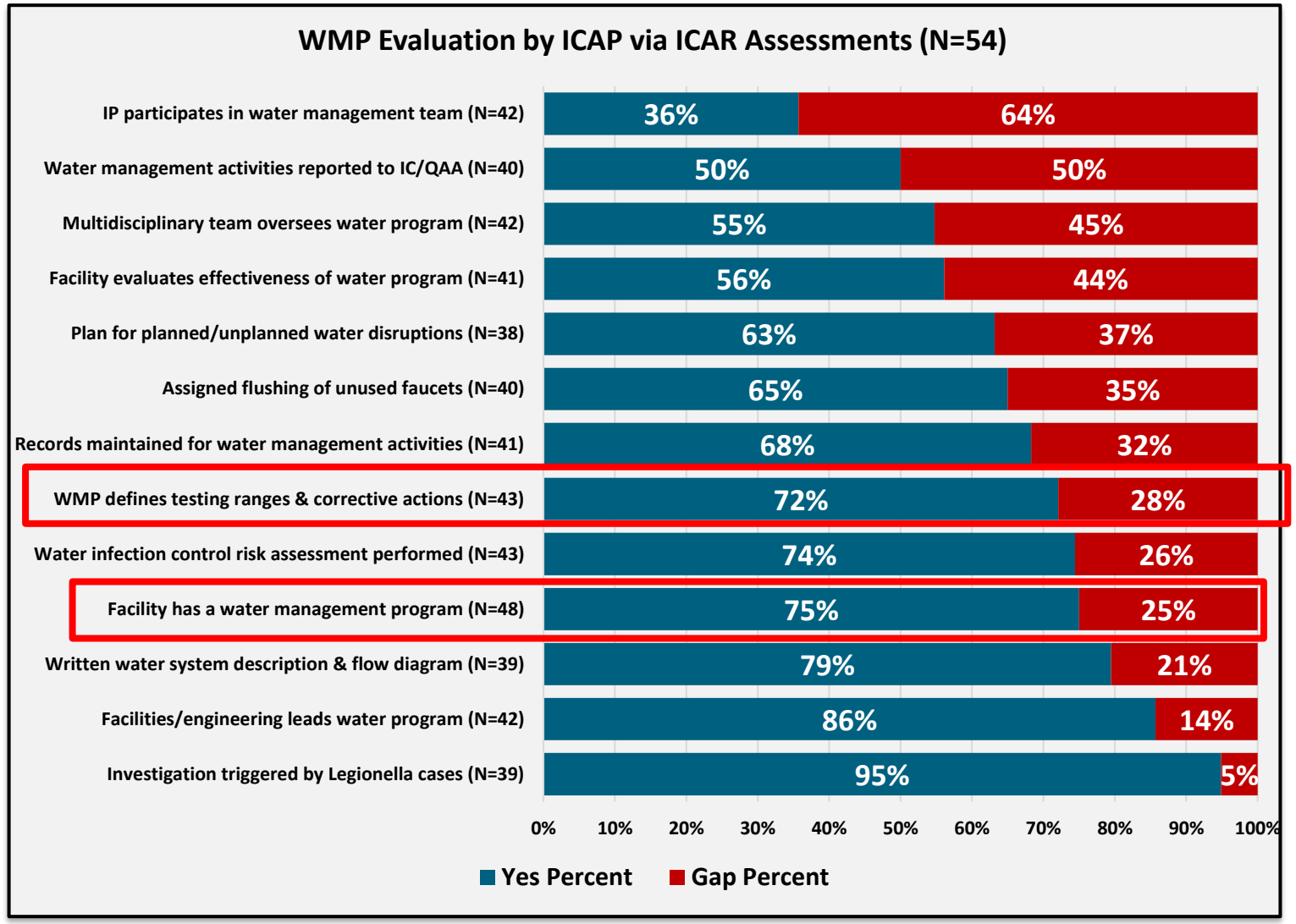
- Indicative of a need to further educate about WMP and their importance for clean and safe water management.
- Important: A WMP is not just good for legionella but for all waterborne illnesses and safe drinking water as well

* Data provided by Nebraska ICAP from June 2022 – July 2026.

WMP Evaluation: ICAP LTCF ICAR Assessments

Overall Performance





- Excludes N<15
- Date Range: 6/22-7/26

[Infection Control Assessment and Response (ICAR) Tool for General Infection Prevention and Control (IPC) Across Settings Module 11: Water Exposure Facilitator Guide]

Elements of a Water Management Program

1

Team/Goal Establishment

Establish a water management program team.

2

Water System Design

Describe the building water system using text and flow diagrams.

3

System Analysis

Identify areas where Legionella could grow and spread.

4

Control Measures

Decide where control measures should be applied and how to monitor them.

5

Intervention

Establish ways to intervene when control limits are not met.

6

Program Performance

Verification and validation the program works and is effective

7

Documentation

Document and communicate all program activities.

CSTE WATER MANAGEMENT PROGRAM TEMPLATE

CMS Regulatory Authorities

Pertinent regulations include, but are not limited to, the following

42 CFR §482.42 for hospitals: "The hospital must provide a sanitary environment to avoid sources and transmission of infections and communicable diseases. There must be an active program for the prevention, control, and investigation of infections and communicable diseases."

42 CFR §483.80 for skilled nursing facilities and nursing facilities: "The facility must establish and maintain an infection prevention and control program designed to provide a safe, sanitary, and comfortable environment and to help prevent the development and transmission of communicable diseases and infections."

42 CFR §485.635(a)(3)(vi) for critical access hospitals (CAHs): CAH policies must include: "A system for identifying, reporting, investigating and controlling infections and communicable diseases of patients and personnel."

State Operations Manual Appendix PP - Guidance to Surveyors for Long Term Care Facilities
State Operations Manual Appendix A - Survey Protocol, Regulations and Interpretive Guidelines for Hospitals and Psychiatric Hospitals
State Operations Manual Appendix W - Survey Protocol, Regulations and Interpretive Guidelines for Critical Access Hospitals (CAHs) and Swing-Beds in CAHs

CMS State Operations Manual-LTCF

Water Management

The bacterium Legionella can cause a serious type of pneumonia called Legionnaires' Disease in persons at risk, such as those who are at least 50 years old, smokers, or with underlying medical conditions such as chronic lung disease or immunosuppression. Legionella can grow in parts of building water systems that are continually wet (e.g., pipes, faucets, water storage tanks, decorative fountains), and certain devices can spread contaminated water droplets via aerosolization.

Legionellosis outbreaks are generally linked to locations where water is held or accumulates and pathogens can reproduce, including those found in long-term care facilities. Transmission from these water systems to humans occurs when the water is aerosolized (i.e., converted into a spray/mist in the air). Legionella is less commonly spread by aspiration of drinking water or ice.

Facilities must be able to demonstrate its measures to minimize the risk of Legionella and other opportunistic pathogens in building water systems such as by having a documented water management program. Water management must be based on nationally accepted standards (e.g., ASHRAE (formerly the American Society of Heating, Refrigerating, and Air Conditioning Engineers), CDC, U.S. Environmental Protection Agency or EPA) and include:

- An assessment to identify where Legionella and other opportunistic waterborne pathogens (e.g., Pseudomonas, Acinetobacter) could grow and spread; and
- Measures to prevent the growth of opportunistic waterborne pathogens (also known as control measures), and how to monitor them.

Examples of an assessment include a description of the building water systems using text and flow diagrams for identification. Additionally, control measures may include visible inspections, use of disinfectant, and temperature (that may require mixing valves to prevent scalding). Monitoring such controls include testing protocols for control measures, acceptable ranges, and documenting the results of testing. Water management should also include established ways to intervene when control limits are not met.

An industry standard calling for the development and implementation of water management programs in large or complex building water systems to reduce the risk of legionellosis was published by ASHRAE. The CDC and its partners developed a toolkit to facilitate implementation of this ASHRAE Standard.

Resources are available to develop and implement a water management program, such as:

- "The ASHRAE Standard 188- Legionellosis: Risk Management for Building Water Systems" https://www.ashrae.org;
- The CDC toolkit to facilitate implementation of the ASHRAE Standard titled "Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings: A Practical Guide to Implementing Industry Standards" https://www.cdc.gov/legionella/wmp/toolkit/index.html; and
- The EPA's "Technologies for Legionella Control in Premise Plumbing Systems: Scientific Literature Review" is available at https://www.epa.gov/ground-water-and-drinking-water/technologies-legionella-control-premise-plumbing-systems.

At this time, CMS does not require water cultures for Legionella or other opportunistic waterborne pathogens as part of routine program validation, although there may be instances when it is needed (e.g., a case of healthcare-associated legionellosis or a potential outbreak of legionellosis in the facility).

The facility should contact the local/state public health authority if there is a case of healthcare-associated legionellosis or an outbreak of an opportunistic waterborne pathogen causing disease. The facility must follow public health authority recommendations which may include, but is not limited to, remediating the pathogen reservoir and adjusting control measures as necessary. The SA should work with local/state public health authorities, if possible, to determine if the water management program was inadequate to prevent the growth of Legionella or other opportunistic waterborne pathogens and whether the facility implemented adequate prevention and control measures once the issue was identified.

[Page 822-823 of CMS State Operations Manual]

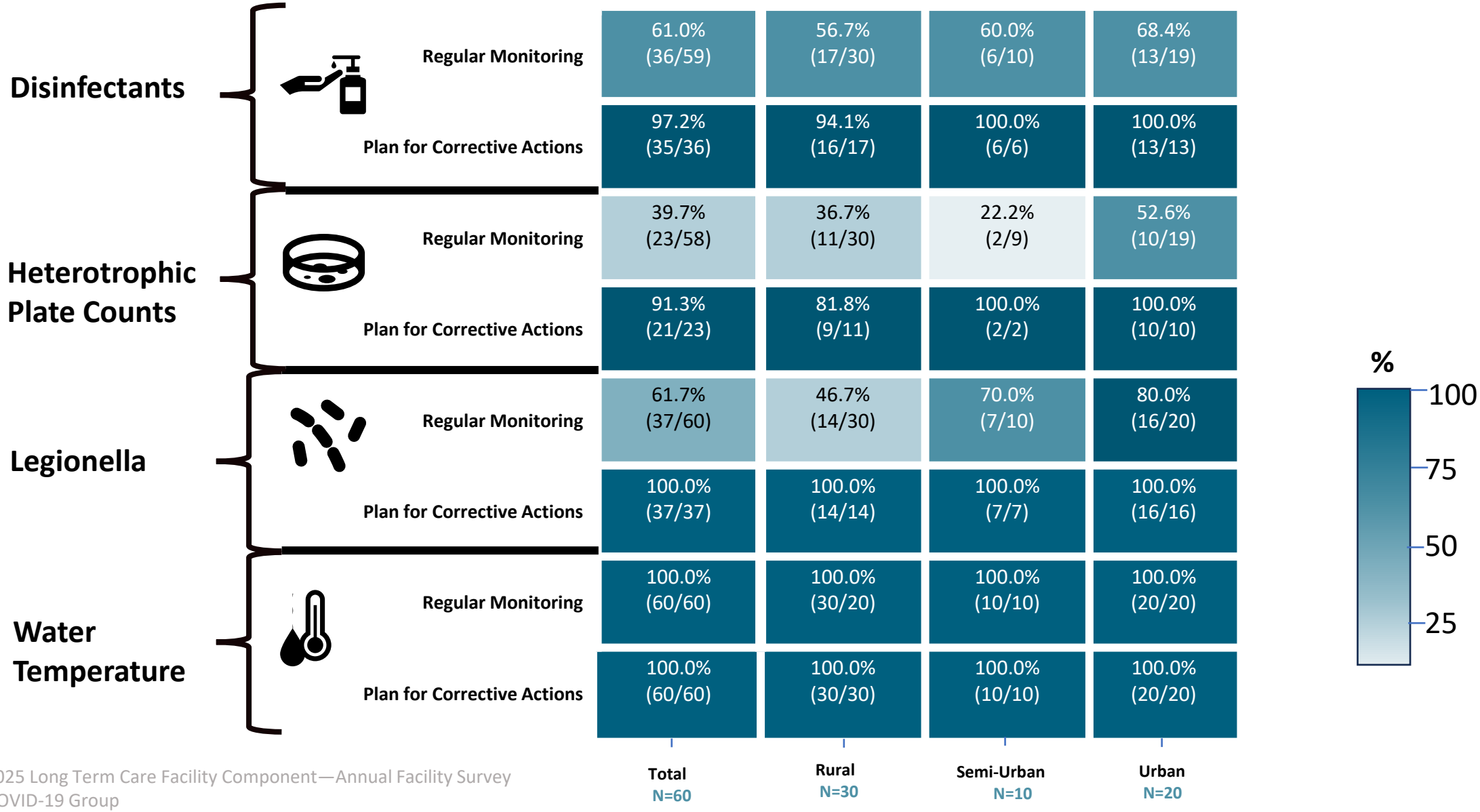
Control measures may include:

- visible inspections
- use of disinfectant
- temperature (that may require mixing valves to prevent scalding).

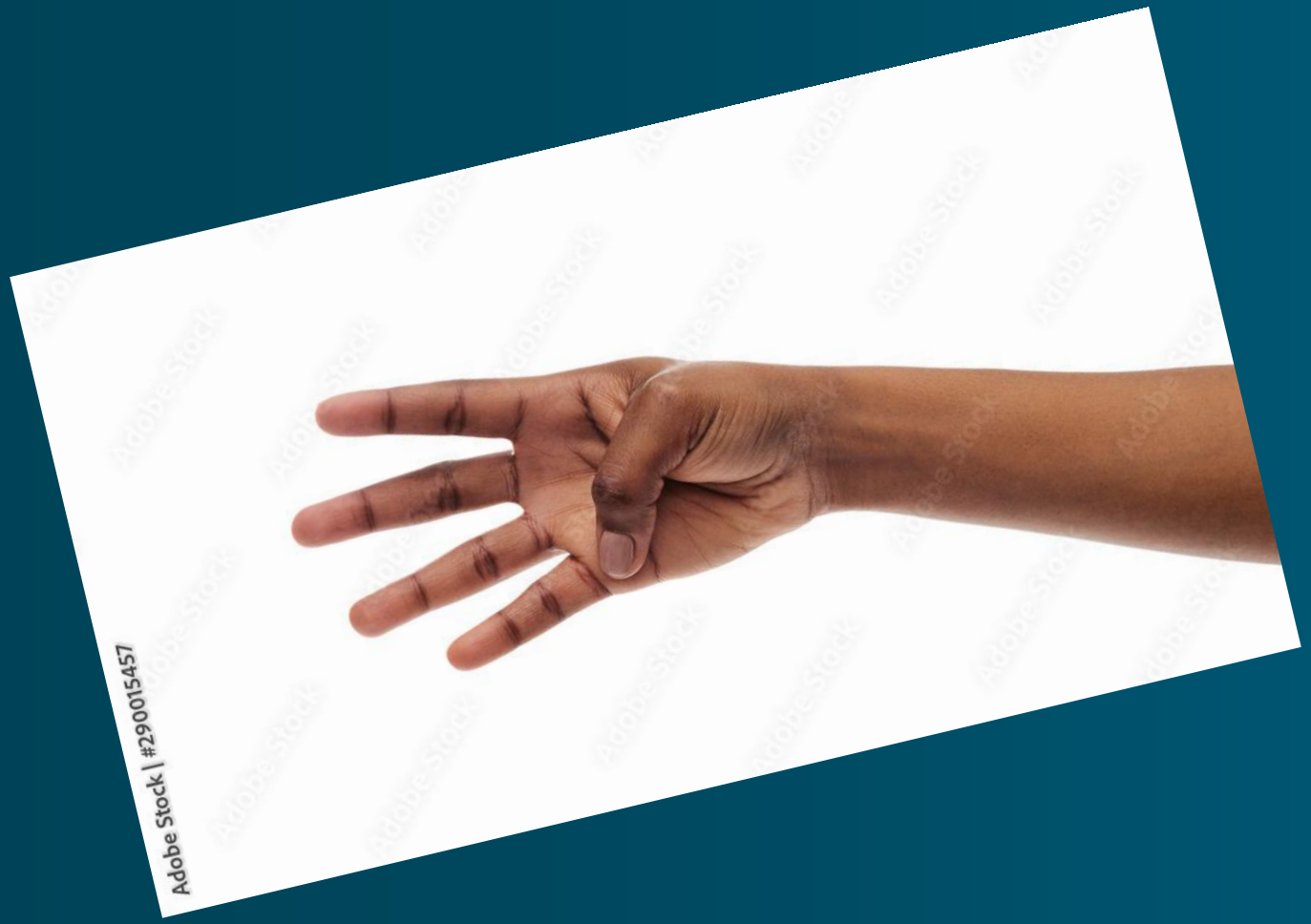
Monitoring such controls include testing protocols for control measures, acceptable ranges, and documenting the results of testing.

Water management should also include established ways to intervene when control limits are not met.

NHSN LTC Core Water Management Indicators
Compliance Rates and Sample Sizes (n/N) by Geographic Group



Data is from the 2025 Long Term Care Facility Component—Annual Facility Survey
NE Dept. of HHS COVID-19 Group



Lesson 4:

Be Aware that Scalding Prevention Measures Targets Temperature where Legionella Can Thrive

Nebraska LB 264 Revised Statute 71-1569

"all bathtubs and showers installed in buildings which contain more than one dwelling unit **after August 30, 1987**, shall be equipped with either a pressure balancing or thermostatic-mixing scald prevention device which is designed and installed to prevent (a) sudden unanticipated changes in the temperature of the water delivered and (b) the temperature of the water delivered from exceeding ***one hundred fifteen*** degrees Fahrenheit."

Nebraska LB 264 Revised Statute 71-1569

Temperature Control Measures for Legionella

> 157°F	Disinfection range. Legionella death imminent.
120-157°F	Legionella growth slows as temperature increases. Legionella death begins to occur with faster death at higher temperatures. Risk of scalding at these temperatures.
68-120°F	Legionella growth range. Optimal growth noted between 85-108°F. Legionella *pneumophila* optimal growth between 95-99°F.
< 68°F	Legionella growth is minimized, but not absent. Dormancy likely.

115

Considerations:

- Hot water distributions – post mixing valves – are typically within ideal growth range
- Increased heat reduce residual disinfectant (chlorine) levels
- Temperatures >120°F can scald if in contact with skin
- What is hot closer to the water heater might not be the case the more distal away
- Contact time – how long hot water is maintained for a set period

Temperature Documentation

Documentation Considerations:

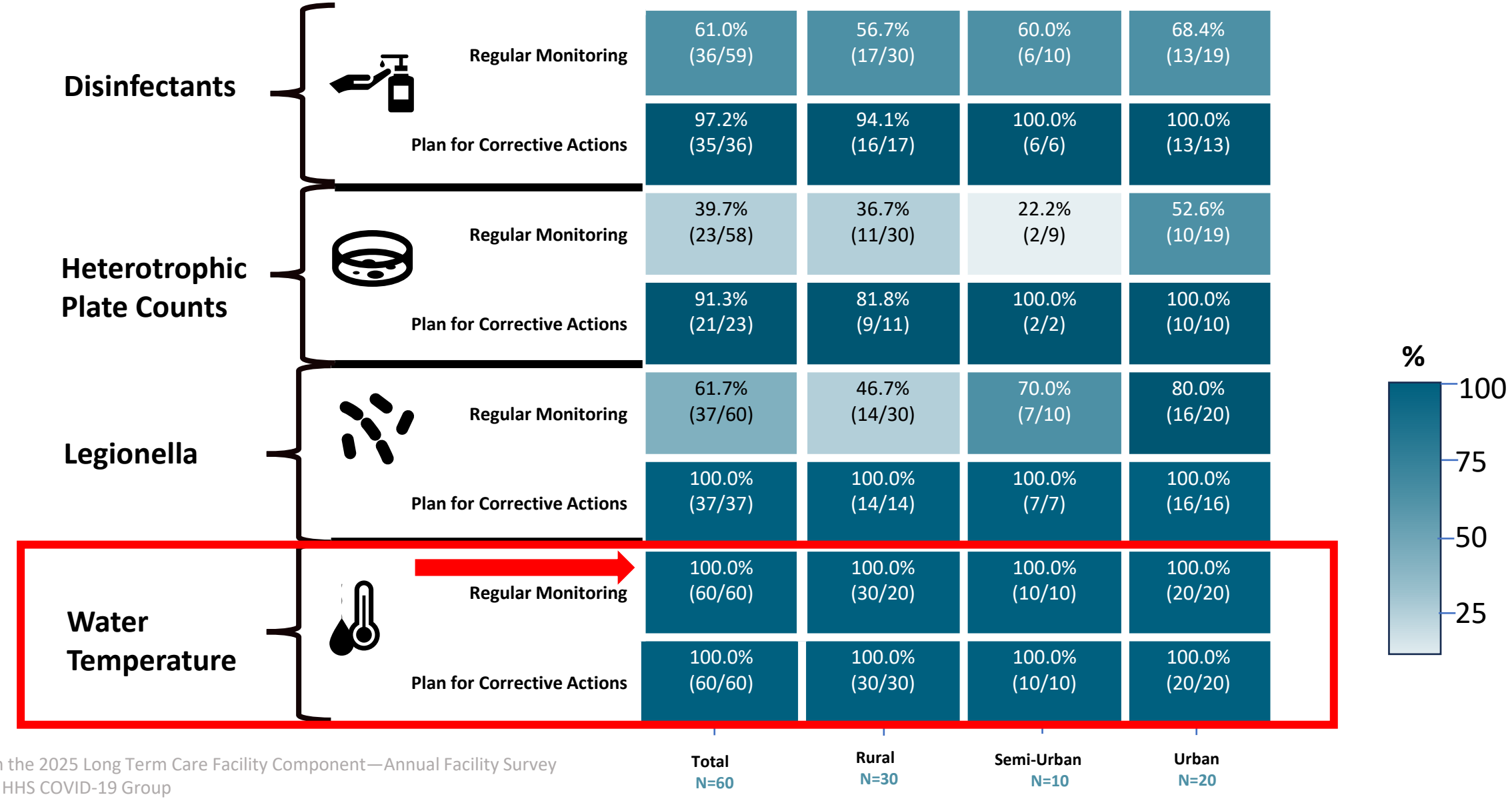
- Control locations (heater, etc.)
- Control range (at or above 140°F)
- Monitoring method (manual or automated)
- Frequency measure needs to be monitored
- Corrective actions and how documentation is stored

[CSTE Water Management Program Template]

Date	Location/Source	Time	pH	Temp (F)	Cl (mg/L)	Flushing (Y/N)	Staff Initials	*Legionella* result

Component	Response
Are cisterns and/or water storage holding tanks used to store potable water before it is heated? If yes, explain.	No
Is there a recirculation system? If yes, describe where it runs and delivery/return temperatures if they are measured.	No
Are thermostatic mixing valves (TMV) used? If yes, describe where they are located.	Yes. TMV's are located in every sink faucet.
Type of system	Ex: instantaneous heater, hot water heater, solar heating…etc.
Describe the manufacturer details about the system. Include manufacturer, serial number and date of installation.	
Total capacity	gallons
Usual temperature setting	145°F
What is the maximum hot water temperature at the point of delivery permitted by state/local regulations?	Ex: 120°F
Are hot water temperatures ever measured at the points of us? If yes, use Table 23 to record.	Yes

NHSN LTC Core Water Management Indicators
Compliance Rates and Sample Sizes (n/N) by Geographic Group



Data is from the 2025 Long Term Care Facility Component—Annual Facility Survey
NE Dept. of HHS COVID-19 Group

Lesson 5:

More than one kind of Legionella can cause human disease

(and be found in the environment)

Types of Legionella

Legionella is a gram-negative bacilli naturally found in freshwater environments including lakes, rivers, ponds, etc.

- Currently, more than 60 species of legionella are recognized.
- *Legionella pneumophila* is most commonly associated with disease including:
    - 15 serogroups
    - *L. pneumophila* serogroup *1* is most common.

Others: less frequent, occasional causes of legionellosis

- L. pneumophila serogroups 2-15
- L. micdadei
    - Sometimes referred to as the "Pittsburgh pneumonia agent."
- L. dumoffi
- L. longbeachae
- L. bozemanii

[John Hopkins Medicine Legionella Species]

Non-*Legionella pneumophila* serogroup 1 pneumonia: Diagnosis of a nosocomial legionellosis with the Biofire Pneumonia plus panel

Camille Courboules [a], Nathalie Dournon [b], Christine Lawrence [c], Latifa Noussair [d], Ghislaine Descours [e], Valérie Sivadon-Tardy [a], Sophie Jarraud [e], Jean-Louis Herrmann [d], Jean-Louis Gaillard [a], Florence Espinasse [f], Faten El Sayed [a], Anne-Laure Roux [a,*]

▸ Author information ▸ Article notes ▸ Copyright and License information

PMCID: PMC8967999 PMID: 35369568

https://pmc.ncbi.nlm.nih.gov/articles/PMC8967999/

▸ Microorganisms. 2021 Jan 31;9(2):291. doi: 10.3390/microorganisms9020291

Legionellosis Caused by Non-*Legionella pneumophila* Species, with a Focus on *Legionella longbeachae*

Stephen T Chambers [1,*], Sandy Slow [1], Amy Scott-Thomas [1], David R Murdoch [1]

Editor: Janet E Stout[1]

▸ Author information ▸ Article notes ▸ Copyright and License

PMCID: PMC7910863 PMID: 33572638

https://pmc.ncbi.nlm.nih.gov/articles/

INVITED ARTICLE: EMERGING INFECTIONS

Check for updates

Infection Due to *Legionella* Species Other Than *L. pneumophila*

Robert R. Muder, Yu L. Victor

Authors and Affiliations >

Clinical Infectious Diseases 35(8):p 990-998, October 15, 2002. | *DOI:* 10.1086/342884

https://www.ovid.com/journals/clid/abstract/10.1086/342884~infection-due-tolegionellaspecies-other-thanl-pneumophila?redirectionsource=fulltextview

Original Article

Bacteriology

Dual infections with different *Legionella* strains

G. Wewalka [a], D. Schmid [a], T.G. Harrison [b], S.A. Uldum [c], C. Lück [d], on behalf of the European Society of Clinical Microbiology Infectious Diseases Study Group for Legionella Infections (ESGLI)

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https://doi.org/10.1111/1469-0691.12311

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i/S1198743X14602111

First Case of Legionnaire's Disease Caused by *Legionella anisa* in Spain and the Limitations on the Diagnosis of *Legionella* non-*pneumophila* Infections

Lucianna Vaccaro, Fernando Izquierdo, Angela Magnet, Carolina Hurtado, Mireya A. Salinas, Thiago Santos Gomes, Santiago Angulo, Santiago Salso, Jesús Pelaez, Maria Isabel Tejeda, Almudena Alhambra, Carmen Gómez, Ana Enríquez, [...], Carmen del Aguila [view all]

Published: July 21, 2016 • https://doi.org/10.1371/journal.pone.0159726

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0159726

Diagnostic Testing for Legionella:

- Recommended diagnostic tests
  - Culture of lower respiratory secretions (e.g., sputum, bronchoalveolar lavage) on selective media (Buffered Charcoal Yeast Extract Agar [BCYE])
  - Legionella urinary antigen test (UAT)

Table 1. Available diagnostic tests for *Legionella infection*

Test	Sensitivity	Specificity	Advantages	Disadvantages
Culture	20–80%	100%	Detects all species and subgroups; can compare clinical and environmental isolates	Technically difficult; slow to grow (>5 days); sensitivity dependent on technologic skill; requires BCYE agar
Urinary Antigen	70–100%[1]	95–100%	Rapid (same-day)	Only detects Lp1; does not allow for molecular comparison of clinical and environmental isolates
Serology (Paired)	80–90%	>99%	Possible to detect species and serogroups other than Lp1	Requires paired sera collected at acute onset to 2 weeks and 3–6 weeks later; 5–10% of the population has a titer of ≥1:256
Direct Fluorescent Antibody (DFA)	25–75%	≥95%	Can be performed on pathologic specimens (e.g. lung tissue); possible to detect species and serogroups other than Lp1	Technically difficult; reagents may not be readily available
Polymerase Chain Reaction (PCR)	95–99%	>99%	Can be performed on pathologic specimens (e.g. lung tissue); rapid; possible to detect species and serogroups other than Lp1	Assays vary by laboratory; may not be commercially available in the United States

[1]Sensitivity for *Legionella pneumophila* serogroup 1 (Lp1)

Legionella- Culture

LEGIONELLA CULTURE

Start Date	[redacted]		Order Details
Start Time	[redacted]	Result Date	
Ordering Clinician	[redacted]	Result Time	
Specimen	SPUT	Result Status	Corrected
Collection Date	[redacted]	Placer ID	[redacted]
Collection Time	16:59	Last Updated	
Date Lab Received	[redacted]	Last Update Time	
Specimen Received Time	15:10	Age at Time of Test	[redacted]

Test Item	Flag	Value	Units	Reference Range	Test Item Stat
SPECIMEN SOURCE XXX		Sputum			Final
ANNOTATION COMMENT IMP		None			Final
MICROORGANISM/AGENT XXX	Abnormal	Few Legionella pneumophila			Corrected
Report Status		[redacted] Final			Final

Urine Antigen Testing

Advantages:

- Rapid
- Confirmatory laboratory evidence

Disadvantages:

- Can only be used to detect L. pneumophila serogroup 1
- Does not allow for molecular comparison to clinical or environmental isolates

Test Item	Flag	Value	Units	Reference Range	Test Item Status	C
Legionella Ag Ur Ql	Abnormal	Positive		Negative	Final	
S pneum Ag Ur Ql		Negative		Negative	Final	F

Test Item	Flag	Value	Units	Reference Range	Test Item Status
Legionella pneumophila serogroup 1 Ur Ag		POSITIVE		Negative	Final

Diagnostic Testing for Legionella:

Example: Urine Antigen Test
Strep Pneumoniae and Legionella

Results Detail

STREP PNEUMO / LEGIONELLA URINE ANTIGEN

Start Date	[redacted]	Result Date	[redacted]
Start Time	18:00	Result Time	18:00
Ordering Clinician	[redacted]	Result Status	Final
Specimen		Placer ID	[redacted]
Collection Date	[redacted]	Last Updated	
Collection Time	14:28	Last Update Time	
Date Lab Received		Age at Time of Test	[redacted]
Specimen Received Time	00:00		

Order Details | Trend

Test Item	Flag	Value	Units	Reference Range	Test Item Status	Comments	Sensitivities	Other Flags	Collection Date
Legionella Ag Ur Ql		Negative		Negative	Final				[redacted]
S pneum Ag Ur Ql		Negative		Negative	Final	Presumptive negative for pneumococcal pneumonia, suggesting no current or recent pneumococcal infection			

Test Item	Flag	Value	Units	Reference Range	Test Item Status	Comments	Sensitivities	Other Flags	Collection Date
Legionella Ag Ur Ql	Abnormal	Positive		Negative	Final			Abnormal	[redacted]
S pneum Ag Ur Ql		Negative		Negative	Final	Presumptive negative for pneumococcal pneumonia, suggesting no current or recent pneumococcal infection			

Diagnostic Testing for Legionella: PCR Panels

Collection Date	[redacted]	Last Updated	[redacted]
Collection Time	16:09	Last Update Time	
Date Lab Received		Age at Time of Test	[redacted]
Specimen Received Time	00:00		

Test Item	Flag	Value	Units	Reference Range	Test Item Status
A baumannii DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
E cloac comp DNA Bld Pos NAA+non-probe		Not detected			Final
Haem influ DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
Klebsiella sp DNA Bld Pos Q1 NAA+non-prb		Not detected			Final
K oxytoca DNA BAL NAA+non-prb-NCncRng					
K pneumon DNA Bld Pos Q1 NAA+non-probe					
M catarrhalis DNA BAL NAA+non-prb-NCncRng					
L pneumo DNA Lower Resp Q1 NAA+non-probe	Abnormal	DETECTED		NotDetected	Final
Proteus sp DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
P aeruginosa DNA Bld Pos NAA+non-probe		Not detected			Final
S marcescens DNA Bld Pos NAA+non-probe		Not detected			Final
S aureus DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
Gp B Strep DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
S pneum DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
S pyo DNA Bld Pos Q1 NAA+non-probe		Not detected			Final
L pneumo DNA Lower resp Q1 NAA+non-probe	Abnormal	Detected		NotDetected	Final

The Pneumonia Testing Menu

Discover the 33 targets on the BIOFIRE PN Panel, including eight viruses, 18 bacteria, and seven antimicrobial resistance genes associated with lower respiratory tract infections.

Sample Type
BAL-like: (including mini-BAL)
Sputum: (including endotracheal aspirate)

Performance
BAL-like: 96% sensitivity and 98.3% specificity
Sputum: 96.3% sensitivity and 97.2% specificity

BACTERIA (SEMI-QUANTITATIVE)

- *Acinetobacter calcoaceticus-baumannii* complex
- *Enterobacter cloacae* complex
- *Escherichia coli*
- *Haemophilus influenzae*
- *Klebsiella aerogenes*
- *Klebsiella oxytoca*
- *Klebsiella pneumoniae* group
- *Moraxella catarrhalis*
- *Proteus* spp.
- *Pseudomonas aeruginosa*
- *Serratia marcescens*
- *Staphylococcus aureus*
- *Streptococcus agalactiae*
- *Streptococcus pneumoniae*
- *Streptococcus pyogenes*

VIRUSES

- Adenovirus
- Coronavirus
- Human metapneumovirus
- Human rhinovirus/enterovirus
- Influenza A virus
- Influenza B virus
- Parainfluenza virus
- Respiratory syncytial virus

ATYPICAL BACTERIA (QUALITATIVE)

- *Chlamydia pneumoniae*
- *Legionella pneumophila*
- *Mycoplasma pneumoniae*

ANTIMICROBIAL RESISTANCE GENES

Carbapenemases

- NDM
- OXA-48-like
- VIM

ESBL

- CTX-M

Methicillin resistance

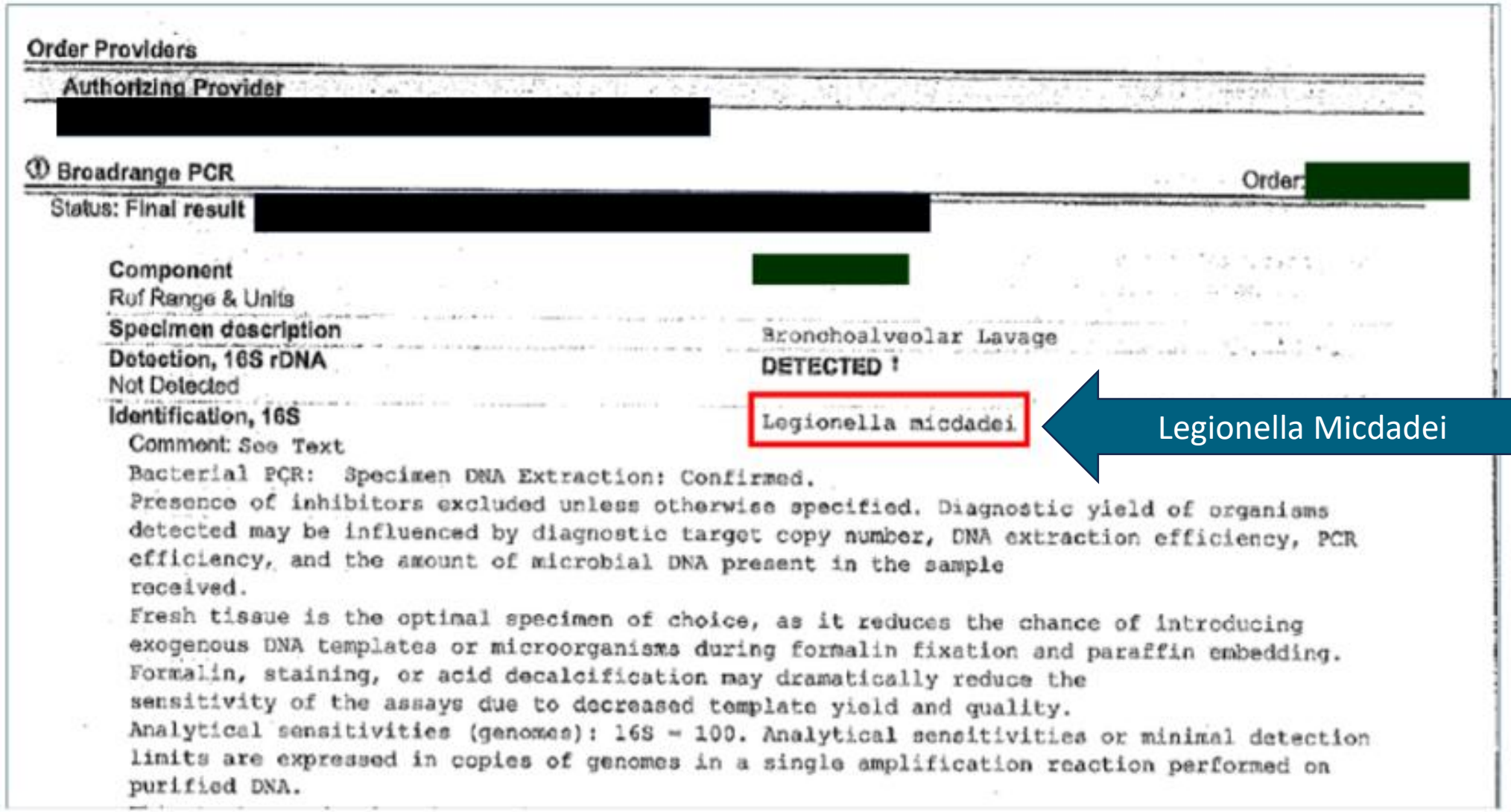
- *mecA/C* and MREJ (MRSA)

Can pick up any serotype

Diagnostic Testing for Legionella

BIOFIRE® FILMARRAY® Pneumonia (PN) Panels

Legionella- Other PCR Test



Order Providers

Authorizing Provider [redacted]

① Broadrange PCR Order: [redacted]

Status: Final result [redacted]

Component	[redacted]
Ref Range & Units	
Specimen description	Bronchoalveolar Lavage
Detection, 16S rDNA	DETECTED !
Not Detected	
Identification, 16S	Legionella micdadei

Comment: See Text

Bacterial PCR: Specimen DNA Extraction: Confirmed.
Presence of inhibitors excluded unless otherwise specified. Diagnostic yield of organisms detected may be influenced by diagnostic target copy number, DNA extraction efficiency, PCR efficiency, and the amount of microbial DNA present in the sample received.
Fresh tissue is the optimal specimen of choice, as it reduces the chance of introducing exogenous DNA templates or microorganisms during formalin fixation and paraffin embedding. Formalin, staining, or acid decalcification may dramatically reduce the sensitivity of the assays due to decreased template yield and quality.
Analytical sensitivities (genomes): 16S - 100. Analytical sensitivities or minimal detection limits are expressed in copies of genomes in a single amplification reaction performed on purified DNA.

Legionella Micdadei

Environmental Testing for Legionella- Negative Results

Mostly Clear Labs, LLC
404 Hardwater Avenue
Omaha, NE 68114
402-867-5309

Client: Riverbend Healthcare Campus
C/O: Ms. Ripley Hydration
RE: Water Testing 4/5/2026

Date of Sampling: 4/5/2026
Date of Receipt: 4/6/2026
Date of Report: 4/20/2026

QUANTITATIVE LEGIONELLA REPORT

Sample ID: Location	Room 106 Mermaid Lane		Room 108 Mermaid Lane		Room 113 Mermaid Lane	
Comments (see below)	Patient Room Sink		Patient Room Shower		Patient Room Sink	
Lab ID- Version †	22201		22202		22203	
Analysis Date	4/20/2026		4/20/2026		4/20/2026	
Sample Type	Water Sample		Water Sample		Water Sample	
Volume (mL)	200		200		200	
Reporting Limits	1 mL		1 mL		1 mL	
Detection Limits †	0.1		0.1		0.1	
Analytical Sensitivity †	0.1		0.1		0.1	
	raw ct.	cfu*/unit	raw ct.	cfu*/unit	raw ct.	cfu*/unit
L. pneumophila serotype 1						
L. pneumophila serotype 2-15						
Other Legionella species						
§TOTAL Legionella	ND	< 0.1	ND	< 0.1	ND	< 0.1

*cfu = colony forming units ND = none detected

Comments:

Sample Volume and Detection Limits
For water testing, the volume submitted may influence the reporting threshold and analytical sensitivity. A minimum sample volume of 200 mL is recommended for potable water evaluations, particularly in facilities serving vulnerable populations. Information regarding sampling procedures, response levels, and industry guidance may be obtained from OSHA resources and other applicable federal, state, and local agencies.

Environmental Testing for Legionella- Positive Results

Mostly Clear Labs, LLC
404 Hardwater Avenue
Omaha, NE 68114
402-867-5309

Client: Riverbend Healthcare Campus
C/O: Ms. Ripley Hydration
RE: Water Testing 4/5/2026

Date of Sampling: 4/5/2026
Date of Receipt: 4/6/2026
Date of Report: 4/20/2026

QUANTITATIVE LEGIONELLA REPORT

Sample ID: Location	Room 106 Mermaid Lane		Room 108 Mermaid Lane		Room 113 Mermaid Lane	
Comments (see below)	Patient Room Sink		Patient Room Shower		Patient Room Sink	
Lab ID- Version †	22201		22202		22203	
Analysis Date	4/20/2026		4/20/2026		4/20/2026	
Sample Type	Water Sample		Water Sample		Water Sample	
Volume (mL)	200		200		200	
Reporting Limits	1 mL		1 mL		1 mL	
Detection Limits †	0.1		0.1		0.1	
Analytical Sensitivity †	0.1		0.1		0.1	
	raw ct.	cfu*/unit	raw ct.	cfu*/unit	raw ct.	cfu*/unit
L. pneumophila serotype 1						
L. pneumophila serotype 2-15						
Other Legionella species			2	0.2		
§TOTAL Legionella	ND	< 0.1	2	0.2	ND	< 0.1

*cfu = colony forming units ND = none detected

Comments:

Sample Volume and Detection Limits
For water testing, the volume submitted may influence the reporting threshold and analytical sensitivity. A minimum sample volume of 200 mL is recommended for potable water evaluations, particularly in facilities serving vulnerable populations. Information regarding sampling procedures, response levels, and industry guidance may be obtained from OSHA resources and other applicable federal, state, and local agencies.

DISCLAIMER: This lab is a fictional sample report created for demonstration, training, educational, or presentation purposes only. All company names, facility names, client names, addresses, sample identifiers, results, and other information contained herein are fictitious unless otherwise noted. Any resemblance to actual persons, businesses, facilities, organizations, or events is purely coincidental and unintended.

Environmental Testing for Legionella- Positive Results

Mostly Clear Labs, LLC
404 Hardwater Avenue
Omaha, NE 68114
402-867-5309

Client: Riverbend Healthcare Campus
C/O: Ms. Ripley Hydration
RE: Water Testing 4/5/2026

Date of Sampling: 4/5/2026
Date of Receipt: 4/6/2026
Date of Report: 4/20/2026

LEGIONELLA SUMMARY SHEET:

Sample ID	Location	Analysis Date	Volume Filtered (mL)	Detection Limit (cfu/ml)†	Analytical Sensitivity (cfu/ml)†	Total Legionella (cfu/ml)§	Legionella Detected
A1	Room 106 Mermaid Lane Patient Sink	4/20/2026	200	0.1	0.1	ND	ND
A2	Room 111 Mermaid Lane Patient Shower	4/20/2026	200	0.1	0.1	ND	ND
A3	Room 117 Mermaid Lane Bathroom Sink	4/20/2026	200	0.1	0.1	ND	ND
B1	Room 202 Flounder Road Patient Shower	4/20/2026	200	0.1	0.1	ND	ND
B2	Flounder Road Ice Machine	4/20/2026	200	0.1	0.1	24	L. pneumophila serotype 2-15
B3	Room 223 Flounder Road Patient Sink	4/20/2026	200	0.1	0.1	224	L. pneumophila serotype 1
C1	Room 301 Sebastian Hallway Patient Sink	4/20/2026	200	0.1	0.1	ND	ND
C2	Room 335 Sebastian Hallway Room Sink	4/20/2026	200	0.1	0.1	ND	ND
C3	Sebastian Hallway Bath House Shower	4/20/2026	200	0.1	0.1	118	L. pneumophila serotype 2-15

*cfu = colony forming units ND = none detected

Comments:

DISCLAIMER: This lab is a fictional sample report created for demonstration, training, educational, or presentation purposes only. All company names, facility names, client names, addresses, sample identifiers, results, and other information contained herein are fictitious unless otherwise noted. Any resemblance to actual persons, businesses, facilities, organizations, or events is purely coincidental and unintended.

Environmental Testing for Legionella- Positive Results

ADDITIONAL SAMPLE INFORMATION

Purchase Order: Not Provided

RESULTS OF ANALYSIS - FINAL REPORT

TEST	RESULT ([CFU]/mL)	ANALYSIS NOTE(S)
Legionella species, SM 9260 J		*2*
Legionella species	**38.8**	

TEST	RESULT	ANALYSIS NOTE(S)
Identification, Culture		
Culture Identification	**Legionella pneumophila (not serogroup 1)**	

SAMPLE AND ANALYSIS NOTES

1. Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.
2. Isolate identification obtained using MALDI-TOF mass spectrometry and DFA (direct fluorescent antibody microscopy). All legionellae colony morphology appeared the same; no other species indicated.

ANALYSIS INFORMATION

TEST	ANALYZED	SITE	RELEASED	ANALYSIS PREP
1. Legionella species, SM 9260 J	[redacted]			
2. Identification, Culture				

DESCRIPTION OF UNITS

[CFU]/mL = Colony Forming Units per Milliliter

SITE(S) PERFORMING TESTING

3200 [redacted]

The result(s) of this report relate only to the items analyzed. Where the laboratory has not been responsible for the sampling stage the results apply only to the sample as received. This report shall not be reproduced except in full without the written approval of the laboratory. If you have any questions, please call [redacted]

Environmental Testing for Legionella- Positive Results

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Public Health Environmental Lab

Nebraska Public Health Environmental
3701 S 14th St
Lincoln, NE 68502
Phone (402) 471-2122
Fax (402) 471-2080

Client: Riverbend Healthcare Campus
C/O: Ms. Ripley Hydration
RE: Water Testing 4/5/2026

ANALYTICAL RESULT QUALIFIERS

Workorder: Profile: [redacted]

Lab ID: [redacted]
Sample ID:
Sampled By:
Location:

Date Received: [redacted]
Date Collected:
Date Reported:

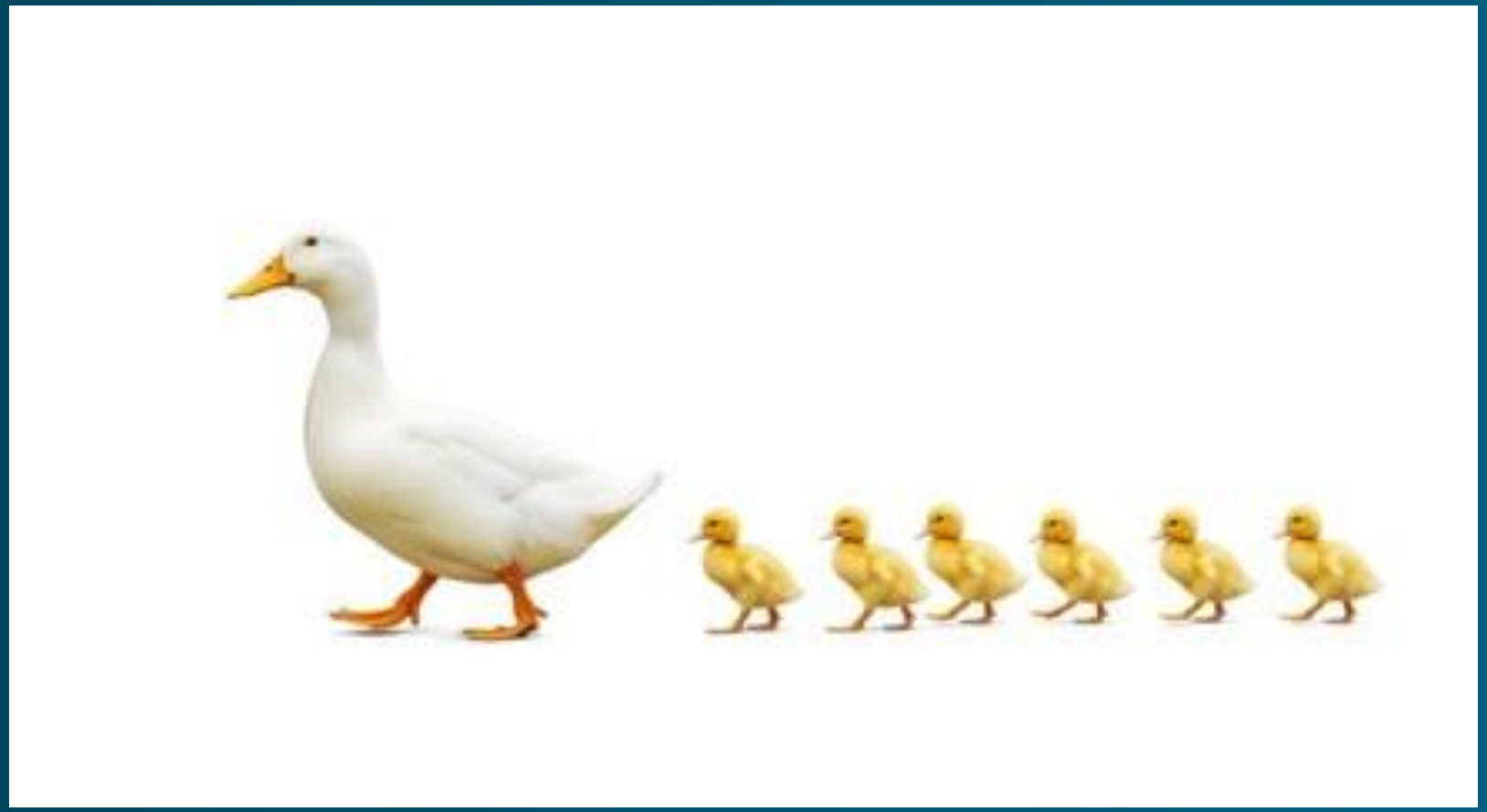
Matrix: **Water**

Parameters	Your Results	Units	Qual	Report Limit	MCL or AL	Analyzed	By
Analytical Method: Legiolert							
Legionella pneumophila	20	MPN/100mL				[redacted]	

SAMPLE COMMENTS:
[redacted]

Lesson 6:

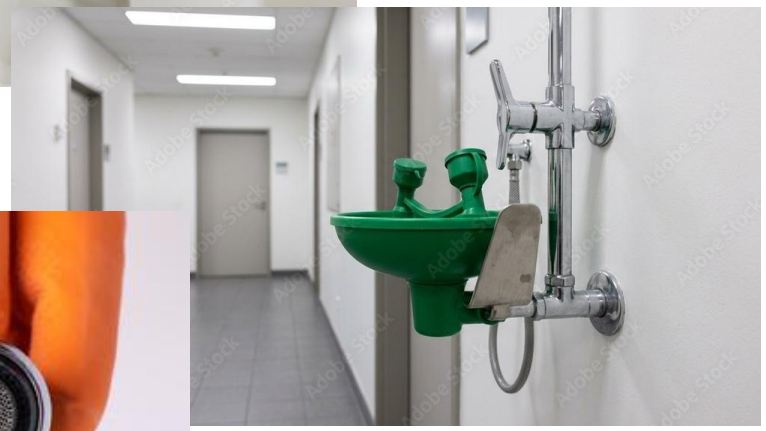
“Other” Fixtures and Devices aren’t being cleaned or maintained

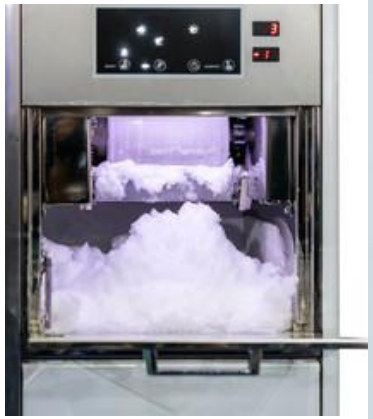


Facility/Building Water System and Devices Checklist

Continued from previous page.

Does the facility have any of the following water system components or devices?	Yes	No
Domestic Water Outlets		
Sink faucets *(i.e., manual, automatic)*	☐	☐
Showerheads	☐	☐
Shower wand/hoses	☐	☐
Bathtubs	☐	☐
Drinking fountains	☐	☐
Emergency eyewash stations	☐	☐
Emergency showers	☐	☐
Ice machines *(including those with internal and/or external carbon filters)*	☐	☐
Dishwashers	☐	☐
Beverage dispensers	☐	☐
Water conservation devices *(i.e., electronic faucets, flow restrictors)*	☐	☐
Landscape irrigation or sprinkler systems	☐	☐





[CSTE Water Management Program (WMP) Evaluation Tool]

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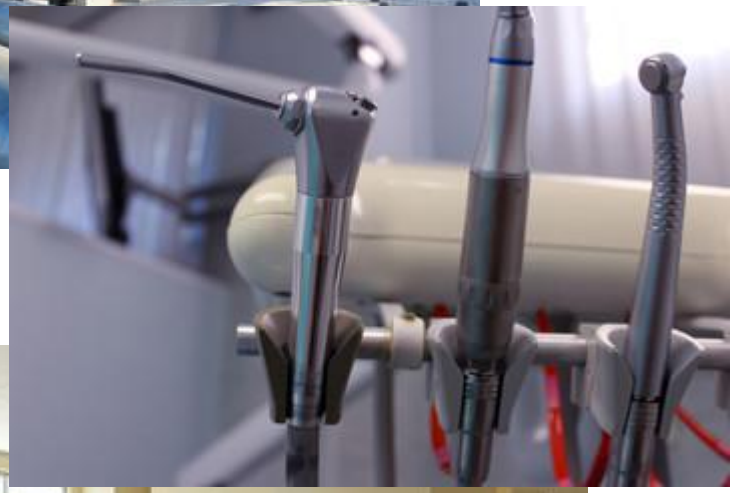

Other Water Systems/Devices		
Emergency fire protection systems	☐	☐
Open- and closed-circuit cooling towers or evaporative condensers	☐	☐
Ornamental fountains or other water features	☐	☐
Whirlpools, spas, or hot tubs	☐	☐
Misters, atomizers, or air washers	☐	☐
Centrally installed or portable humidifiers	☐	☐
On-site water reuse systems *(i.e., rainwater harvesting, stormwater runoff, gray water, steam condensate, irrigation process water, etc.)*	☐	☐
Other:	☐	☐
Health Care Equipment and Devices		
Ventilators and other respiratory care equipment that uses water for humidification, filling, or cleaning *(i.e., CPAP or BiPAP machines, oxygen concentrators, nasal irrigation devices)*	☐	☐
Respiratory aerosolized care and associated masks, tubing, etc. *(i.e., nebulizers, inhalers)*	☐	☐
Hydrotherapy/birthing tubs	☐	☐
Dental unit water lines	☐	☐
Dialysis units	☐	☐

[CSTE Water Management Program (WMP) Evaluation Tool]

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Helpful tool- Point of Use (POU) Filters!

- Highly encourage consideration of point-of-use (POU) filters at spots and areas with most patient-resident risk such as showers and whirlpools
  - Legionella specific 0.2-micron filters
    - Can be place at point-of-use
    - Can be placed in-line with water system
    - There are commercial sellers of point-of-use filter, can be found with internet search
  - Added information:
    - Does decrease water pressure and can reduce temperature due to pressure loss
    - Temporary and not long-term solution
      - **Filter last generally around 180 days**
    - Can be a costly expenditure, but does provide max risk mitigation and safety for patients to use during remediation
  - Decision to not use POU filters must be concretely justified with risk assessment evidence
  - If POU filters are decided not to use consideration of tub baths and removing showers and whirlpools from use must be made

Other Tips and Tricks

- ❑ Make sure that these fixtures are identified as a part of your water management plan
- ❑ Place items on a maintenance plan
  - ❑ Replace/clean items on a schedule such as quarterly, biannually, annually
  - ❑ Ensure that items are being cleaned according to the IFU
  - ❑ Include these items in your testing plans
  - ❑ Maintain a log of preventative maintenance

Other Lessons Learned

Other Lessons Learned

- Mitigation is a long-process, oftentimes leading to multiple failed rounds of testing
  - Often leads to facility frustration and questioning
  - Never forget why we're addressing the situation
- Mitigation is a costly undertaking
  - Important facility understands strategies available to them
  - Equally important to understand ROIs
    - TMVs – costly upfront, but allow for maximum temperature and contamination control
    - Consultants – costly, but provide expert advise with long-term effects
    - POUs – costly, but minimize risk during mitigation
- Mitigation success is very dependent on facility aggressiveness
  - Maximized routine and mitigation focus keeps and maintains controlled levels
  - **A strong WMP forges strong prevention and response!**
- No one size fits all
  - Every response must be tailored – important a facility can visualize their system with diagrams!
  - Patience is needed – some strategies require time to implement
- **All negatives and long-term remediation is obtainable!!**

Use of 3rd Party Water Consultants

- DHHS most recommended strategy
- Pros:
  - Well-versed in water engineering
  - Will consult in person
  - WMP development and revision
  - Can provide critical long-term solutions and insights
  - Really helps facility to understand their water system
- Cons:
  - Can be costly depending on the company
  - Some will only provide solution based on their products
    - Recommended to avoid companies that do so
- DHHS has seen mostly positive results from consultants

References and Resources

References

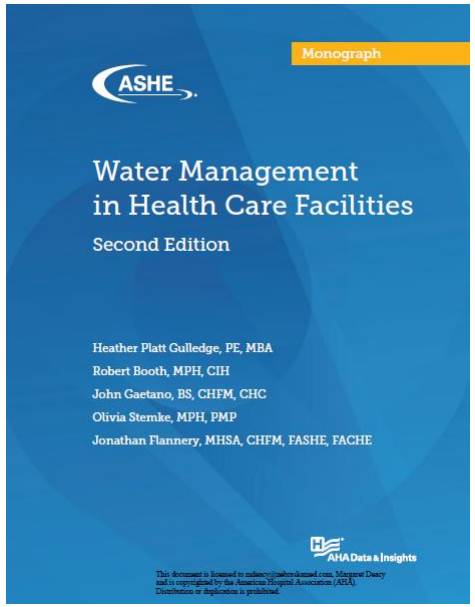
- American Society for Health Care Engineering (ASHE). *Water Management in Health Care Facilities*. 2nd ed. American Hospital Association; 2024
- Auwaerter, P. G. (2023, April 16). *Legionella species: Johns Hopkins Abx Guide*. Legionella species | Johns Hopkins ABX Guide. https://www.hopkinsguides.com/hopkins/view/Johns_Hopkins_ABX_Guide/540308/all/Legionella_species
- *BIOFIRE® FILMARRAY® Pneumonia (PN) panel*. bioMérieux Website. (2026). https://www.biomerieux.com/us/en/our-offer/clinical-products/biofire-pneumonia-panel.html
- Centers for Disease Control and Prevention. (2024, March 15). *Public Health Strategies for Legionella control*. Controlling Legionella. https://www.cdc.gov/control-legionella/php/public-health-strategy/
- Centers for Disease Control and Prevention. (2024a, February 14). *About water disinfection with chlorine and chloramine*. Centers for Disease Control and Prevention. https://www.cdc.gov/drinking-water/about/about-water-disinfection-with-chlorine-and-chloramine.html
- Centers for Disease Control and Prevention. (2026, February 6). *Considerations for reducing risk: Water in Healthcare Facilities*. Centers for Disease Control and Prevention. https://www.cdc.gov/healthcare-associated-infections/php/toolkit/water-management.html#cdc_generic_section_4-opportunistic-pathogens-of-premise-plumbing
- Centers for Disease Control and Prevention. (2025, September 30). *Developing a water management program to reduce Legionella*. Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings. https://www.cdc.gov/control-legionella/media/pdfs/toolkit.pdf
- Centers for Disease Control and Prevention. National Notifiable Diseases Surveillance System (NNDSS) Annual Summary Data for years 2016-2023, United States, CDC WONDER online database. Accessed at http://wonder.cdc.gov/nndss-annual-summary.html on Aug 13, 2026 1:55:04 PM
- Centers for Disease Control and Prevention. (2024a, February 21). *Drinking water standards and regulations: An overview*. Centers for Disease Control and Prevention. https://www.cdc.gov/drinking-water/about/drinking-water-standards-and-regulations-an-overview.html
- Centers for Disease Control and Prevention. (2024, April 17). *Defining Healthcare facilities and associated cases*. Centers for Disease Control and Prevention. https://www.cdc.gov/legionella/health-depts/healthcare-resources/healthcare-facilities.html#:~:text=Defining%20Healthcare%2Dassociated%20Legionnaires'%20Disease&text=Presumptive%20healthcare%2Dassociated%20Legionnaires'%20disease,days%20before%20onset%20of%20symptoms
- Centers for Disease Control and Prevention. (2023, June 27). *ICAR tool for general infection and control (IPC) across ...* Infection Control Assessment and Response (ICAR) Tool for General Infection Prevention and Control (IPC) Across Settings Module 11: Water Exposure Facilitator Guide. https://www.cdc.gov/infection-control/media/pdfs/IPC-mod11-water-exposure-508.pdf
- Centers for Medicare & Medicaid Services. (2025, July 23). *State operations manual appendix PP - guidance to surveyors for*. State Operations Manual Appendix PP - Guidance to Surveyors for Long Term Care Facilities. https://www.cms.gov/regulations-and-guidance/guidance/manuals/downloads/som107ap_pp_guidelines_ltcf.pdf

References

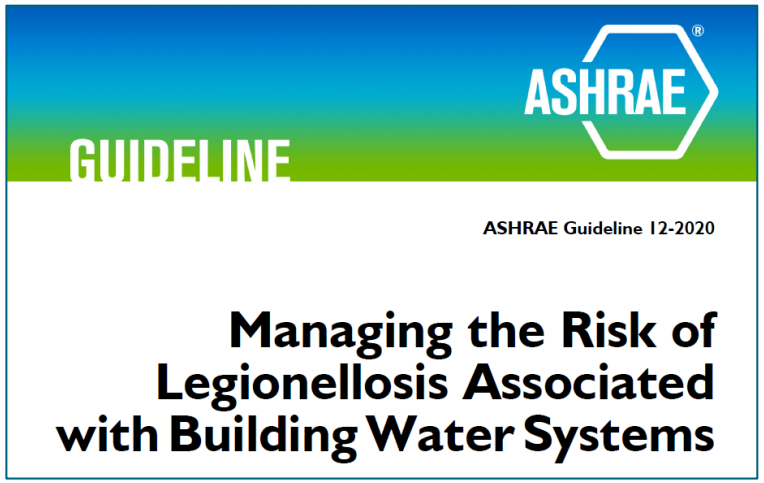
- Centers for Medicare & Medicaid Services. (2020, February 21). State Operations Manual Appendix W - Survey Protocol, Regulations and Interpretive Guidelines for Critical Access Hospitals (CAHs) and Swing-Beds in CAHs. https://www.cms.gov/regulations-and-guidance/guidance/manuals/downloads/som107ap_w_cah.pdf
- Centers for Medicare & Medicaid Services. (2025, September 5). State Operations Manual Appendix A - Survey Protocol, Regulations and Interpretive Guidelines for Hospitals and Psychiatric Hospitals. https://www.cms.gov/files/document/qso-25-24-hospitals-original-release-date-2025-09-05.pdf
- Collier SA, Deng L, Adam EA, et al. Estimate of burden and direct healthcare cost of infectious waterborne disease in the United States. Emerg Infect Dis. 2021;27(1):140–9
- CSTE (Council of State and Territorial Epidemiologists). (n.d.). *Water Management Program (WMP) evaluation tool*. CSTE Water Management Program (WMP) Evaluation Tool. https://cste.org/resource/resmgr/2015ps/Legionella_WPM_EvalTool_FINA.pdf
- CSTE (Council of State and Territorial Epidemiologists). (2019, June). Water Management Program Template . www.cste.org/resource/resmgr/ld_newfolder/Water_Management_Program_Tem.pdf
- Environmental Protection Agency. (2026a, August 19). *Safe Drinking Water Search for the State of Nebraska*. EPA. https://enviro.epa.gov/envirofacts/sdwis/search/form?state_abbr=NE
- Environmental Protection Agency. (2026, February 23). Summary of the Safe Drinking Water Act. EPA. https://www.epa.gov/laws-regulations/summary-safe-drinking-water-act
- Heymann, D. L. (2022). Control of Communicable Diseases Manual. APHA Press, an imprint of American Public Health Association.
- Nebraska Department of Health and Human Services. (2025, March 18). *Department of Health and Human Services - title 179, public ...* DEPARTMENT OF HEALTH AND HUMAN SERVICES TITLE 179, PUBLIC WATER SYSTEMS. https://dee.nebraska.gov/sites/default/files/titles/Title%20179%20Effective%2003-18-2025.pdf
- Nebraska Department of Water, Energy, and Environment. (2026). *Drinking water*. Drinking Water | DWEE NE. https://dwee.nebraska.gov/groundwater-drinking-water/drinking-water
- Nebraska Department of Water, Energy, and Environment. (2026). *Drinking Water Monitoring & Compliance*. Drinking Water Monitoring & Compliance | DWEE NE. https://dwee.nebraska.gov/drinking-water-and-water-wells/drinking-water/drinking-water-monitoring-compliance
- Pavlovsky, L. L., Teran, J., & Ashraf, M.S. (2026, June 2). Assessment of Facility Water Management Program (WMP) Practices: Analysis of 2024 NHSN Annual Survey Data from Nebraska Healthcare Facilities. [poster session]. CSTE Annual Conference 2026, Boston, Massachusetts.
- All images, unless otherwise noted, in presentation are from Adobe stock (http://stock.adobe.com/).

Guidelines Referenced

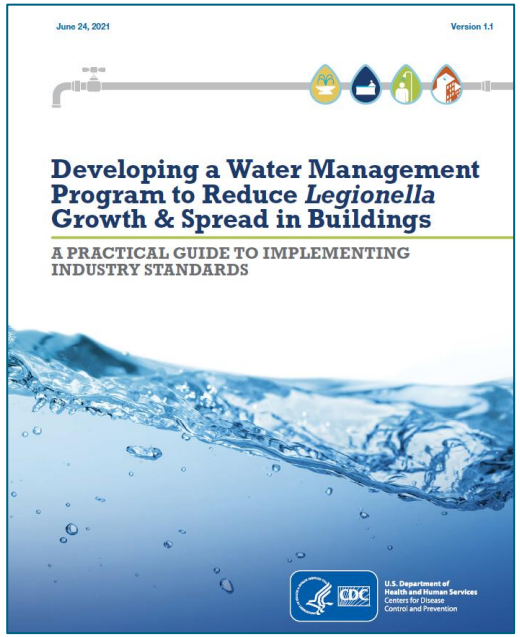
https://www.ashrae.org/technical-resources/bookstore/ansi-ashrae-standard-188-2018-legionellosis-risk-management-for-building-water-systems



American Society for Health Care Engineering (ASHE). *Water Management in Health Care Facilities*. 2nd ed. American Hospital Association; 2024

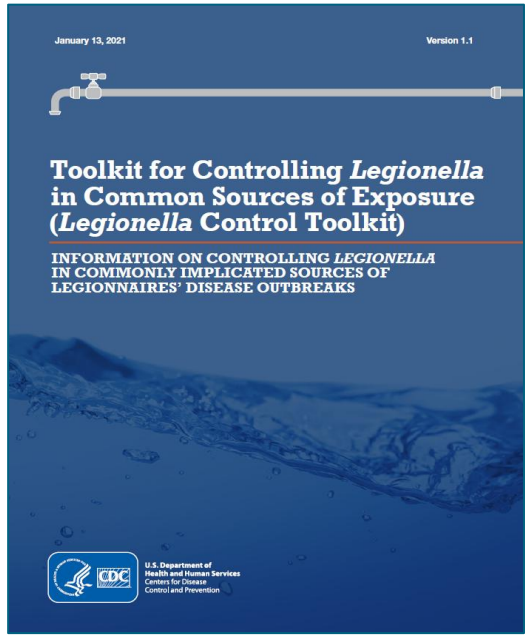


https://www.ashrae.org/technical-resources/standards-and-guidelines/guidance-for-water-system-risk-management



https://www.cdc.gov/legionella/wmp/toolkit/index.html

https://www.cste.org/page/Legionnaires



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

THANK YOU

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