# Identifying & Minimizing *Legionella* Bacteria Risk Levels and Creating your Water Management Program

OALA Fall Conference 2024

ENVIRONMENTAL GROUP
A Division of Barclay Water Management
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## Today's Presenter

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SR. *LEGIONELLA* REGULATIONS MANAGER

- **Nearly 100 facilities surveyed**
- **Create and update WMPs**
- **Provide support during *Legionella* investigations**

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## Today's Content

1. *Legionella* Bacteria and Biofilm Overview & Sources in Building Water Systems
2. Creating an Effective Water Management Program (WMP)
3. Why create a WMP?
4. Identifying WMP Vulnerabilities through **Verification &Validation**
5. Response & Remediation Strategies

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## Legionella Bacteria and Biofilm Overview

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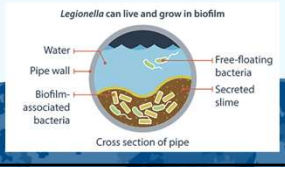
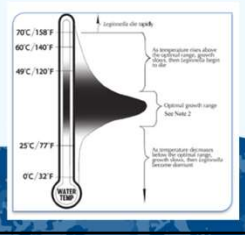
- *Legionella* bacteria is a waterborne pathogen found in natural water
- More than 60 species of *Legionella,* with *Legionella* pneumophila responsible for 90% of case of human infection
- Growth Factors:
  - **Temperature**
  - **Nutrients**

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| Temperature °F | *Legionella* bacteria survival |
|---|---|
| <68 | Do not multiply but still viable |
| 90-110 | Optimal amplification temperature |
| >122 | 90% kill in 2 hours contact time |
| >140 | 90% kill in 2 minutes contact time |
| >158 | 100% rapid kill |

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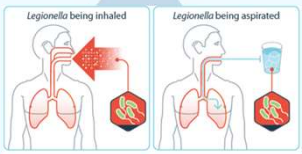
## What is Legionellosis?

**Illnesses caused by *Legionella* bacteria**

- **Legionnaires' disease** is a serious type of pneumonia caused by Legionella bacteria & requires antibiotics.
- **Pontiac Fever** is a milder infection, clears on its own & does not require antibiotics

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## Public Health Impacts

EPA and CDC recognize legionellosis as a significant and growing public health concern:

- 10,000 **reported** cases of Legionnaires' disease in the US in 2018
- An estimated 52,000 to 70,000 cases of Legionnaires' disease annually.
- 3,000+ annual Emergency Department visits (91% result in hospitalizations)
- **Death rate is ~33%** of Legionella infections

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## What are *Legionella* Bacteria Sources in Buildings?

- Cooling Towers
- Humidifiers
- Showerheads
- Faucets
- Water Fountains
- Whirlpool Baths or Spas
- Decorative Fountains
- Misting Machines at Grocery Stores
- Dental Lines
- Ice Machines
- Water Storage Tanks

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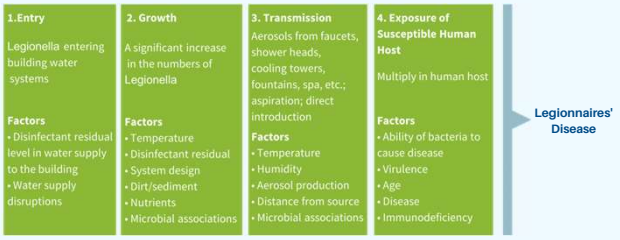
## Factors and Events Leading to Legionnaires' Disease

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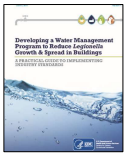
ASHRAE




CMS

The Joint Commission

## Creating an Effective Water Management Program (WMP)

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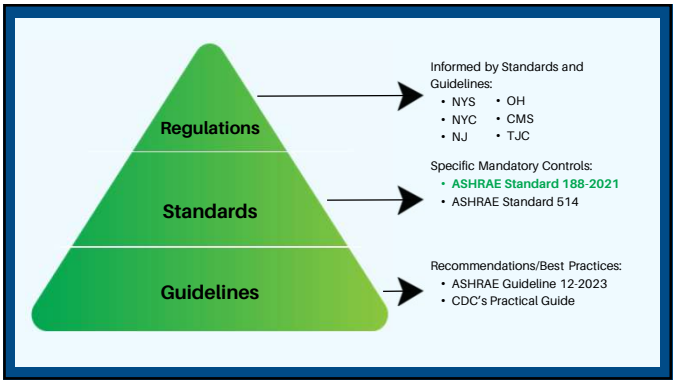


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## ASHRAE Standard 188

The pioneer of Legionella risk management in the US

- Describes environmental conditions that promote Legionella growth
- Provides a WMP framework
- Informative annexes

All roads lead back to ASHRAE 188...

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| | |
|---|---|
| ASHRAE Standard 514 | Outlines physical, chemical, and microbial hazards in a healthcare facility. |
| The Joint Commission Standard EC.02.05.02 | Requires accredited facilities to implement a WMP that meets their criteria, in alignment with ASHRAE Standard 188. |
| CMS Memorandum | Requires CMS funded facilities to implement a WMP in accordance with ASHRAE Standard 188 and the CDC. Must also address other waterborne pathogens - primarily in biofilm. |
| CDC Guideline & Toolkit | General guide on creating a WMP, endorsing the ASHRAE Standard 188 approach. |
| ASHRAE Guideline 12-2024 | Best practices, how tos, and control measures. |

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| | |
|---|---|
| New York Regulations | Requires healthcare facilities and cooling tower owners to implement WMPs and MPPs, along with required *Legionella* testing |
| New Jersey Senate Bill 2188 | Passed September 12, 2024, will require a large array of facilities to implement WMPs |
| Ohio Administrative Code 3701-22-07 | Passed June 2024 and went into effect September 10, 2024, and requires hospitals to implement a WMP |

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## Creating a Water Management Program Adapted from ASHRAE Standard 188-2021

- Conduct **RISK ASSESSMENT** (by conducting a Water Systems Survey)
- Form **PROGRAM TEAM**
- Create **FLOW DIAGRAMS**
- Determine **CONTROL LOCATIONS**. These are points in which *Legionella* bacteria growth and transmission can be minimized
- Construct **PROCEDURES FOR VERIFICATION AND VALIDATION** to confirm Water Management Program is working effectively.
- Establish **DOCUMENTATION** concerning all procedures and records

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Conduct **RISK ASSESSMENT** (by conducting a Water Systems Survey)






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Conduct **RISK ASSESSMENT** (by conducting a Water Systems Survey)

- Immunocompromised Individuals
- Respiratory Therapy
- High Risk Units (ICU, NICU, Dialysis, etc.)
- High Exposure Areas

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Form **PROGRAM TEAM**

| Name | Job Title | Email Address | Role on WMP Team |
|---|---|---|---|
| | Senior Manager | | Coordinates Team's actions. Understands principles of the WMP |
| | HVAC | | Understands Buildings' utility water systems |
| | Plumbing | | Understands the Buildings' domestic/potable water systems |
| | Safety | | Helps with decision making in area of expertise |
| | Infection Disease | | Helps with decision making in area of expertise |
| | Nursing | | Helps with decision making in area of expertise |
| | Consultant | | Helps with decision making in area of expertise |

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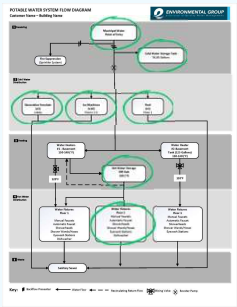
Create **FLOW DIAGRAMS**



- Basic diagram that maps water supply through the facility
- High risk areas may be marked as sampling locations

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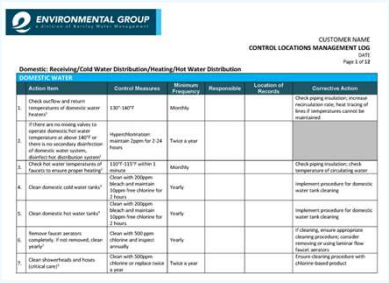
Determine **CONTROL LOCATIONS**. These are points in which *Legionella* bacteria growth and transmission can be minimized



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CUSTOMER NAME
CONTROL LOCATIONS MANAGEMENT LOG
DATE

Domestic: Receiving/Cold Water Distribution/Heating/Hot Water Distribution

| DOMESTIC WATER | | | | | | |
|---|---|---|---|---|---|---|
| | Action Item | Control Measures | Minimum Frequency | Responsible | Location of Records | Corrective Action |
| 1. | Check outflow and return temperatures of domestic water heaters[1] | 130°-140°F | Monthly | | | Check piping insulation; increase recirculation rate; heat tracing of lines if temperatures cannot be maintained |
| 2. | If there are no mixing valves to operate domestic hot water temperature at above 140°F or there is no secondary disinfection of domestic water system, disinfect hot distribution system[1] | Hyperchlorination: maintain 2ppm for 2-24 hours | Twice a year | | | |
| 3. | Check hot water temperatures of faucets to ensure proper heating[1] | 110°F-115°F within 1 minute | Monthly | | | Check piping insulation; check temperature of circulating water |
| 4. | Clean domestic cold water tanks[1] | Clean with 200ppm bleach and maintain 50ppm free chlorine for 2 hours | Yearly | | | Implement procedure for domestic water tank cleaning |
| 5. | Clean domestic hot water tanks[1] | Clean with 200ppm bleach and maintain 50ppm free chlorine for 2 hours | Yearly | | | Implement procedure for domestic water tank cleaning |
| 6. | Remove faucet aerators completely. If not removed, clean yearly[1] | Clean with 500 ppm chlorine and inspect annually | Yearly | | | If cleaning, ensure appropriate cleaning procedures; consider removing or using laminar flow faucet aerators. |
| 7. | Clean showerheads and hoses (critical care)[1] | Clean with 500ppm chlorine or replace twice a year | Twice a year | | | Ensure cleaning procedure with chlorine-based product |

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Establish **DOCUMENTATION** concerning all procedures and records

- Ex. Documentation for biannual cooling tower cleaning
- Ex. Cooling tower disinfection due to high levels of Legionella bacteria
- Ex. Documentation for quarterly ice machine cleaning
- Ex. Documentation (ex. log book) of weekly faucet temperature readings

**Control Locations, Control Measures, & Rangers should only consist of what the facility will commit to doing - These tasks often change/are updated as time goes on!**

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Establish **DOCUMENTATION** concerning all procedures and records

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Water Management Program History

| Meeting Type | Date | Changes Made to WMP |
|---|---|---|
| Implementation | 2019 | N/A |
| Annual | 2020 | Updates made to WMP template to ensure compliance with EC.02.05.02, ASHRAE Standard 188, and local and state guidance. |
| Annual | 2021 | Updates to: Executive Summary, Control Locations Management Log, Flow Diagrams, Building System Details Forms |
| Annual | 2022 | Updates to: WMP Team |
| Annual | 2022 | Updates to: Control Locations Management Log |
| Annual | 2023 | Risk Assessments Updated |
| Annual | 2024 | An Annual Assessment was performed. The Control Log, Team, and Templates were updated with the information from the annual assessment questions |

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Construct **PROCEDURES FOR VERIFICATION AND VALIDATION** to confirm Water Management Program is working effectively.

- Meet Regularly as a WMP Team
- Actions are being taken
- Results being documented
- Clear responsibilities
- Changes in system

**Update WMP annually**

**Have a system in place to validate that the hazards are being controlled**

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## Why create a WMP for your facility?

- Compliance with regulations
- Improve building water system operations
- SAFETY OF OCCUPANTS, VISITORS, AND STAFF

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## Validation Testing

Validate water management with testing:

- Disinfectant residuals in representative outlets –measured on-site while taking samples
- *Legionella* bacteria in representative outlets, ice, water heaters
- Lead levels in areas where people may consume the water
- Total bacteria (HPC) and Coliform bacteria

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## Recognized Legionella Testing Method

Live Culture Method is the gold standard - buffered charcoal yeast extract (BCYE) agar. Takes 10-14 days. Serotype if there are positive results.

Other methods are not recognized by CDC but could be useful in other ways-Polymerase Chain Reaction (PCR), Rapid Tests

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ASHRAE Guideline 12-2024

Table C-1 Performance Indicators for Water Management Programs for Potable Water Systems [a]

| Calculated *Legionella*, CFU/mL [b] | Program Performance | Suggested Response |
|---|---|---|
| ≤1 or not detected | *Legionella* growth appears well controlled. | Continue Program. |
| >1 | Conditions may allow *Legionella* growth. | Implement the guidance in Section C5 [d] |
| **Trending of Test Results over Time [c]** | **Program Performance** | **Suggested Response** |
| 10 to 100 fold increase | *Legionella* growth appears to be poorly controlled. | Implement the guidance in Section C5 [d] |
| >100 fold increase | *Legionella* growth appears to be uncontrolled. | Implement the guidance in Section C5 [d] |

a. This table provides guidelines that may be used to evaluate the performance of Programs and provides responses to the *Legionella* test results. The information in this table does not necessarily correlate with health risk and is not predictive of disease. Results of testing for *Legionella* have been interpreted based on concentration, extent of colonization, and type of *Legionella*.
b. If test results are expressed in units other than CFU/mL, consult the testing laboratory or test manufacturer for the appropriate interpretation of results.
c. A tenfold (1 Log) increase in the number of *Legionella* previously detected, even when the increase results in values that, taken alone, indicate *Legionella* growth appears well controlled, (ie, example of a tenfold increase is from 1 to 10 CFU/mL, an example of a 100-fold (2 Log) increase is from 1 to 100 CFU/mL).
d. In health care facilities where at-risk persons are housed or treated and where *Legionella* growth does not appear well controlled, consider implementing measures from the health care facility's water management plan to protect patients from exposure to water aerosols while implementing the guidance in Section C5.

Table C-2 Performance Indicators for Water Management Programs for Cooling Towers and Evaporative Heat Exchangers [a]

| Calculated *Legionella*, CFU/mL [b] | Program Performance | Suggested Response |
|---|---|---|
| ≤10 or not detected | *Legionella* growth appears well controlled. | Continue Program. |
| >10 | Conditions may allow *Legionella* growth. | Implement the guidance in Section C5. |
| **Trending of Test Results over Time** | **Program Performance** | **Suggested Response** |
| 10 to 100 fold increase [c] | *Legionella* growth appears to be poorly controlled. | Implement the guidance in Section C5. |
| >100 fold increase [c] | *Legionella* growth appears to be uncontrolled. | Implement the guidance in Section C5. |

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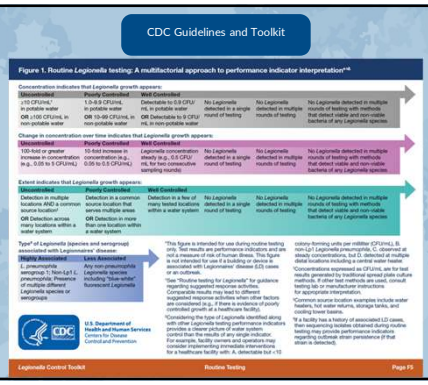
CDC Guidelines and Toolkit

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## Suggested Responses

| Concentration of Legionella Bacteria (CFU/mL) | Suggested Response Actions |
|---|---|
| <1 | • Review sample collection, handling, and testing for potential errors.<br>• Confirm that system equipment is in good working order and functioning as intended. |
| >1 | • Review records to confirm that the WMP was implemented as designed (verification).<br>• Review assumptions about operating conditions, such as physical and chemical characteristics of incoming water.<br>• Re-evaluate fundamental aspects of the WMP, including analysis of hazardous conditions, cleaning, maintenance procedures, chemical treatment, and other aspects that could affect Legionella testing.<br>• Adjust WMP as necessary to address any deficiencies identified.<br>• Consider whether remedial treatment is needed only after completion of the above.<br>• If remedial treatment was performed, wait at least 48 hours after the system returns to normal operating conditions and retest a set of representative samples to confirm the effectiveness of the response. |

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**Responding to Positive Legionella Bacteria Results**

In the absence of an outbreak:

- NYS Protection Against Legionella, Subpart 4-2
- ASHRAE 188 says Program Team should decide what to do
- OSHA and CDC have general guidelines (based on number of Legionella bacteria, CFU/mL)
- To protect the population exposed to potential risk, installation of 0.2 micron Point of Use filters is recommended until a remediation is implemented

**In the presence of an outbreak, follow the directions of corresponding Department of Health**

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## Control Measures to Limit Legionella Growth and Biofilm in Potable Water Systems

- **S**ediment
- **T**emperature
- **O**xidant Levels
- **P**lumbing Water Stagnation

Mitigate **STOP** conditions in all *Legionella* bacteria Control Locations

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| Water Parameter | Control Measure | Recommendations |
|---|---|---|
| **S**ediment | Flushing, cleaning, and maintenance | • Flush after an intrusion event (e.g. water main break).<br>• Clean & maintain water system components such as water heaters, mixing valves, aerators, showerheads, hoses, and filters regularly. |
| **T**emperature | Control Limits | • Store hot water >140°F & maintain circulating hot water >120°F.<br>• Store & maintain circulating cold water below <68°F. |
| **O**xidant Levels | Control Limits | • Chlorine: Detectable residual as directed by WMP.<br>• Monochloramine: Detectable residual as directed by WMP.<br>• EPA MCL: <4.0 ppm |
| **P**lumbing Water Stagnation | Flushing | • Flush low-flow pipe runs & dead legs at least weekly.<br>• Flush infrequently used fixtures regularly. |

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## CDC Guidelines


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## Why Flush?

**Stagnation during low water usage in a building can cause:**

- Elimination of protective disinfection residual levels
- Increased risk of biofilm and waterborne pathogen growth
- Scale on pipes leaching metals like lead into the water

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## Short-Term Remediation

| Short-Term Disinfection Type | Notes |
|---|---|
| Chemical Shock / Hyperhalogenation | • Extremely corrosive<br>• Disruptive to patients<br>• Costly – labor intensive<br>• Temporary |
| Point-of-Use 0.2 Micron Filters | • Effective at filtering out *Legionella* bacteria<br>• Must be changed on a routine basis<br>• No carrying disinfectant (no oxidant use) |
| Thermal Disinfection | • **CDC no longer recommends thermal disinfection for short-term remediation in building water systems.**<br>• Temporary – does not protect against re-colonization of the system<br>• Disruptive to patients<br>• Employee & patient safety concerns (scalding)<br>• Costly – labor intensive<br>• Costly on infrastructure (piping, valves, pump seals) |
| Flushing | • Can help minimize sediments & biofilms<br>• Decreases water age<br>• Increases disinfectant residual |

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## Long-Term Remediation

| Long-Term Disinfection Type | Notes |
|---|---|
| Sodium Hypochlorite (chlorine) | • Not as effective as monochloramine or chlorine dioxide<br>• Extremely corrosive<br>• EPA-regulated disinfection byproducts<br>• Taste & odor |
| Copper/Silver Ionization | • Highly corrosive<br>• pH restriction of 8.0<br>• Must be cleaned with acid<br>• Dosage limits (1.0 ppm copper, 0.1 ppm silver) |
| Chlorine Dioxide | • Chlorite must be measured daily<br>• Decomposes rapidly, does not carry into hot water well |
| Monochloramine | • Has been used as drinking water disinfectant for >90 years<br>• Lower levels of disinfectant byproducts than chlorine<br>• Longer system hold times, superior in complex systems<br>• Less corrosive than chlorine or chlorine dioxide |

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## Content Recap

1. *Legionella* Bacteria and Biofilm Overview & Sources in Building Water Systems
2. Creating an Effective Water Management Program (WMP)
3. Why create a WMP?
4. Identifying WMP Vulnerabilities through **Verification &Validation**
5. Response & Remediation Strategies

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# Thank you

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