Managing Legionnaires’ Disease Through Water Safety Management Planning
Disclaimer:
This booklet is intended to introduce you to general principles based on current guidance and suggested practices from government agencies and industry groups. As with any overview program, these materials and our guidance are general, and you should always consult your own advisors as appropriate for your circumstances.
Legionnaires’ Disease Overview
Legionella Characteristics

- Aerobic
- Gram-negative (do not stain well)
- Nonsporing-forming
- Flagellated
- Pleomorphic
- Facultative intracellular bacteria
- The causative agent of *legionellosis* including:
  - Pontiac fever
  - Legionnaires' Disease
Legionnaires’ disease

- Legionnaires’ disease is a severe pneumonia, often requiring doctor visit or hospital stay.
- People can get sick when they breathe in mist or accidently aspirate water into the lungs that contain the bacteria.
- It is NOT spread person to person.
- People 50 years or older, current or former smokers, and people with a weakened immune system or chronic disease are at higher increased risk.
- However, 25% of disease cases do not fit this profile.
Infectivity Risk Factors – Need All 3

Exposure route

Virulent Strain

Susceptible Patient
Where does *Legionella* live?

**Potable Water**

- A person washing hands under a faucet.
- Water flowing from a showerhead.
- Rusty water heater.

**Nonpotable Water**

- Industrial cooling system.
- Hospital operating room.
- Indoor swimming pool.
Infectivity – *Legionella* Aerosolization

Shower aerosol

Cooling tower aerosol
Cases and outbreaks of Legionnaires’ disease – Two types of exposure routes:

**Travel-associated**
Hotel, spa, cruise ship

**Community acquired**
Building water system at a hospital, nursing home, office, apartment complex, including cooling towers
Legionnaires’ disease is on the rise

- Reported cases have increased more than 550% in the last 15 years
- ~10% of known cases are fatal, but **25%** if contracted in healthcare setting

Source: National notifiable disease surveillance system
*Legionella pneumophila* is the cause of 97% of Legionnaires' disease cases.

Data from clinical cultures of 4,719 patients over seven years in 17 countries.

*L. pneumophila* is one of the most dangerous waterborne pathogens

Waterborne outbreaks associated with drinking water, 2013-2014

World Health Organization (WHO) focus on *L. pneumophila*

**Drinking Water Parameter Cooperation Project**

“Focus verification monitoring on *L. pneumophila* instead of *Legionella spp.* This is the approach taken by France, for example. *L. pneumophila* is the most significant causative agent of legionellosis in Europe.”

“When a microbiological parameter is defined taxonomically, the parameter is much less prone to ambiguous results. This also allows for the development of alternative methods, as the endpoint is defined, while in the case of *Legionella spp.* the endpoint is defined by the culture method. Note that this has also been the rationale for changing from faecal coliforms to *E. coli* in the previous revision of the Directive.”

WHO Recommendation paper September 2017
Legionnaires’ disease is largely preventable

9 in 10

CDC investigations show almost all outbreaks were caused by problems preventable with more effective water management.

Adapted from CDC *vital*Signs June 2017

[https://www.cdc.gov/vitalsigns/pdf/2017-06-vitalsigns.pdf](https://www.cdc.gov/vitalsigns/pdf/2017-06-vitalsigns.pdf)
Legionnaires’ disease
Summary

- *Legionella* bacteria live in water, including in man-made systems
- *Legionella* bacteria must be aerosolized and breathed in to create illness
- Legionellosis consists of two disease states: Pontiac fever and Legionnaires’ disease
- Not all *Legionella* are pathogenic; *Legionella pneumophila* are the causative agent of Legionnaire’s disease
- A well implemented water safety management plan can effectively reduce Legionnaires’ disease
Overview of Water Safety Management Standards and Rules
Many organizations have rules or guidance on managing Legionnaires’
ASHRAE 188:2018 Standard and the CDC Tool Kit are good resources

ASHRAE 188
- First NA standard
- Only ANSI Accredited Standard
- Consensus view of the best practices for managing Legionnaires’ risk in building water systems
- Recommended Water Safety Plan
- Testing specific section

CDC Toolkit
- Yes/No Worksheet for risky building areas
- Walk through of Legionella mgmt. program
- Example problem scenarios
- Healthcare-specific guidance
Centers for Medicare & Medicaid Service (CMS) Memo

Memo June 2017
Updated July 2018

Sent to:
State Survey Agency Directors

Subject:
Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires’ Disease (LD)
CMS Memo
Basic requirements for water systems

1. Conduct risk assessment; where could pathogens grow?
2. Implement a water safety management program
3. Specify monitoring: test methods and ranges
CDC Tool Kit Water management Plan
7 core activities

1. Establish a water management program team
2. Describe the building water systems using text and flow diagrams
3. Identify areas where Legionella could grow and spread
4. Decide where control measures should be applied and how to monitor them
5. Establish ways to intervene when control limits are not met
6. Make sure the program is running as designed and is effective
7. Document and communicate all the activities

Continuous program review (see below)

Source: CDC  Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings Version 1.1
ASHRAE 188 Water management Plan
7 core activities

1. Establish Team
2. Describe System
3. Assess Risk
4. ID Controls
5. Monitor/Correct
6. Verify/Validate
7. Document
Standards and Guides for managing Legionnaires’ disease

Summary

- Of the many standards and guides, the most used are ASHRAE 188 and CDC Tool Kit
- These two documents both employ a 7-step process to help create effective water management plans (WMP)
- Not even the best plans will eradicate *Legionella* from a water system, this is about management
- CMS Memos references ASHRAE 188 and CDC Tool Kit
Water Management Planning

Team Roles and Responsibilities
WATER MANAGEMENT PLANNING STEPS

- Team Roles & Responsibilities
- Describe the System
- Identify Risk Areas
- Determine Controls
- Monitoring & Corrective Actions
- Verify & Validate the Plan
- Document
WMP Plan – 7 core activities
ASHRAE 188

1. Establish Team
2. Describe System
3. Assess Risk
4. ID Controls
5. Monitor/Correct
6. Verify/Validate
7. Document
WMP Plan Team – key roles

- Ability to oversee the program
- Ability to communicate regularly about the program
- Knowledge of the water systems
- Ability to identify control locations and control limits
- Ability to confirm program performance
- Ability to monitor and document program performance
- Ability to identify and take corrective actions
The WMP Team composition and dedication to reducing risk are the single biggest keys to successfully managing the risk from Legionnaires’ disease

Carefully consider the core knowledge you have in-house and identify knowledge gaps that can be filled by outside partners or consultants.
Public Health organizations
What they can contribute to WMP teams

- State and Local Health Officials from Public Health groups
- Association of State and Territorial Health Officials (ASTHO)
- National Association of City and County Health Officials (NACCHO)
- Environmental Council of the States (ECOS)
- Including: sanitarians, environmental health specialists, microbiologists, industrial hygienists, safety/hazard officers
WMP Plan Team – Determine your WMP Team

Water Management Program Team

- Ability to oversee the program
- Knowledge of the water systems
- Ability to communicate regularly about the program
- Ability to confirm program performance
- Ability to identify control locations and control limits
- Ability to monitor and document program performance
- Ability to identify and take corrective actions
WSM Team Roles and Responsibilities

Summary

- Understand the core competencies needed to form an effective WSM team
- Insure that you have a facilitator/decision maker
- Include people who understand the building systems, how to identify risk, the occupants (including employees) and where/how to manage identified risks
- Include the testing laboratory and water provider; they have core knowledge that shouldn’t go untapped
- Public health officials can participate in WMP teams
- Document team activities and record meeting minutes for future reference
Water Management Planning

Describe the System
WATER MANAGEMENT PLANNING STEPS

1. Describe the System
2. Team Roles & Responsibilities
3. Identify Risk Areas
4. Determine Controls
5. Monitoring & Corrective Actions
6. Verify & Validate the Plan
7. Document
Describe the system

**ASHRAE 188 WMP Core Elements:**

2. Describe System

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROGRAM TEAM</td>
<td>Identify persons responsible for Program development and implementation.</td>
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<td>DOCUMENTATION</td>
<td>Establish documentation and communication procedures for all activities of the Program.</td>
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Describe the system

**CDC website:** Every building is different (depending on factors such as the structure, age, location, occupants of the building, or surrounding conditions), so each one needs a tailored program.

2. **Describe the building water systems using flow diagrams and a written description:** Include details like where the building connects to the municipal water supply, how water is distributed, and where hot tubs, water heaters or boilers, and cooling towers are located.
Building Water Survey(s)

Survey your building (or property) to determine if you need a water management program to reduce the risk of *Legionella* growth and spread.

If you answer **YES** to any of questions 1 through 4, you should have a water management program for *that building’s* hot and cold water distribution system.

**Healthcare Facilities**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is your building a healthcare facility where patients stay overnight or does your building house or treat people who have chronic and acute medical problems or weakened immune systems?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2. Does your building primarily house people older than 65 years (like a retirement home or assisted-living facility)?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3. Does your building have a centralized hot water system (like a hotel or high-rise apartment complex)?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4. Does your building have more than 10 stories (including basement levels)?</td>
<td></td>
</tr>
</tbody>
</table>

Devices in buildings that can spread contaminated water droplets should have a water management program even if the building itself does not. If you answer **NO** to all of questions 1 through 4 but **YES** to any of questions 5 through 8, you should have a water management program for *that device*.

<table>
<thead>
<tr>
<th>Yes</th>
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<tbody>
<tr>
<td>5. Does your building have a cooling tower?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>6. Does your building have a hot tub (also known as a spa) that is not drained between each use?</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
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<tr>
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<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>8. Does your building have a centrally-installed mister, atomizer, air washer, or humidifier?</td>
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[www.cdc.gov/legionella/WMPtoolkit](http://www.cdc.gov/legionella/WMPtoolkit)
1. Yes? / No? Is your building a healthcare facility where patients stay overnight or does your building house or treat people who have chronic and acute medical problems or weakened immune systems?

2. Yes? / No? Does your building primarily house people older than 65 years (retirement home, assisted-living)?

3. Yes? / No? Does your building have a centralized hot-water system (hotel or high-rise apartment complex)?

4. Yes? / No? Does your building have more than ten stories (including subgrade levels)?
Describe the system

CDC Toolkit / 188: Building Questions 5-8

5. Yes? / No? Does your building have a cooling tower?

6. Yes? / No? Does your building have a hot tub (also known as a spa) that is not drained between each use?

7. Yes? / No? Does your building have a decorative fountain?

8. Yes? / No? Does your building have a centrally installed mister, atomizer, air washer, or humidifier?
Implement a WMP for the following building water systems:

- Cooling Towers
- Evaporative condensers
- Whirlpool spas
- Ornamental fountains
- Misters, air washers, atomizers, humidifiers
- Other devices that aerosolize and release fine water droplets

Describe the system

Bottom Line for ASHRAE Section 5.1
Implement a WMP for premise plumbing systems if a building is characterized with any one of the following:

- Multiple housing units with a centralized hot water system
- >Ten stories (include subgrade)
- Housing designated for people over 65 years of age
- Patients staying more than 24 hours
- An area housing or treating people with certain medical risk factors...
Describe the system
Use simple drawings to describe water flow/use
Describe the system: Process flow diagrams

(Example)
Process Flow Diagram
Potable (Domestic) Water System

Process Steps Key:
(name and number)

P = primary potable
S = fire suppression
F = drinking fountains
ST = steam table
I = ice machine
C = cafeteria service line
Describe the system: Process flow diagrams

(Example)
Process Flow Diagram
Nonpotable (Utility) Water System

Process Steps Key:
(name and number)

U = utility
B = boiler
ST = steam table
P = primary potable
HW = hot water
CW = chilled water
CT = cooling tower
(X-Ref Pot) = cross/ref potable water systems
Describe the system

Summary

- Both the potable & non-potable water systems in the building must be described using written and process flow diagrams
- Flow diagrams should be sufficient in detail to enable the identification, analysis and management of risk throughout the building’s water systems.
- Highlight how water is received and processed in the building and delivered to end point uses
- Document, Document & Document everything!
Water Management Planning

Identify Risk Areas
WATER MANAGEMENT PLANNING STEPS

1. TEAM ROLES & RESPONSIBILITIES
2. DESCRIBE THE SYSTEM
3. IDENTIFY RISK AREAS
4. DETERMINE CONTROLS
5. MONITORING & CORRECTIVE ACTIONS
6. VERIFY & VALIDATE THE PLAN
7. DOCUMENT
Identifying areas of risk

ASHRAE 188 WMP
Core Elements:

3. Access Risks

- **PROGRAM TEAM**—Identify persons responsible for Program development and implementation.
- **DESCRIBE WATER SYSTEMS/FLOW DIAGRAMS**—Describe the potable and nonpotable water systems within the building and on the building site and develop water-system schematics.
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- **CONTROL MEASURES**—Determine locations where control measures must be applied and maintained in order to stay within established control limits.
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- **CONFIRMATION**—Establish procedures to confirm that
  - the Program is being implemented as designed (verification), and
  - the Program effectively controls the hazardous conditions throughout the building water systems (validation).
- **DOCUMENTATION**—Establish documentation and communication procedures for all activities of the Program.
Identifying areas of risk
No two buildings are the same

CDC website: Every building is different (depending on factors such as the structure, age, location, occupants of the building, or surrounding conditions), so each one needs a tailored program.

3. Identify areas where *Legionella* could grow and spread: Identify where potentially hazardous conditions could occur in your building water systems, such as areas where water temperature could promote *Legionella* growth or where water flow might be low.
Remember the Infectivity Risk Factors

Exposure

Virulence of Strain

Susceptibility of Patient
Identifying areas of risk
Devices that can contribute to risk

- Faucets and shower heads
- Spas and whirlpool tubs
- Humidifiers
- Decorative fountains
- Sprinklers
- Ice machines
- Cooling towers
- Evaporative condensers
- Medical/dental equipment
- and others

Which of these aerosol producing devices are present in your building?
Identifying areas of risk

Who Would Think—A Grocery Store?

- An ultrasonic mist maker device was operating over one section of the produce display …
- No one at the grocery store was familiar with the operation or maintenance of the device …
- High levels of *Legionella (Lp1)* were recovered from the device: 34 cases/2 deaths (Bogalusa, LA Winn-Dixie store / 1990)
Identifying areas of risk

Who Would Think – An Ice Machine?!

Where? can Legionella grow:
- Hot and cold water storage tanks
- Water heaters
- Water-hammer arrestors
- Expansion tanks
- Water filters
- Electronic faucets
- Aerators
- Faucet flow restrictors
- Shower heads and hoses
- Nonsteam aerosol-generating humidifiers
- Infrequently used equipment, including eyewash stations

- **Ice machines**

- Aspiration of *ice chips* contaminated with *Legionella pneumophlia*
- 20% of Ice Machines had *Lp1*
- 3 Cases / 1 Death (2013)
Identifying areas of risk

Temperature matters

*L. pneumophila* are heat resistant and can grow and multiply in a wide temperature range. Keep hot water hot and cold water cold.
Identifying areas of risk
Biofilm harbors bacteria, including *L. pneumophila*

“... Biofilm is the Root of the Problem ...”

Legionellosis is the most significant waterborne disease in the US, and biofilm is the root of the problem, NSF says

The National Science Foundation (NSF) indicates biofilm as the root of Legionellosis, that accounts for thousands of hospital admissions and many deaths in the U.S. only, and the Centers for Disease Control and Prevention (CDC) confirm that biofilm protects Legionella from disinfectant, provides food and shelter to germs. Read more.
Identifying areas of risk

Biofilm is in our water systems
Identifying areas of risk

**Legionella:** Thrive within Biofilm
Identifying areas of risk

Summary

- Identifying areas of risk is critical to establishing control measures and strategies to help prevent disease
- Use the process flow diagrams to evaluate where hazardous conditions may occur in the building systems
  - Where water may become aerosolized
  - Where temperature may need to be controlled
  - Where biofilm may grow and harbor bacteria
- Determine where control measures can be applied to control potentially hazardous system conditions
- Consider the vulnerability of occupants and include provisions to respond to water service disruptions
- Document, Document and Document everything!
Water Management Planning

Control Measures to Mitigate Risk
WATER MANAGEMENT PLANNING STEPS

1. TEAM ROLES & RESPONSIBILITIES
2. DESCRIBE THE SYSTEM
3. IDENTIFY RISK AREAS
4. DETERMINE CONTROLS
5. MONITORING & CORRECTIVE ACTIONS
6. VERIFY & VALIDATE THE PLAN
7. DOCUMENT
Control measures to mitigate risk

ASHRAE 188 WMP
Core Elements:

4. Identify Controls

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Control measures to mitigate risk
Principles of effective water management

- Maintain water temperatures to prevent *Legionella* growth – Keep Hot water Hot & Cold water Cold
- Prevent water stagnation, keep water moving through the system
- Ensure adequate disinfection throughout the system
- Maintain devices to prevent scale, corrosion, and microbial growth (biofilm), all of which provide a habitat and nutrients for *Legionella*

> Once established, water management programs require regular monitoring of key areas for potentially hazardous conditions and the use of predetermined action responses to remediate such conditions if the team detects them.
Control measures to mitigate risk
Establish 4 things for each Control Measure

1. Set Control Limits for each point where control is applied
2. Determine Monitoring Method for each point where control is applied
3. Set Monitoring Frequency for each point where control is applied
4. PRE-determine Corrective Actions for when control measures are Outside of Limits
Control measures to mitigate risk
Types of control measures

Hierarchy of Controls

- **Elimination**: Physically remove the hazard
- **Substitution**: Replace the hazard
- **Engineering Controls**: Isolate people from the hazard
- **Administrative Controls**: Change the way people work
- **PPE**: Protect the worker with Personal Protective Equipment

Most effective

Least effective
Control measures to mitigate risk
Secondary Disinfection options

Risk Mitigation: Secondary Disinfection

Chemical Oxidation
- Chlorine
- Chorine Dioxide
- Monochloramine

Chemical Reduction
- Cu: 400 ppb
- Ag: 40 ppb

Temperature Control
- < 77°F (25°C)
- > 140°F (60°C)

Point of Use Filtration
- 0.2 micron
Controlling temperature on devices is one of the easiest and most effective measures the WMP team can take to control the growth and proliferation of *L. pneumophila*.

Insure devices are kept at temperature ranges that reduce risk while still managing scalding risk.
Control measures to mitigate risk
Point of use filters

Legionella Bacteria are …

Very, very, very, very …

*small* bacteria

0.3–0.9 µm (by)
2–20 µm

A 0.2 µm filter can be effective to reduce *L. pneumophila* exposure at the point of use, but long-term they can be challenging to properly maintain and be expensive.
Control measures to mitigate risk

Chemical disinfection methods

Any chemical disinfection process should be performed by a certified water treatment professional

- Continuous Supplemental Chlorination (1-4 ppm)
- Copper-Silver ionization (continuous) (400/40 ppb)
- Chlorine Dioxide (ClO₂)
- Monochloramine (continuous)

- Shock Chlorination: >10 ppm free residual, may require water tanks to be 25-50 ppm
Control measures to mitigate risk
Summary

- Control measures to mitigate risk is the heart of a WSM plan and the key to preventing disease.
- The Team shall determine the control measures to be maintained, including:
  - preplanning of physical design & equipment siting
  - treatment methods
  - all aspects of monitoring to maintain the proper (safe) chemical and physical conditions of the water
- For each control measure determine: location, limits, monitoring methods & frequency as well as corrective actions for control measures outside of control limits.
- Document, Document and Document everything!
Water Management Planning
Monitoring and Corrective Actions
WATER MANAGEMENT PLANNING STEPS

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3. IDENTIFY RISK AREAS
4. DETERMINE CONTROLS
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WSM Plan – Corrective Actions

ASHRAE 188 WMP
Core Elements:

5. Monitor / Correct

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WSM Plan – Corrective Actions
A pre-determined plan for when things go wrong

Pre-determined Corrective Action planning will:

- Saves time and money when something goes wrong
- Gives the WMP team guidance when things are hectic
- Allows others, outside the WMP team, visibility and direction on actions to implement when team members aren’t present

Exercise: think of what might happen if the control measures or validation testing weren’t in expected ranges; what activities would correct the situation back to ‘normal’ and who would perform those correcting activities?
WSM Plan – Corrective Actions
Example 1

CORRECTIVE ACTION EXAMPLES / per the CDC TOOLKIT

Building water systems are dynamic. You should plan for your monitoring results to vary over time and be prepared to apply corrective actions. **Corrective actions** are taken in response to systems performing outside of control limits. The following are examples of corrective actions.

Example 1—Biofilm growth in the fountain

1. During her weekly inspection of the fountain in the first floor lobby, Michelle Patterson notes that the fountain walls have accumulated a slimy growth.

2. As dictated by her water management program, Michelle immediately shuts off the fountain, drains it, and scrubs it with a detergent recommended by the manufacturer.
WSM Plan – Corrective Actions

Example 1: Corrective Actions / Biofilm growth in the fountain

(CDC Toolkit)

3. She then follows the program’s start up procedure to refill the fountain with water and checks the residual disinfectant levels to make sure that they are within control limits.

4. Michelle documents her observations and the performance of interim cleaning in her log book. She informs her supervisor.
WSM Plan – Corrective Actions
Example 2

Example 2: Corrective Actions / Unoccupied Floor

(CDC Toolkit)

1. The eighth floor of the building is being renovated and is closed to the public. Jason Hernandez understands that this may cause a temporary hazardous condition because water usage will decrease, which means that stagnation is possible.

2. After discussing the issue with his supervisor, Jason counteracts the potential for stagnation by daily flushing of the sinks and fixtures with hot and cold water in several rooms including those at the end of the hall, which are furthest from the vertical pipe serving that floor (riser).
Example 2: Corrective Actions / Unoccupied Floor

3. Jason also increases monitoring of temperature and chlorine levels on the eighth floor from weekly to daily for the duration of the renovation.

4. He documents the method and duration of flushing and records his daily temperature and chlorine readings in his log book. He reviews his documentation with his supervisor.
WSM Plan – Corrective Actions

Example 3: Corrective Actions / Debris in the Cooling Tower

1. During weekly inspection of the cooling tower, Michelle discovers that leaf litter has accumulated in the reservoir.

2. Upon further investigation, she finds that a panel has become dislodged, allowing windblown debris to enter.
3. After replacing the panel and skimming out the debris, Michelle checks the disinfectant levels and performs a heterotrophic plate count to find that the conditions are still within control limits.

4. She documents her actions in her log book. She also makes a note to check the disinfectant levels daily for a week to make sure that the cooling tower remains within control limits. She reviews her actions and documentation with her supervisor.
Learn from the Experience/Mistakes of Others

- **Outbreaks can also occur under these situations:**
  - New Construction or Renovations
  - After installation of Low Flow/Electronic Sensor Faucets
  - After long dormant periods (weeks or months) before building occupancy in unoccupied rooms or at seasonal lodging establishments
Final Thoughts: Construction and *Legionella*

- Legionnaires’ disease and *Legionella* contamination can occur in new buildings during construction & in existing structures during renovation of old buildings.

- Risk can be managed:
  - Assessment and Water Safety Management Plans
  - Think (*Legionella*) **differently** about the routine commissioning process
  - Test for *Legionella* before & after construction
WSM Plan – Corrective Actions
Summary

- Things will go wrong, but that is not the time to decide what to do!!
- The WMP team must have pre-determined actions in place to address when control measures are out of control
- Think about each control measure and what could go wrong, then write the actions to be taken and include who the responsible party will be to take those actions
- Document everything
Water Management Planning

Verification and Validation
WATER MANAGEMENT PLANNING STEPS

- Team Roles & Responsibilities
- Describe the System
- Identify Risk Areas
- Determine Controls
- Monitoring & Corrective Actions
- Verify & Validate the Plan
- Document
WSM Plan – Corrective Actions …

6. Confirmation

ASHRAE 188 WMP

Core Elements:

- **PROGRAM TEAM**—Identify persons responsible for Program development and implementation.
- **DESCRIBE WATER SYSTEMS/FLOW DIAGRAMS**—Describe the potable and nonpotable water systems within the building and on the building site and develop water-system schematics.
- **ANALYSIS OF BUILDING WATER SYSTEMS**—Evaluate where hazardous conditions may occur in the water systems and determine where control measures can be applied.
- **CONTROL MEASURES**—Determine locations where control measures must be applied and maintained in order to stay within established control limits.
- **MONITORING/CORRECTIVE ACTIONS**—Establish procedures for monitoring whether control measures are operating within established limits and, if not, take corrective actions.
- **CONFIRMATION**—Establish procedures to confirm that
  - the Program is being implemented as designed (verification), and
  - the Program effectively controls the hazardous conditions throughout the building water systems (validation).
- **DOCUMENTATION**—Establish documentation and communication procedures for all activities of the Program.
WSMP – verification & validation

Verification and Validation are your most important forms of documentation

**Verification**: Confirming activities of the WSM Plan are being done
- Checking temps
- Checking disinfectant
- Cleaning is done
- Everything is documented

**Validation**: Confirms the WSM Plan is *actually working*
- Testing for *L. pneumophila* bacteria at predetermined sites

Source: ASHRAE 188:2018
WSM Plan – Verification
Doing what you said you’d do

Confirm that the control measures of the WSM plan are being performed and being appropriately responded to.

The WSM Team assessed risk, identified control measures and put sampling and monitoring protocols in place along with corrective actions.

Now, what does the team do to insure those activities are taking place?
WMP Verification is much like an internal audit

The WMP Team put considerable effort into insuring the Plan will reduce the risk of contracting Legionnaires’ disease and protect public health.

To insure the plan is being implemented as written, then a designated person/group must check that all the controls are functioning as expected. These ‘checks’ must be documented. This is much like an internal audit.
Control measure: Chlorine level checks in Hydrotherapy spa

- The Plan states:
  - Chlorine level in this spa is to be 0.5 - 0.7 ppm
  - Spa is to be tested daily and results recorded in a log book
  - If it is below 0.5 ppm,
    - Request “R” (spa operator) adjust to the range
    - Notify WSM “A” contact who will cascade to the right “R’s” for necessary corrections, including re-training and potential infection risk

The individual tasked with performing routine verification will check that these activities were performed and documented. They will check log book entries, values and note actions taken and if any Plan corrections were needed and performed.
Control measure: Boiler #1 to be maintained at or above 140 °F

- The Plan states:
  - ✓ Boiler #1 to maintain at or above 140 °F
  - ✓ Temperature to be tested daily and results recorded in a log book
  - ✓ If temperature is below 140 °F:
    - • Request team member (operator) adjust the temperature
    - • Notify team of finding, who will cascade to the right contact necessary corrections, including re-training and potential infection risk

The individual tasked with performing routine verification will check that these activities were performed and documented. They will check log book entries, values and note actions taken and if any Plan corrections were needed and performed.
WSM Plan – verification example 3

- Control measure: disinfectant residual checks
- The Plan states:
  - Preselected taps and showers must be at 0.2 – 0.5 ppm chlorine
  - Sites are tested weekly, results recorded in a log book
  - If it is outside 0.2 – 0.5 ppm:
    - Request (water treatment professional) adjust to the range
    - Notify WMP team who will cascade to the right contact for necessary corrections, including re-training and potential infection risk

The individual tasked with performing routine verification will check that these activities were performed and documented. They will check log book entries, values and note actions taken and if any Plan corrections were needed and performed.
Validation demonstrates WMP effectiveness

Validation determines if WMP is effectively reducing risk and can be accomplished through either:

- **PROACTIVE Validation:**
  
  Routinely testing water samples for *L. pneumophila*

  OR

- **REACTIVE Validation:**

  Clinical surveillance for cases or outbreaks of Legionnaires’ disease
Accredited labs should do *L. pneumophila* testing
ASHRAE 188 Annex C guidance if *Legionella* testing is utilized

- Labs performing routine microbiological testing of environmental water samples **should be accredited** by a regional, national, or international accrediting body according to a nationally or internally recognized standard

- Lists of accredited laboratories are available

*Per ASHRAE 188:2018, Appendix C and CDC ELITE website FAQs https://wwwn.cdc.gov/elite/Public/FAQ.aspx*
Reliable data translates to cost effective actions

Accredited laboratories are more likely to produce reliable validation data; the laboratory should provide your WSM team with:

- A copy of their accreditation certificate and Scope of Accreditation
- Chain of Custody and Sampling Protocols, then train all sampling personnel to them
- Documentation of successful Proficiency Test samples
- A blinded Data Report, all reports should include Quality Control (QC) and Quality Assurance (QA) requirements

Additionally, an accredited laboratory will:

- Be able to identify the pathogen target, *L. pneumophila*; to avoid WSM Plan actions, and cost, for detecting non-pathogenic bacteria
- Develop a Quality Assurance Project Plans (QAPP) that covers customer testing, documentation and reporting needs
Taking water samples for *Legionella pneumophila* testing

- Sample-taking is just like all other normal water samples for other bacteria testing, like coliform testing.
- Use protective equipment when sampling cooling towers if the fans cannot be shut off.
- Wearing gloves is good practice when taking ANY bacteria sample!!
- The accredited laboratory will have sampling instructions.
Analytical Culture Methods used for Validation Testing

- Liquid culture, with bacterial enzyme indicators
- Specialized solid media on spread-plates – BCYE derived
Most Probable Number (MPN) and Colony Forming Units (CFU) are used interchangeably

- Both units are used to report the estimated number of bacteria in a sample.
- Utilities, facilities, public health agencies regularly rely on MPN methods for accurate results.
- Globally, regulatory bodies allow methods that report in either CFU and MPN and they are used interchangeably in regulatory action limits.
WSM Plan validation – Interpreting routine test results for *L. pneumophila*

1. How much is there?
2. Is this a **change** from an accepted baseline?

Results from one test to another must be reliable to know this.
ISO 11731:2017 culture method

Potable samples

Majority of samples

10-14 days to results
CDC culture method

Note: this is not a CDC ‘approved’ method, just developed by CDC

High Counts
(Non-potable water)

Transfer 1mL

Acid treat pH2.2 15 min

Low Counts
(Potable water)

Centrifuge

OR

Membrane Filter

Plate 0.1mL

GCV, GCV, BCYE

Check plates at 4 and 7 days

Confirm

BCYE AND BCYE- OR Blood Agar

10-14 days to results
Spread-plate culture methods – not easy to read, hard to reliably reproduce test data

- Subjectivity of colony interpretation
- Variation of media between vendors
- Interference of non-\textit{Legionella} organisms
- Analyst experience level
Legiolert™ liquid culture method

Negative Sample

Positive Sample
Detection of *L. pneumophila* by Legiolert

- Confirmed results in 7 days
- Detects and quantifies all serogroups of *Legionella pneumophila* (*Sg1 – 15*)
- 99% reproducibility and repeatability (inter/intra lab samples get the same results)
- Smaller sample size of 100 mL
<table>
<thead>
<tr>
<th>Entity</th>
<th>Type of rule</th>
<th>Potable water limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC</td>
<td>Guidance</td>
<td>Depends on Risk Mgmt Plan</td>
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<tr>
<td>ASHRAE</td>
<td>Guidance</td>
<td>Depends on Risk Mgmt Plan</td>
</tr>
<tr>
<td>AIHA</td>
<td>Guidance</td>
<td>≥ 10 cfu/mL</td>
</tr>
<tr>
<td>OSHA</td>
<td>Guidance</td>
<td>≥ 10 cfu/mL</td>
</tr>
<tr>
<td>VA Directive 1061</td>
<td>Guidance</td>
<td>Any positive</td>
</tr>
<tr>
<td>New York State Dept. of Health</td>
<td>Legislation</td>
<td>≥ 30% “positive” outlets (healthcare facilities only)</td>
</tr>
<tr>
<td>Ministry of Health</td>
<td>Legislation</td>
<td>≥ 1 cfu/mL</td>
</tr>
<tr>
<td>Germany</td>
<td>Trinkwasserverordnung TrinkwV 2001</td>
<td>Legislation ≥ 1 cfu/mL</td>
</tr>
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</table>
# Action limits – Guidance / Legislation

## Nonpotable water

<table>
<thead>
<tr>
<th>Country</th>
<th>Entity</th>
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</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>CDC</td>
<td>Guidance</td>
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<td>ASHRAE</td>
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<td>Guidance</td>
<td>≥ 100 cfu/mL</td>
</tr>
<tr>
<td></td>
<td>New York State Dept. of Health</td>
<td>Legislation</td>
<td>≥ 20 cfu/mL</td>
</tr>
<tr>
<td></td>
<td>New York City Dept. of Health</td>
<td>Legislation</td>
<td>≥ 10 cfu/mL</td>
</tr>
<tr>
<td>France</td>
<td>Ministry of Health</td>
<td>Legislation</td>
<td>≥ 1 cfu/mL</td>
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<tr>
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<td>Trinkwasserverordnung TrinkwV 2001</td>
<td>Guidance</td>
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</tr>
<tr>
<td>Canada</td>
<td>Quebec</td>
<td>Legislation</td>
<td>≥ 10 cfu/mL</td>
</tr>
</tbody>
</table>
Remember: Legionnaires’ disease is highly preventable

Consistent, reliable, data insures the water management plan is effective, initially and over-time.
Routine Legionella validation testing provides concrete evidence of WMP effectiveness

An ounce of prevention is worth a pound of cure…

Reasons building owners and managers are increasingly asking about routine *Legionella* testing:

✓ To reduce the risk of a deadly outbreak “on their watch”
✓ To reduce their liability
✓ To reduce the risk to their reputation
✓ To reduce their insurance costs or exposure
Verification and validation - Summary

- Verification Confirms the WMP is being implemented as written
- Validation Confirms the WSM plan is effectively reducing exposure of *L. pneumophila* to public and employees
- Verification and validation uncover any issues needing attention from the team
- Validation testing for the pathogen reduces risk and cost
- Document, document, document
Water Management Planning

Documentation
WATER MANAGEMENT PLANNING STEPS

1. **Team Roles & Responsibilities**
2. **Describe the System**
3. **Identify Risk Areas**
4. **Determine Controls**
5. **Monitoring & Corrective Actions**
6. **Verify & Validate the Plan**
7. **Document**
Documentation of the plan
What should you keep track of?

At a minimum:
1. The complete Water Safety Plan document, including drawings, hazard control points and control measures put in place
2. WMP Team members with contact information AND their back-ups
3. A log book of any/all monitoring of control measures
4. Contact names and phone numbers for local and state health officers and local water utility personnel (who should also be part of the water safety team)
5. Verification assessments
6. Validation testing data reports
7. Meeting minutes, agenda and attendees
If you don’t write it down, it’s like it never happened!
Final thoughts

➢ A water management plan should be a living document, in that it will require continuous review and revision as new information comes to light, additions or changes to the system are made or for a number of other reasons.

➢ Review your plan at least annually for any needed updates
Consider outside support

- Consider hiring professionals with specific *Legionella pneumophila* experience.
- There are no certification programs available for WSMP providers.
- **Water treaters** or **engineering firms** will often provide planning services

Factors to consider*:
- Environmental assessment expertise
- Remediation expertise
- Water Management expertise
- Knowledge of codes, standards, and regulations

*CDC website
Additional Water Safety Management resources

- **Association of Water Technologies (AWT)** Certified Water Treaters list [WWW.AWT.org](https://www.awt.org/pub/ad6d24e6-f693-773f-7049-62df1aa75ee6) and list of accredited testing labs: [https://www.awt.org/pub/ad6d24e6-f693-773f-7049-62df1aa75ee6](https://www.awt.org/pub/ad6d24e6-f693-773f-7049-62df1aa75ee6)

- **HC Info**: WSM Templates, checklists & technical information [https://hcinfo.com/home/](https://hcinfo.com/home/)

- **ASHRAE**: Guidance on Reducing the Risk of Legionella [www.ASHRAE.org](http://www.ASHRAE.org)

- **Centers for Disease Control (CDC)**: Information on Legionella and the CDC Tool Kit [www.cdc.gov/legionella](http://www.cdc.gov/legionella)

- **IDEXX**: information on *L. pneumophila* [www.idexx.com/findlp](http://www.idexx.com/findlp) and a directory of testing laboratories [www.idexx.com/legionellatesting](http://www.idexx.com/legionellatesting)
Contact Information

For help from a Water Safety Specialist near you, complete the Contact Us form at:

https://www.idexx.com/en/water/contact-water/legiolert-info/

Or email us at Watersafety@idexx.com

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www.IDEXX.com/water