Waterborne Pathogens- Building a water Management Plan 101

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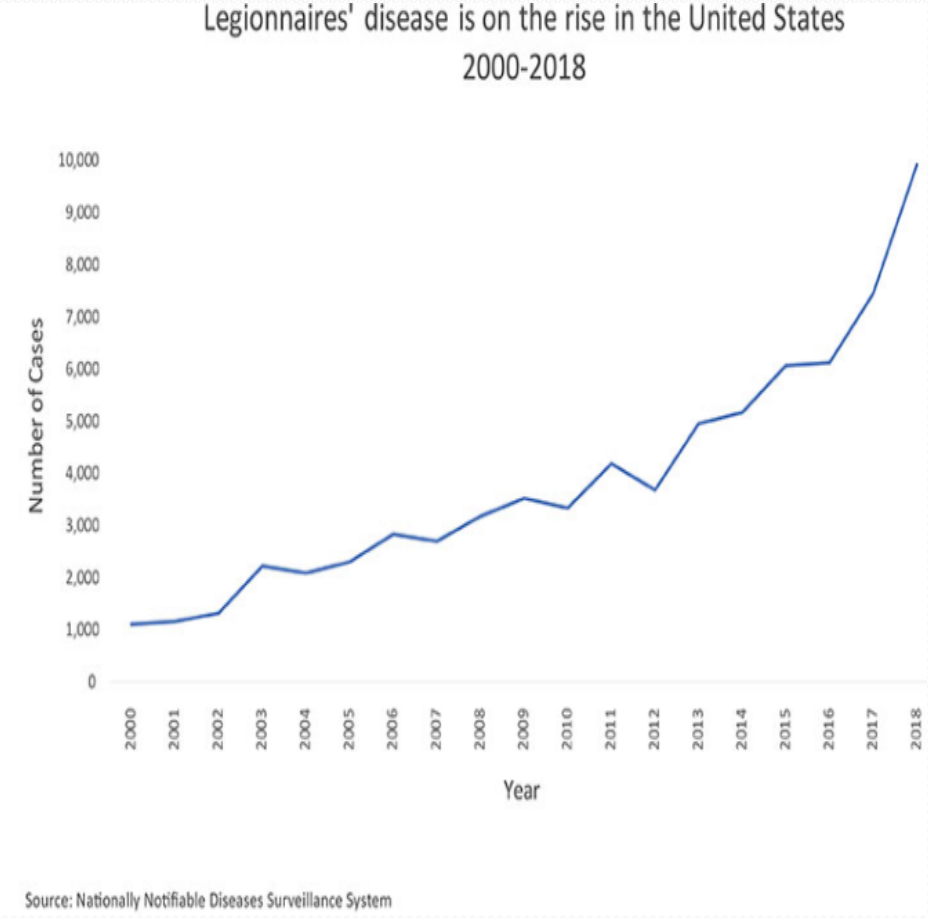
INTRODUCTION

- Rate of reporting has grown by nearly 9 times since 2000
- 76% acquire Legionnaires' disease from healthcare facility
- 1 in 4 individuals expire due to healthcare facility acquired infection
- 4 in 5 could have been prevented
- Prevention is not limited to Infection Prevention
- Outbreak with one single event



Objectives

- Upon completion, participants will be able to understand what opportunistic pathogens are associated with plumbing/potable water systems
- Upon completion, participants will be able to identify factors associated with outbreaks and potential transmission mechanisms
- Upon completion, participants will be able to discuss recommendations and practices the infection preventionist should implement to become a stronger partner with risk and facilities in the development of water safety management plans.

Get Down with the Language

- **ASHRAE:** American Society of Heating, Refrigerating and Air Conditioning Engineers
- **Water management Plan:** The risk management plan for the prevention and control of legionellosis associated with building water systems, including the documentation of the plan's implementation and operation.
- **Potable water system**: a building water distribution system that provides hot and cold water intended for human consumption
- **Dead legs**: capped pipes with water but no flow resulting in stagnate water.
- **Verification**: initial and ongoing confirmation that the program is being implemented as designed.
- **Validation:** initial and ongoing confirmation that the program, when implemented as designed, effectively controls the hazardous conditions throughout the building water systems

Get Down with the Language

- **Monitoring**: Conducting a planned sequence of observations or measurements
- **Control Limit**: A maximum value, a minimum value, or a range of values
- **Corrective Action**: Action to be taken to return control values to within established limits when indicated
- **Sink Aerators:** reduce the volume of water thus reduces the splash distance
- **Cooling Tower**: for heating, ventilation, and air conditioning (**HVAC**)

Healthcare-acquired Legionnaires' Disease

Legionella

- Found naturally in freshwater and human-made aquatic environments as well as in soils.
- Legionella spends much of their life cycle in biofilms.
- Biofilms allow Legionella to be protected from environmental stressors such as extreme temperatures and disinfectants

Legionella

Spreads by droplets and people inhale them in.

- People can get sick by aspiration of drinking water, less common
- Not person to person spread.
  Becoming symptomatic post exposure to Legionella can result in two different illnesses
- Legionnaires' Disease which results in pneumonia. cough, SOB, Fever, muscle aches, headaches) and
- Pontiac Fever – a milder infection & symptoms: fever and muscle aches, the patient does not develop pneumonia

People at increased risk

- People 50 years or older
- Chronic lung disease
- Immunocompromised –transplant, diabetes etc
- Oncology patients or other underlying illness

Other Waterborne Pathogens

- Pseudomonas species
  - This bacteria is commonly found in the environment
  - Spread to people when exposed to contaminated water or soil
  - Pseudomonas spp cause a wide variety of infections in the body
- Nontuberculosis Mycobacterium (NTM)
  - Environmental organisms found in soil, dust and water including natural water sources and municipal water sources.
  - Difficult to eliminate due to biofilm.
  - NTM can cause a wide variety of infections in the body however most commonly focus on the lungs

Sources linked to water systems

Exposure Sources

- **Hospitals**
- Nursing Homes
- Rehab centers
- Office build
- Apart build
- Hotels

- **Cooling towers**
- Potable water systems
- Evaporative condensers
- **Spas/whirlpools/hydrotherapy**
- **Respiratory therapy**
  Bronchoscopes
- Room air humidifiers
- **Decorative fountains**
- **Showers**
- **Ice machines**
- **Medical devices – CPAP**
- Eye washes
- Sink faucets

Regulatory Requirements-Industry Guidance

DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop C2-21-16
Baltimore, Maryland 21244-1850

CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

Center for Clinical Standards and Quality/Survey & Certification Group

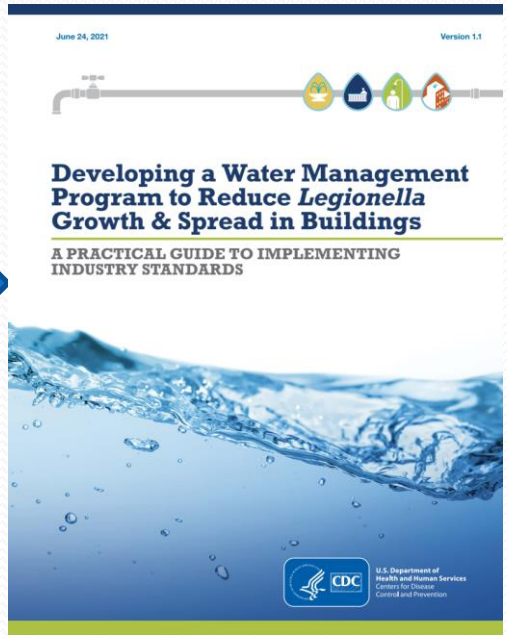
Ref: S&C 17-30-*Hospitals/CAHs/NHs*
REVISED 06.09.2017

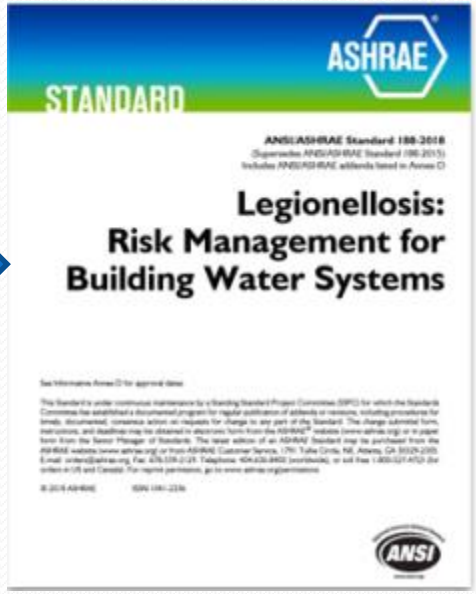
DATE: June 02, 2017

TO: State Survey Agency Directors

FROM: Director
Survey and Certification Group

SUBJECT: Requirement to Reduce *Legionella* Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease (LD)





ASHRAE 188: compliance Good News, Bad News

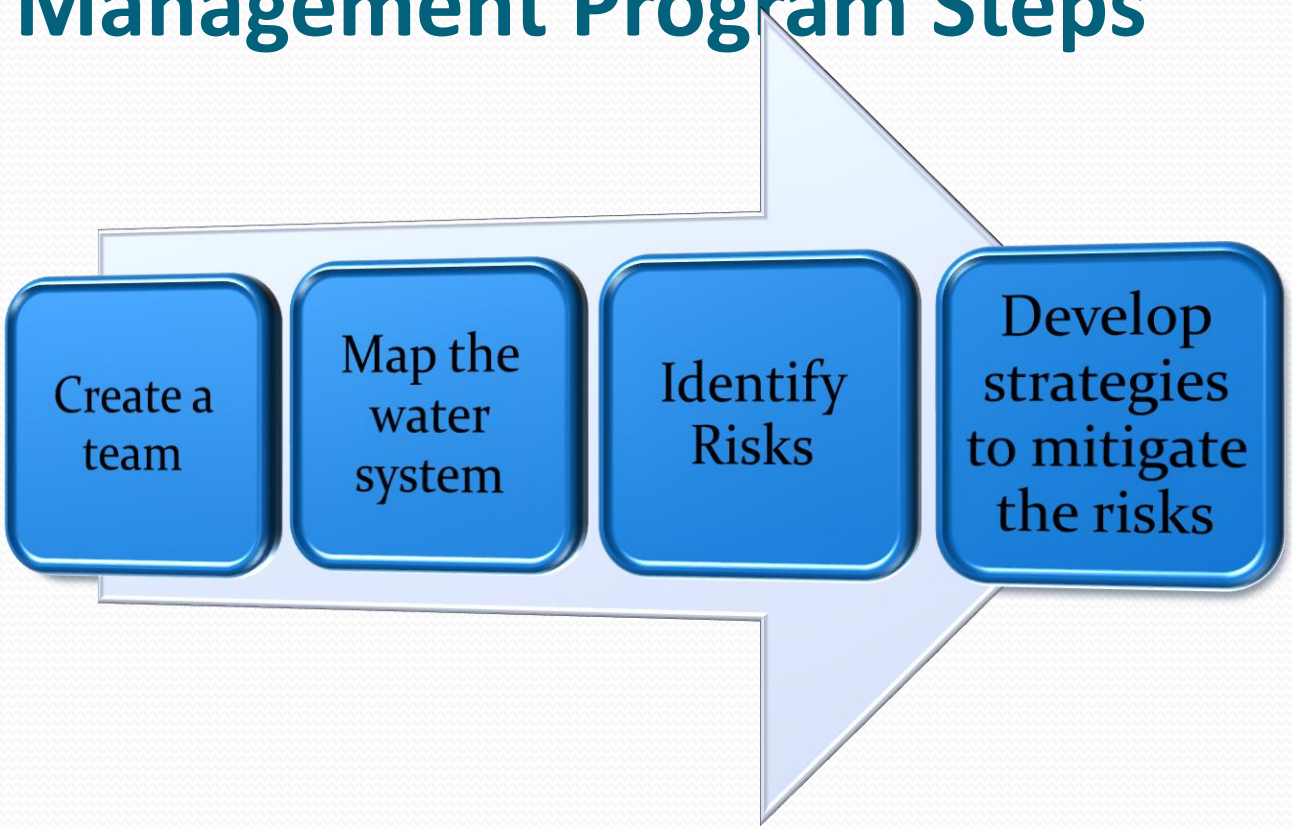
Standard is not prescriptive

- Good news: You get to make lots of decisions

- Bad news: You get to make lots of decisions

Water Management Program Team - Partners

Water Management Program Steps



Source: ASHRAE Standard 188,
https://www.hfmmagazine.com/articles/3771-seven-steps-to-creating-a-water-management-program

Map Your Water Systems

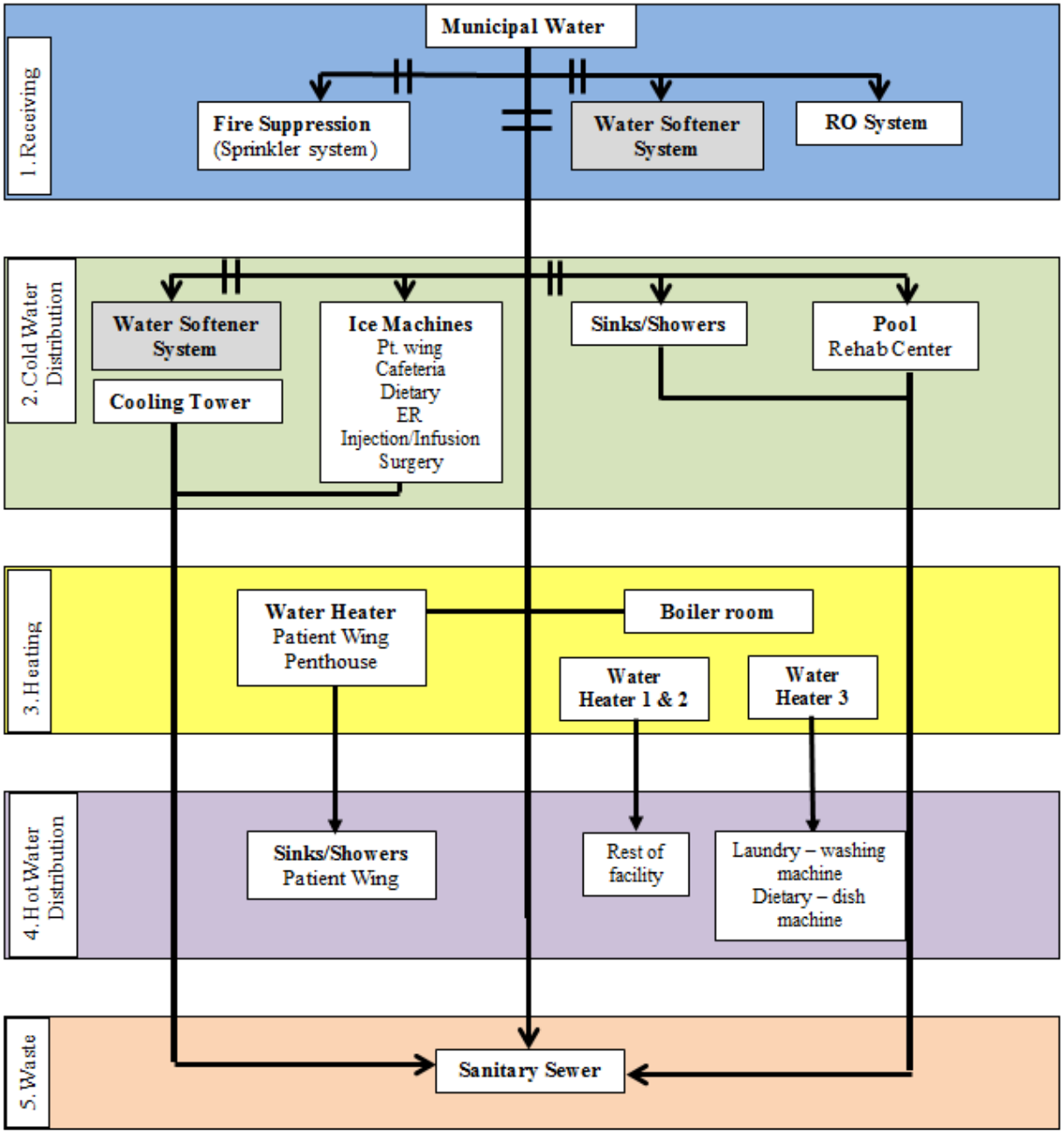
Create a simple description of your buildings water system and devices.

Describe the water building system using text and flow diagrams.

HINT: Start with the facility plumbing plans and create the document from there.

- Where does the water enter?
- Where is cold water distributed?
- Where is the cold water heated?
- Where is the hot water distributed?
- Where does the hot, cold and tempered wastewater discarded?

Community Hospital Water System Flow Diagram



Identify Risks

Identifying Buildings at Increased Risk

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

Yes ___ No ___ 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?

Yes ___ No ___ 2. Does your building primarily house people older than 65 years (like a retirement home or assisted-living facility)?

Yes ___ No ___ 3. Does your building have multiple housing units and a centralized hot water system (like a hotel or high-rise apartment complex)?

Yes ___ No ___ 4. Does your building have more than 10 stories (including basement levels)?

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*.

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

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

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

Yes ___ No ___ 8. Does your building have a centrally-installed mister, atomizer, air washer, or humidifier?

Individual Risk Factors

Building Risk Factors

- Population served
- Multiple units or floors and centralized hot water system

Device Risk Factors

- Cooling Tower(s)
- Hot tub or spa
- Decorative fountain
- Central mister, atomizer, air washer, or humidifier

Risk management plan for

LEGIONELLA CONTROL

in the operation and maintenance of the water systems of

St Charles Surgical Hospital

Facility name	St Charles Surgical Hospital
Facility address	1717 St Charles Ave
Responsible person	Jay Gould – Director of Plant Operations

Revision history

Revision	Comment	Date	Initials
N/A	Initial Review	09/11/17	MD

https://www.hindmarshplumbing.com.au/media/enhealth-RMP-Template-Final.pdf

Risk Assessment

System/Component	Qualitative measures of likelihood					Qualitative measures of consequence or impact on ficility					Score
Prpbability X Risk X Preparedness = score	Almost Certain	Likely	Possible	Unlikely	Rare	Insignificant	Minor	Moderate	Major	Catastrophic	
SCORE	A	B	C	D	E	1	2	3	4	5	
Incoming Water											
Incoming water contamination											
Loss of supply											
Failure of Backflow prevention device											

- https://www.hindmarshplumbing.com.au/media/enhealth-RMP-Template-Final.pdf

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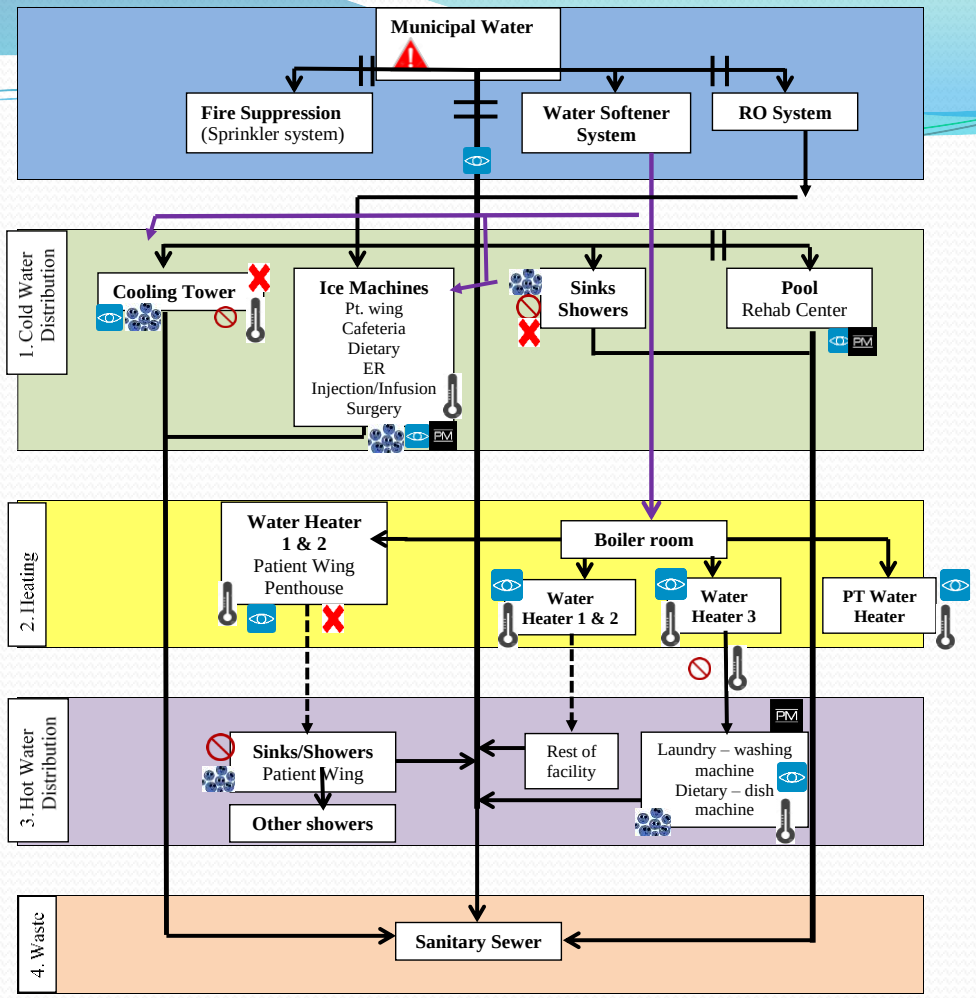
SCORE	A	B	C	D	E	1	2	3	4	5	
Incoming Water											
Incoming water contamination				x					x		
Loss of supply											
Failure of Backflow prevention device											

Qualitative risk analysis matrix - level of risk

Likelihood	Consequences				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastropic
A (Almost Certain)	Moderate	High	Very high	Very high	Very high
B (Likely)	Moderate	High	High	Very high	Very high
C (Possible)	Low	Moderate	High	Very high	Very high
D (Unlikely)	Low	Low	Moderate	High	Very high
E (Rare)	Low	Low	Moderate	High	High



Legend:

Water Process	Backflow Preventer	Water Flow	Recirculating Return Flow
Temperature Permissive	Preventative Maintenance	Stagnation	Disinfectant
Conditions for bacteria spread	Visual Inspection	External Hazards	

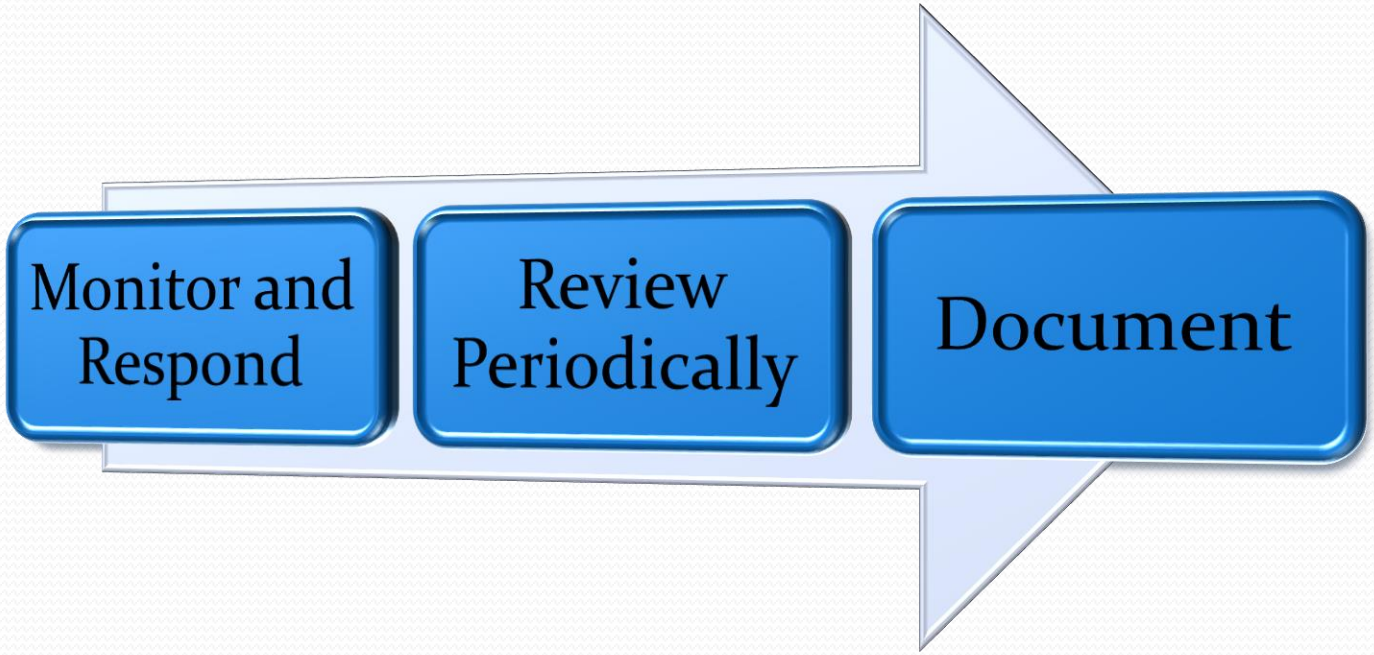
Develop Strategies to Mitigate Risks

Determine what strategies you can implement to reduce the risks to your facility.

- Flushing of hot and cold water
- Temperature checks
- Chemical checks
- Competencies of the key players doing these tasks
- Environmental sampling for viable Legionella.
- Monitoring water quality

Table 1 Hazard identification and risk assessment table, including and add rows as required)			
System component	Hazard and hazardous event	Risk score	Possible control measures
Incoming water	Incoming water contamination	High	Isolate incoming water - see what the contaminate is and how to treat it, then sanitize whole system with appropriate method
	Loss of supply	High	Pull up MOUs with other facilities to get water supplies here if an extended outage is anticipated
	Failure of backflow prevention device	Moderate	Repair/replace back flow preventer - if believe contamination occurred to the water system - would sanitize water system
Hot water system	Water stored below 140 debrees	Moderate	open
	Heater failure or under capicity	Low	The hot water heating systems has a redundency built into the system. If one water heater was not functioning then would bring another hot water heater on line.
	Build up of sludge in tank - Physical Therapy	Low	Annual PMs completed - if sludge noted the sludge would be cleaned out

Water Management Program Steps



Source: ASHRAE Standard 188,
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ASHRAE Recommendations

Monitor and Respond aka Meter/Measure/Manage

- Method
- Frequency
- Control Limit
- Corrective Action

Ornamental water feature

- Water quality weekly
  - pH
  - Water Temperature
  - Visual Inspection
  - Odor
- Heterotrophic plate count (HPC) monthly

Source: ASHRAE Standard 188,
https://www.hfmmagazine.com/articles/3771-seven-steps-to-creating-a-water-management-program

Monitoring

Table 2 Operational monitoring, showing examples (edit, add or delete rows as required)							
System Component	**Risk**	**Parameter**	**Frequency**	**Location**	**Critical limit**	**Record (where is the measurement recorded)**	**Corrective action (all corrective actions listed here should have a procedure listed in table 1**
Incoming water	Low disinfectant residual	Chlorine residual	Online or weekly	Point of entry into facility	Less than 0.5mg/l	Chlorine residual record sheet	Increase chlorine dose within facility
Hot water	Low temperature	Temperature	Weekly	Hot water Outlet in Kitchen (sink tap at far right corner)	Temperature less than 149F	Weekly temperature kitchen record sheet	Increase temperature of water heater
Warm water	Water temeraature that supports legionella growth	Temperature	Daily	Outlet furthest from water heater (wash basin tap in room XX)	Temperature grater than 68 F and less than 122F	Daily temperature record sheet	Check heater temperature and adjust if required, check pipework for loss of heat, check operation of TMV

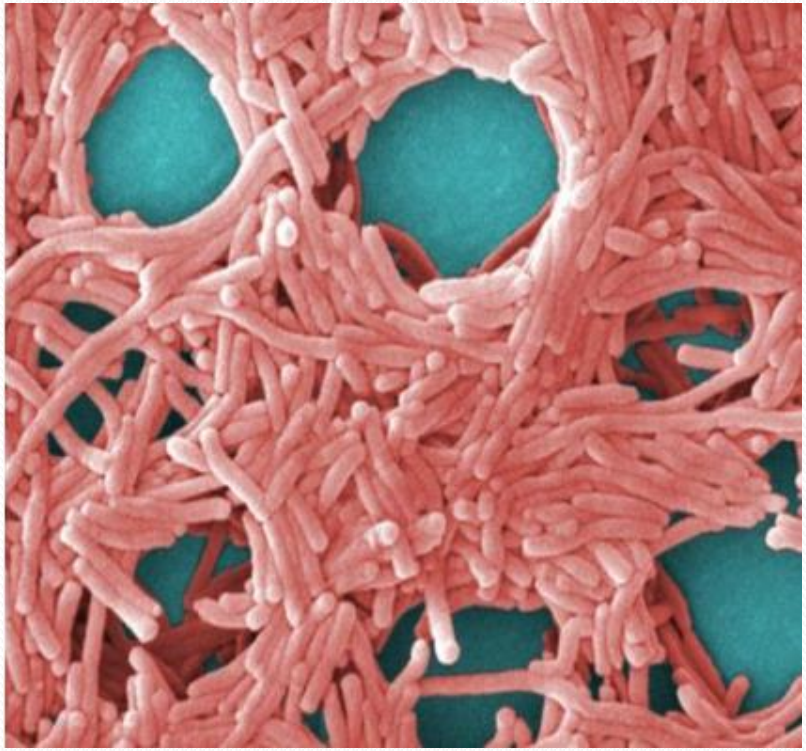
Verification monitoring

Table 3 Verification monitioring, showing examples (edit, add or delete rows as required)						
Paramater	Frequency	Location	Limit	Reported to	Operational response to exceedance of critical limits (all responsed should have a procedure as per table 1	Clinical response to exceedance of limit (all responses should have a procedure listed as per table 2)
Heterotrophic plate count	Monthly	Distal warm water taps-wash basins in room xxx	Greater than 500 CFU/ml	Building, engineering and maintenance services (BEMS) supervisor	1. Check operational measurements (temperature, pH, turbidity, disinfectant residuals and dose), maintenance schedules (including flushing regimes) and structural integrity 2. Flush water through until sufficient disinfectant tesidual is achieved at sampling point. 3. Resample after responses are completed	None
Legionella spp.	Quarterly	Distal warm water taps-wash basins in room with low risk patients	Greater than 10CFU/100 ml	BEMS manager and CEO	1. Check operational measurements maintenance schedules and structural integrity of system 2. Clean and sanitize TMV and outlet fitting 3. If resample positive, move to next row	Remove patient/s from affected room/s

Review

- Data review
- Response review
- Review plans for updates

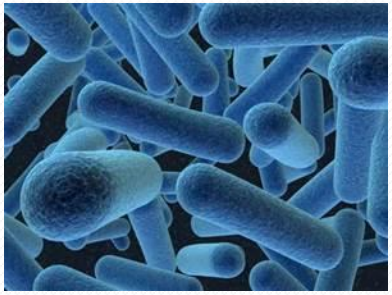
Document and Communicate



- Program team
- Building description
- Water system description and process flow diagrams
- Control measures
- Confirmatory procedures
- Document collection

Outbreak Avoidance During Construction, Renovation, or Preventative Maintenance Practices

- Consistency between water management plan and facility construction risk assessment
- Water intrusion
- Prevent frozen pipes
- Commission and recommissioning of unused space
- Update documents
- Construction events
- Water shut down

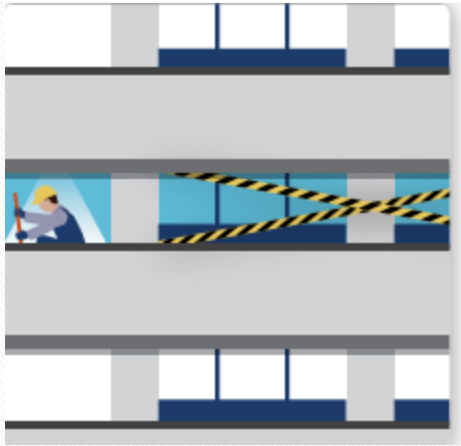


Challenges with older buildings

- Potential for dead legs increases
- Unoccupied floors/space
- Water main break or pipes breaking
- Equipment damaged or broken
- Construction/ Renovation

Challenges with newer buildings

- Connecting with municipality water supply can create problems
- Not enough chlorine comes to the building
- Unoccupied floors/space

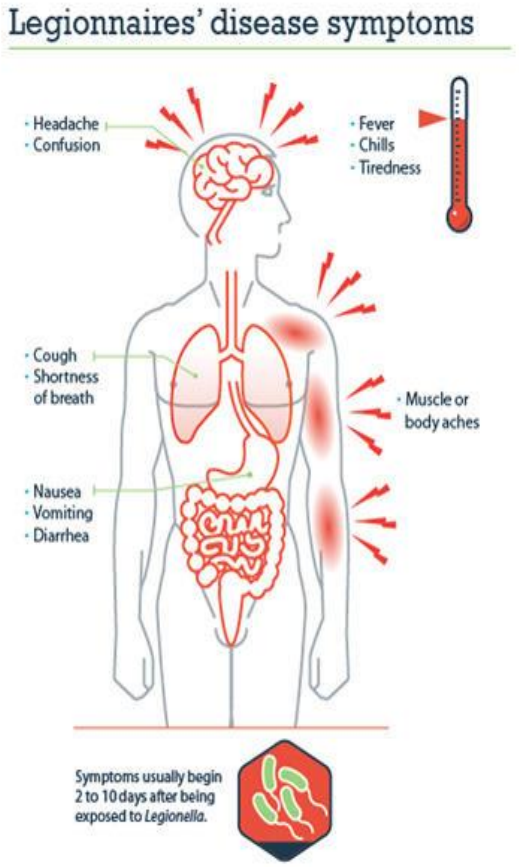


Outcomes

- The desired outcome is confirming on a regular basis that our water management program is being followed. We verify and validate the program continuously to manage your facilities risks.
- A successful WMP:
  - Is meeting all verification and validation steps.
  - Water quality is within established parameters.
  - Environmental testing for Legionella are within limits
  - No Legionellosis cases are identified in our patients/clients from a healthcare associated cause.

What if I have a legionella case!

- Determine if facility-acquired infection
- Report to Public Health
- Document your determination
- If met the definition of potential or FAI, notify medical director and active your water management team and plar
- Activate full investigation if:
  - 1 or more FAI
  - 2 or more cases of possible FAI
  - Activate outbreak plan



Don’t Forget

- Dialysate Water
- Sterilization and Processing Department
- Sprinkler Heads
- RO systems

Prevention with Equipment Design

- **Hand Washing Stations**
  - Faucets
  - Location
  - Soap
  - Drying
  - Aerators
  - Sink Controls

- **Whirlpool or Spa Bathing Facilities**
  - Manufacture recommendations
  - Understand operation
  - Training on cleaning, disinfection, and preventative maintenance
  - Monitor chemical levels and water temperature

Cooling Tower Prevention

CDC

- Direct drift away from the air-intake system
- Minimizing aerosol drift
- EPA-approved biocides

Routine System Monitoring

- Checklists
- Observe wetted surfaces
- Dosing & control equipment

Compliance Inspection

Risk Mitigation

Red Flags

- Lack of responsible, knowledgeable water risk management team
- Failure to maintain any secondary disinfection system
- Prior inability to control water temperature fluctuation/stagnation issues/biofilm/sediment
- Untreated cooling towers or lack of drift eliminators
- Lack of documentation-maintenance logs, remediation, response actions, results
- Failure to comply with any state, local regulations

Conclusion

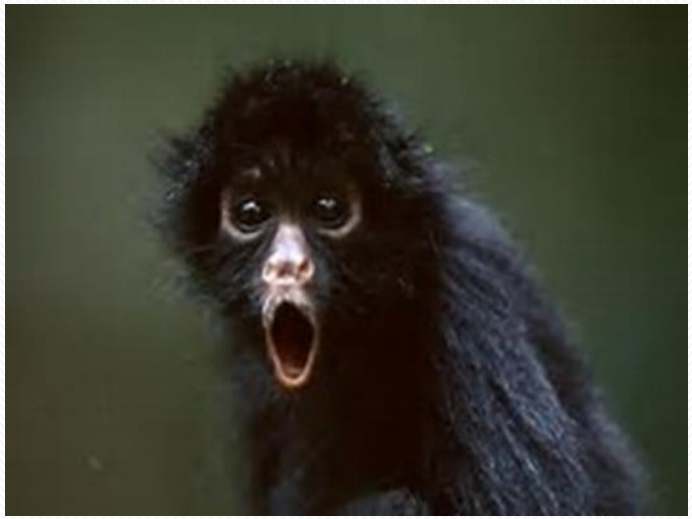
- We have reviewed what opportunistic pathogens are associated with plumbing/potable water systems.
- We have reviewed factors associated with outbreaks and potential transmission mechanisms.
- Able to discuss recommendations and practices the infection preventionist should implement to become a stronger partner with risk and facilities in the development of water safety management plans.

Don’t chase zero

Zero Legionella

Is virtually impossible to

Achieve in complex water systems



Resources

- Water Management Program Template, 2019: https://cha.com/wp-content/uploads/2019/03/Water-Management-Program-Template.pdf
- CDC Legionella Environmental Assessment Form: https://www.cdc.gov/legionella/downloads/legionella-environmental-assessment-p.pdf
- CDC Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings -A Practical Guide To Implementing Industry Standards: https://www.cdc.gov/legionella/downloads/toolkit.pdf
- Centers for Medicare & Medicaid Services S&C 17-30 Revised 06.09.2017, https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/Survey-and-Cert-Letter-17-30.pdf
- Risk management plan for *LEGIONELLA* CONTROL in the operation and maintenance of the water systems **https://www.hindmarshplumbing.com.au/media/enhealth-RMP-Template-Final.pdf**