Water Management Plans in Long term Healthcare to Prevent Legionnaires Disease and Other Waterborne Pathogens

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Legionnaires Disease

Legionella pneumophila, a ubiquitous gram-negative bacteria naturally occurring at low levels in surface water. Most cases are caused by inhaling water droplets containing *Legionella pneumophila* serogroup 1, there are at least 15 other serotypes

Not transmitted from person to person

Two clinical syndromes

- Pontiac fever--Self limiting flu-like illness --under reported and diagnosed
- Legionnaires Disease aka *Legionella* Pneumonia--About 10% mortality rate
  - Onset about 2-10 days after exposure
  - Severe cough, high fever, chest pain, nausea, vomiting and diarrhea, and confusion

Risk factors for Legionnaires disease include

- Age > 50
- Current or former smoker
- Chronic Lung Disease (emphysema or COP)
- Immune system disorders
- Other underlining chronic illness

Diagnosis based on clinical examination and laboratory tests

- Urinary Antigen Test
- Microbiological isolation of *Legionella species* in sputum

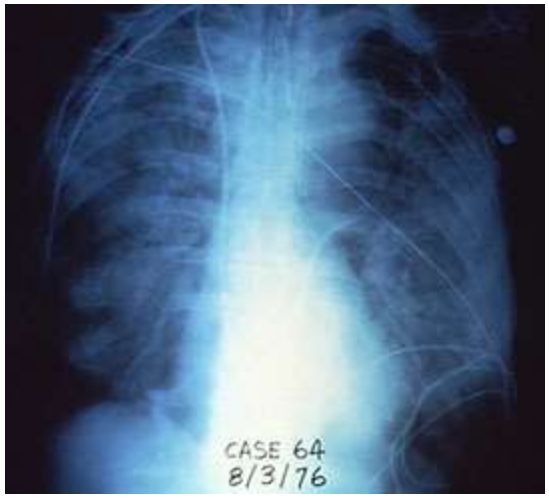
Legionnaires Disease is Reportable

Reportable disease under § 130A-134 and 10A NCAC 41A .0101 (#36)

Communicable Disease Manual- contains instructions for entry into North Carolina Electronic Disease Surveillance System (NCEDS) and to investigate cases

- >90 % of cases are “sporadic” -- no link in time and space with other cases.
- Two or more cases, especially in health care, or linked in time and space are considered an outbreak and trigger an environmental investigation
- One case in LTC may be considered as “sentinel”

Treatment by antibiotics either quinolones (ciprofloxacin, levofloxacin) and macrolides (azithromycin)



https://www.cdc.gov/Legionella/about/signs-symptoms.html

https://www.webmd.com/lung/ss/slideshow-legionnaires-disease-overview

North Carolina Electronic Disease Surveillance System (NC-EDS)Legionellosis Communicable Disease Report

https://epi.dph.ncdhhs.gov/cd/lhds/manuals/cd/reportforms/legionellosis.pdf

Communicable disease nurses obtain information from health care providers, laboratories, and patients

- Lab results
- Clinical findings
- Hospitalization
- Predisposing conditions
- Treatment
- Outcomes
- Isolation control measures
- Travel information
- Case interviews
- Outdoor exposure
- Health care Blood and body fluid exposure risks
- Water exposures
- Geographical site of exposure
- Other

Complexity of the problem

Alliance to prevent Legionnaires Disease https://preventlegionnaires.org

Lines of prevention include:

1. Education and awareness
2. Source water treatment - Safe Drinking Water Act
3. Public water supplies --Opportunities exist for Legionella and other bacteria to colonize and multiply in public water systems– biofilms, corrosion, and low disinfectant levels
4. Residential water systems
5. *Building water systems*
   - *Greater risk of waterborne bacteria because of complexity of building water systems, fixtures, and equipment*
6. *Water equipment and management*
   - *Proper selection, placement, maintenance, treatment, monitoring, and management of water-based equipment*
7. Investigation protocols – currently single sporadic cases outside of health care or other regulated facilities are rarely thoroughly investigated
8. Ongoing research on causes, prevention and treatment of disease

Alliance to Prevent Legionnaires' Disease

LEGIONNAIRES' DISEASE
LINES OF PREVENTION

#1 EDUCATION

The general public, building owners and health care professionals need **more information** on *Legionella* bacteria and how it may cause Legionnaires' disease. There are many myths surrounding the disease, so up-to-date and accurate information is crucial to reduce its incidence and increase prevention. Knowledge of the origins and exposure points of *Legionella* throughout the water system help us to understand how best to prevent its spread.

#2 SOURCE WATER TREATMENT

The water we use, collected from lakes, rivers and reservoirs, is known as **source water.** Source water naturally contains bacteria and nutrients. To protect public health it is treated and filtered* to limit the levels of contaminants, per the Safe Drinking Water Act.

* New York City does not filter 90% of its water, having been given an exemption from the EPA if the water meets certain criteria, including residual disinfectant concentrations, and not being identified as a source of a waterborne disease outbreak.

#3 PUBLIC WATER DISTRIBUTION SYSTEMS

After collection and treatment, source water enters the **public water system.** Opportunities exist for *Legionella* and other bacteria to colonize and reproduce in the public water system. Pipe biofilm and corrosion, potential low chlorine levels and stagnant water all contribute to growth. It is critical to design, manage and maintain new distribution systems, as well as upgrade and repair older ones, to limit the growth of bacteria.

#4 RESIDENTIAL WATER SYSTEMS

Most of our water use is in our very own homes. According to the CDC, 96% of all Legionnaires' Disease cases are individuals and sporadic—not associated with an outbreak. That's why a focus on the consistent delivery of contaminant-free water to residents and raising awareness of the risks at home are so critical, especially to protect the immunocompromised. Every day we use water to shower and bathe, drink, clean, irrigate, and live. Water quality issues impacting homes, and associated risks, must be broadly understood and managed.

#5 BUILDING WATER SYSTEMS

Multi-story buildings are at greater risk of water-borne bacteria than smaller buildings, as the complexity of their piping provides more opportunity for bacterial growth. The exposure points in a **building water system** are numerous, from showers, baths and drinking water to ice machines, faucets, and cooling equipment. A multi-disciplinary team has developed ASHRAE Standard 188 for risk management of building water systems.

#6 WATER EQUIPMENT MANAGEMENT

Proper selection, placement, maintenance, treatment, monitoring, and management of **water-based equipment,** such as medical equipment, humidifiers, misters, hot tubs and pools, can further reduce the risk of exposure to water-borne *Legionella* bacteria.

#7 INVESTIGATION PROTOCOL

When Legionnaires' disease clusters or outbreaks are reported, it is crucial to determine the point of exposure by **testing** all water sources within the water system.* When the exposure point is found, it can be treated to stop the spread. Prematurely ending an investigation with the first positive sample may lead to further outbreaks which could occur unexpectedly, even months later, as multiple exposure points to bacteria are possible within one water system. Failure to test throughout the system may result in inconclusive or incorrect findings, or mis-identification of the source of the bacteria that caused the illness.

*Currently, single cases are rarely investigated, except in healthcare facilities.

#8 ONGOING RESEARCH

As Legionnaires' disease is a relatively newly discovered disease, ongoing **research** is imperative to better understand its causes, prevention and treatment. New studies and their findings are published periodically and it is important that this new information is communicated to dispel myths with proven measures for combatting the disease.

Alliance to prevent Legionnaires Disease https://preventlegionnaires.org

Sources of Legionella in Building Water Systems

Low levels of *Legionella* can be found in public water supplies –*Legionella* can survive traditional treatment and disinfection methods.

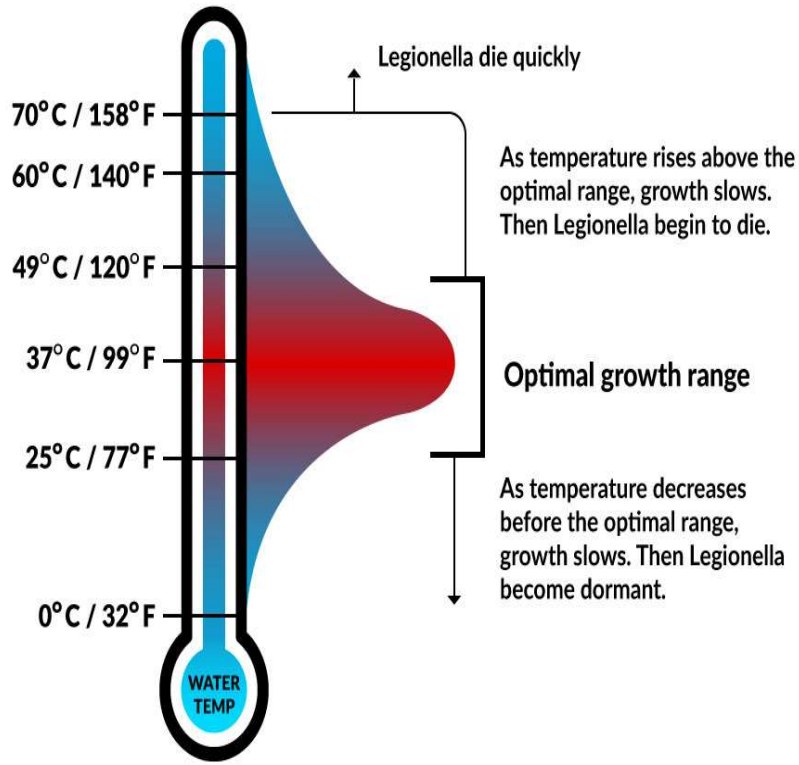
Building water systems can be places where *Legionella* can multiply/amplify

- Optimum temperature of Legionella to grow
- Presence of biofilms, stagnant water, low flow, dead legs, and reduced levels of disinfectants in systems, at fixture, and in features

Ways that water are used provide mechanisms for dispersal or dissemination of aerosols

Other potential sources

- Inspiration of contaminated water from ice machines
- Inhalation of airborne potting soil or leaf compost
- Inhalation of aerosols from windshield washer fluid



Source: ASHRAE Guideline 12-2020 Figure 1 Temperature effects on survival and growth of Legionella in laboratory conditions

Ice Machine as Source of Legionella

Water supply line passes near compressor & accumulator

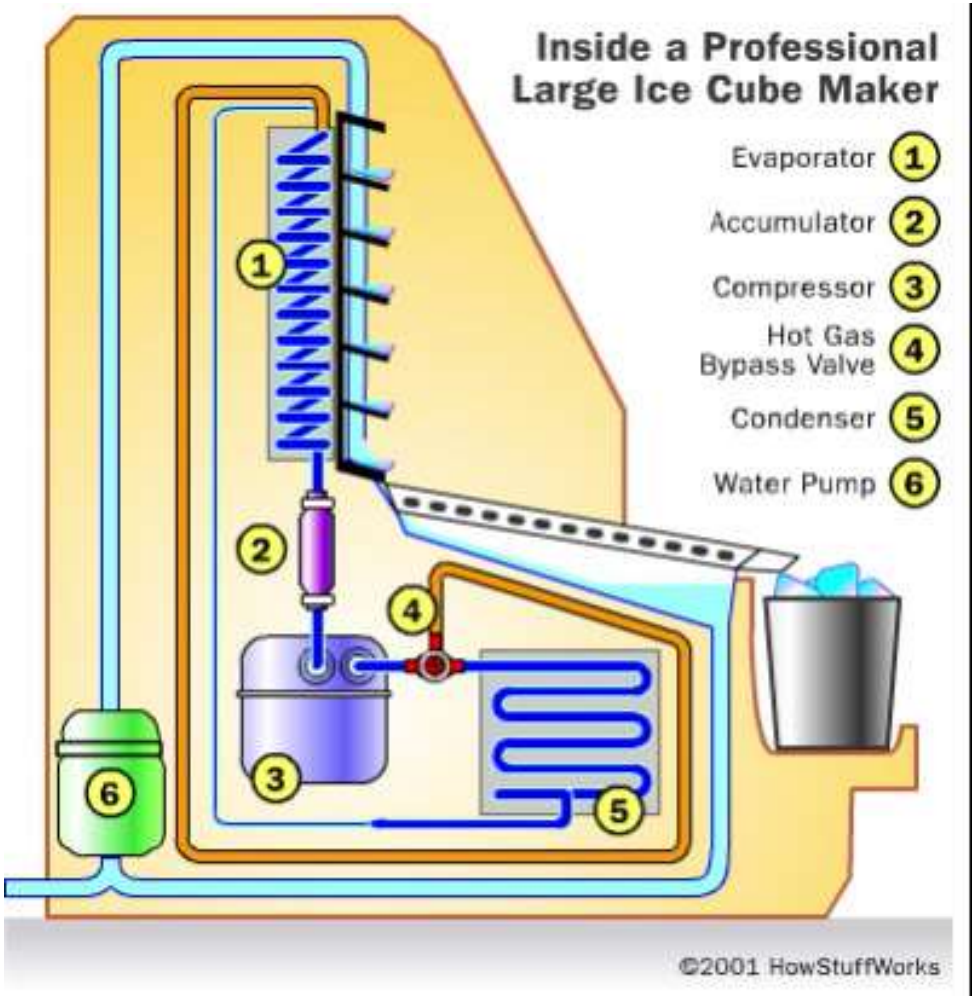
Heat from condenser & accumulator and compressor is dissipated (points 3, 4, and 5)

At the cooling unit refrigerant evaporates and heat is transferred from the water to form ice

Filters can be reservoirs

Legionella in ice is dormant but not dead

Incidental aspiration of ice



Ice Machine as a reservoir for Legionella

Water supply line passes near compressor & condenser

Heat from condenser and compressor is dissipated

At the cooling unit refrigerant evaporates and heat is transferred from the water to form ice

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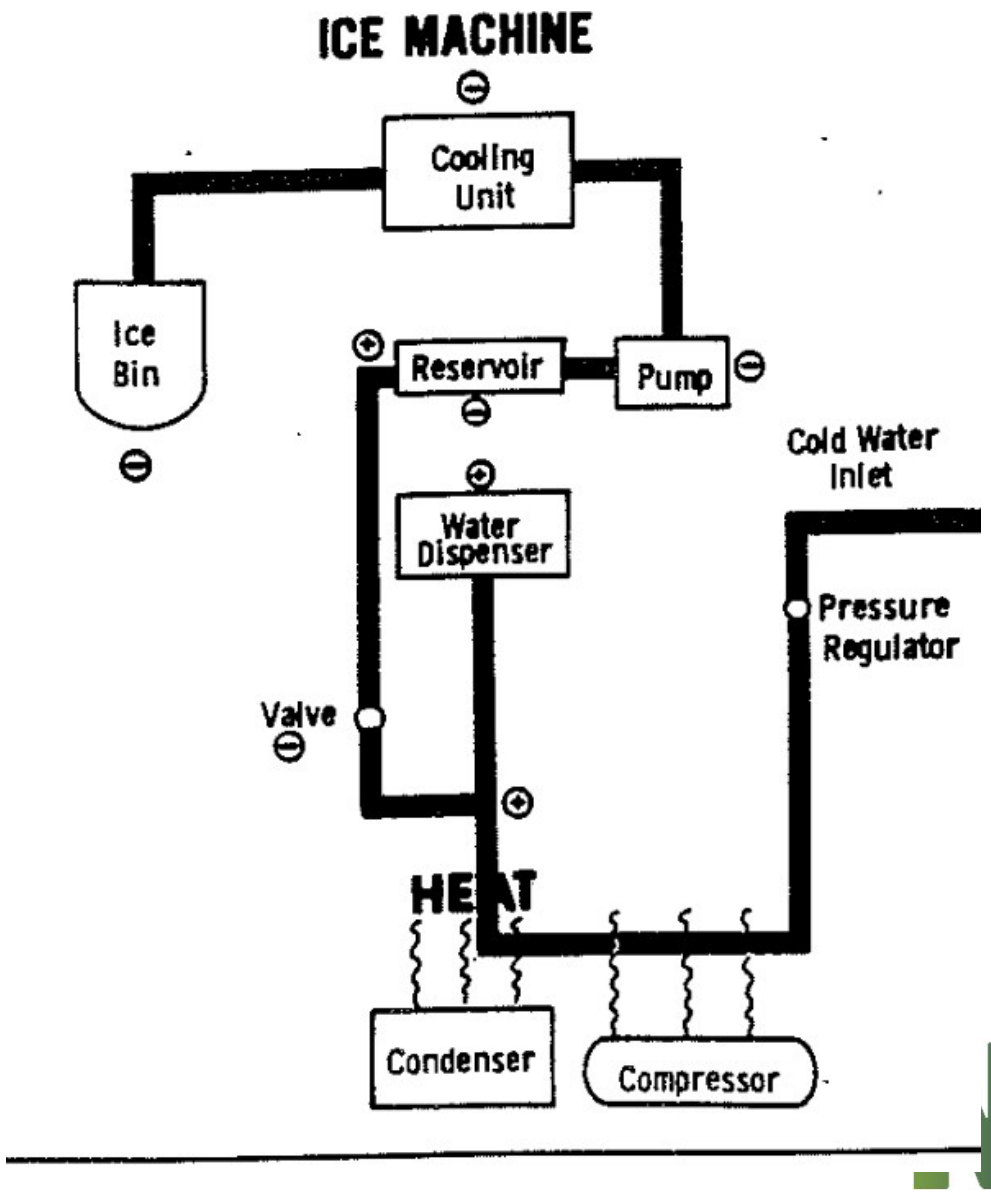


Hot tubs and spas

- Permitted -- must meet Rules Governing Public Swimming Pools 15A NCAC 18A .2500 plus additional requirements, inspected by local health departments
- Certified (licensee) pool operators
- Circulation turnover rate one every 30 minutes
- Continuous disinfection (2–4 ppm chlorine or 4-6ppm bromine)
- Maintain pH between 7.2–7.8.
- Needs routine cleaning, maintenance, monitoring disinfectant levels, filter changes etc.

Hot tubs at temporary events

Final report – Legionnaires Disease at Mountain State Fair September 2019

136 cases associated with hot tubs on display

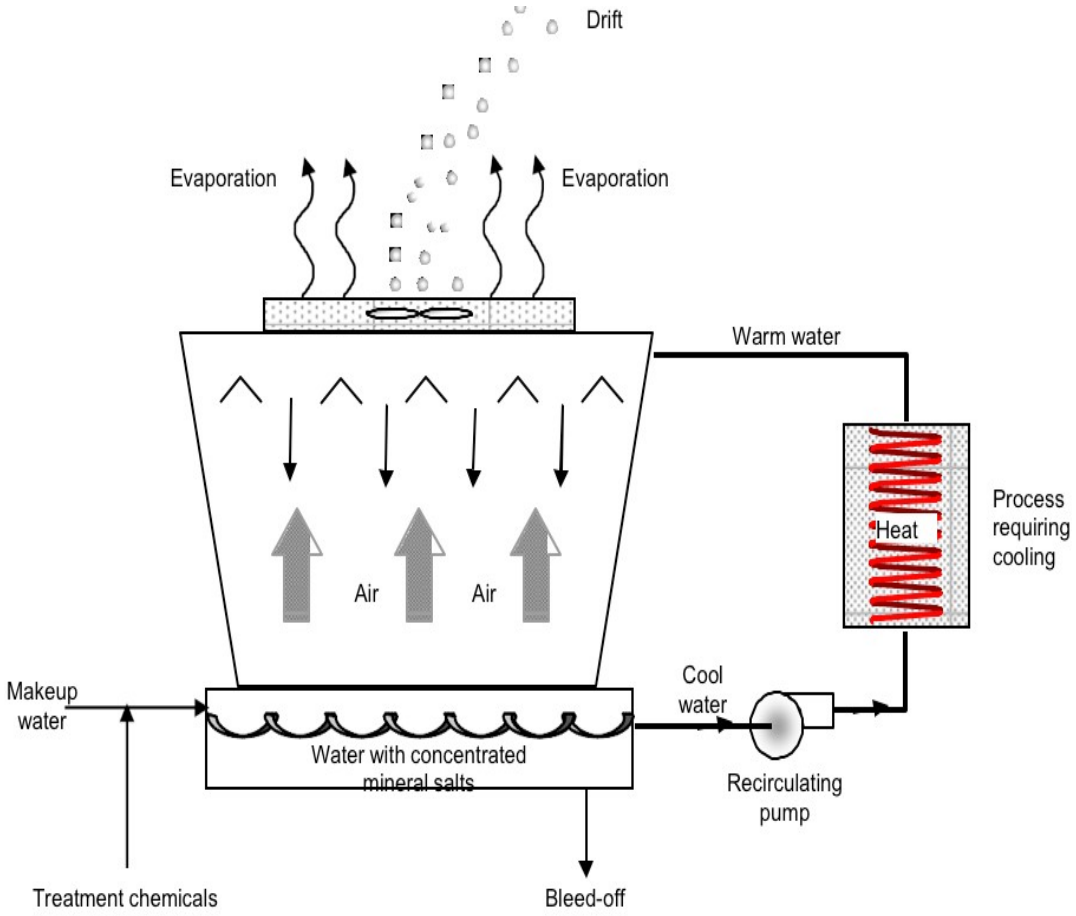
https://epi.dph.ncdhhs.gov/cd/legionellosis/MSFOutbreakReport_FINAL.pdf

https://emergency.cdc.gov/han/han00422.asp Hot Tub Displays and *Legionella* Risk—Guidance for Environmental and Public Health Practitioners

Increase awareness of event planners and hot tub vendors of hazards and risks of hot tubs at displays

- Training for operators and vendors
- Maintain free chlorine (2–4 parts per million or ppm) or bromine (4–6 ppm)
- Maintain the pH level of the water at 7.2–7.8.
- Test pH and disinfectant levels at least twice per day.
- After display is over cleaning, disinfecting, maintenance, and safe storage of hot tubs

Legionnaires Disease --often associated with cooling towers



Original 1976 outbreak traced to mist from a cooling tower cooling tower pulled into the building HVAC system 200 people ill and 34 fatalities

August 2015 Bronx New York 128 cases with 12 fatalities in the community traced to a cooling tower at Opera House Hotel

New York City became the first city to register and regulate cooling towers

https://www.globalspec.com/learnmore/manufacturing_process_equipment/heat_transfer_equipment/cooling_towers

Water Management Plans in Buildings

Policies, procedures, and practices that

- Limit the potential for *Legionella* bacteria and other waterborne pathogens to amplify in building water systems
- Reduce potential for building occupants to be exposed to water containing *Legionella* bacteria and other waterborne pathogens
- Operate building plumbing systems safely and efficiently

Water Management Plans (WMP) are driven by

- Hazard analysis – places where physical, chemical, or microbial conditions exist that may cause harm.
- Risk characterization -- probability and severity of harms from hazards
- Control points --- Places where water enters, is processed, and used and where actions to prevent, eliminate or reduce to hazards to an acceptable level can be applied
- Control limits -- Something that can be monitored at a control point by measurement or observation, based on science, regulation, and best practices -- Temperature, pH, residual disinfectant level, and time.

Why Healthcare facilities need water management plans

CMS *requires* water management plans (WMP) in Hospitals, Critical Access Hospitals, and Long-Term Care https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/Survey-and-Cert-Letter-17-30.pdf

Joint Commission --Water Management Programs

- EC 02.05.01 and EC 02.05.02 and EP1 –EP4 and EP6
- Joint Commission Tip Sheet on Water Management Program Requirements in Nursing Care Centers

VA Directive 1061, Prevention of Healthcare-Associated Legionella Disease and Scald Injury from Potable Water Distribution Systems https://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=3033

Industry Standard: Legionellosis: Risk management for building water systems ANSI/ASHRAE standard 188–2018

CDC Toolkit for developing a Water Management Program https://www.cdc.gov/Legionella/wmp/toolkit/index.html

Why other large buildings need WMP

Government Recommendations -- CDC and other states

ASHRAE Standard 188 water management plans for all buildings that meet any of these criteria

- Multi-housing units with one or more centralized circulating water heaters
- More than ten stories tall
- Intended for housing occupants > 65 years old
- ASHRAE standards are not regulatory unless adopted by an Authority Having Jurisdiction

Costs from outbreaks associated with a facility

- Disruption of operations, shutdown or equipment, or closure of fixtures and features
- Water use restrictions
- Expensive and difficult to remediate and control hazards
- Liability and negative publicity
- Investigation of outbreaks by local or state health departments and CDC

Elements of a WMP

1. Form a Water management team
2. Develop Program goals
3. Describe and document water systems in detail
4. Water systems hazard analysis and risk analysis
5. Identify control points
6. At each control point
   - Establish control measures
   - Identify control limits
   - Monitoring
   - Record keeping and documentation
7. Develop pre-determined actions plans when deviations from control limits occur
8. Validate that plan is working
   - Update when appropriate
9. Verify that plan is meeting program goals

- Recordkeeping
- Documentation
- Communication
- Engagement

1. Water management team

Interdisciplinary across organization and external partners

Team members should be "competent Persons" – knowledge, skills, and abilities to recognize hazards and authorized to take corrective actions

Documentation and recordkeeping

Integrate into existing programs policies and procedures

Main team

- Facility director
- Facility administrator
- Medical Director
- Nursing Director
- Health and safety
- Infection control
- Environmental services
- Chief engineer
- Maintenance director

Ad Hoc

- Finance
- Human resources
- Legal
- Public affairs
- Contractors & consultants
- Local water Utility
- Regulators

Get the most from outside help

Water management is a growth industry, expect to be solicited by contractors and consultants offering products and services

Think of consultants and contractors are partners in the process

- Make sure that facility and contractor/consultants have clearly defines roles and responsibilities specific to the facility

When selecting contractors and consultants consider

- Experience in developing and implementing WMP
- Expertise in design and operation of plumbing systems
- Knowledge of codes, standards, regulations and best practices – certified pool operators
- Conflicts of Interest

CDC, Considerations when working with Legionella Consultants
https://www.cdc.gov/Legionella/maintenance/consultant-considerations.html

2. *Program goals*

Align program goals with main strategies to prevent *Legionella* from amplification colonization in building water systems

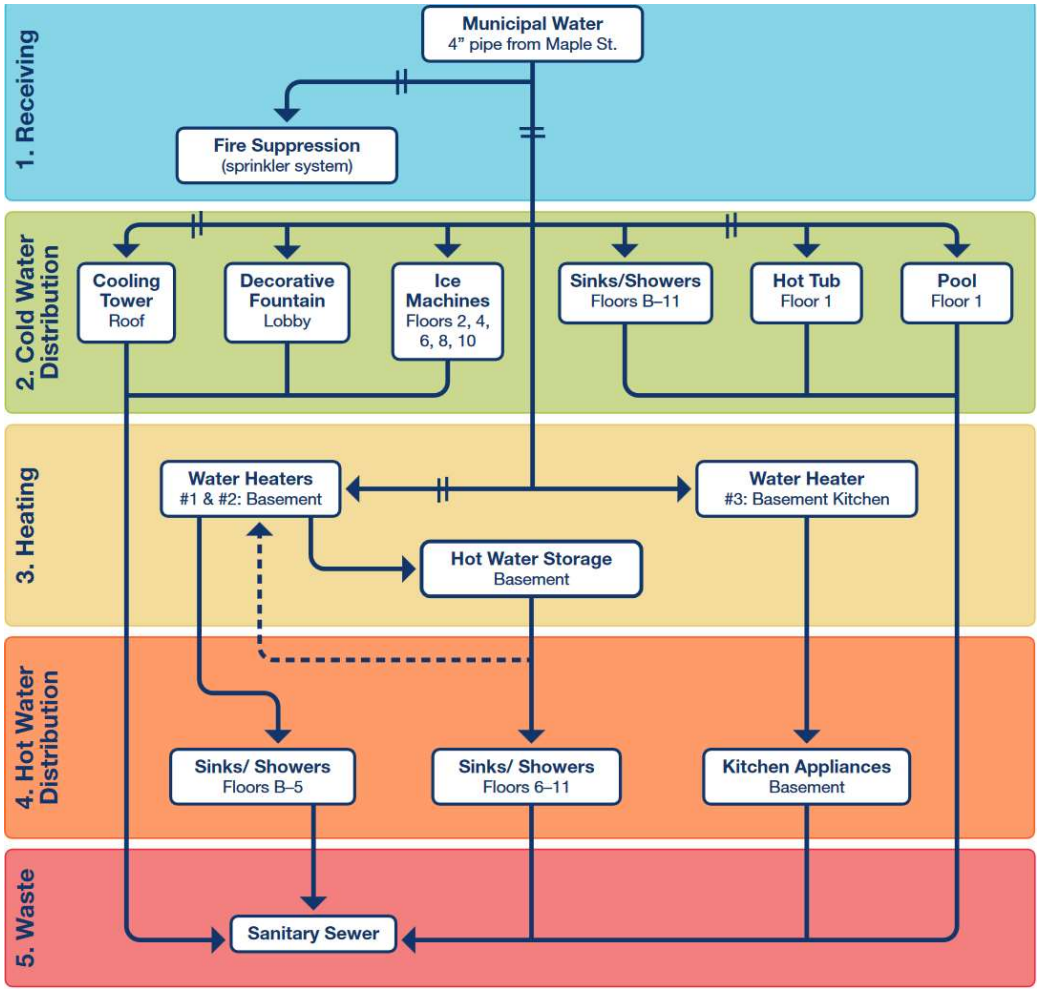
- Water Temperature
- Prevent stagnation (time, flow, and dead legs)
- Maintain adequate disinfectant levels
- Maintenance and cleaning prevent sediment, scale and biofilms
- Pathways for exposure to droplets

Goals need to be realistic, feasible, achievable, defensible

3. Describe water systems

Flow charts, architectural plans, engineering diagrams, written descriptions, interviews and other records

- Hot and cold potable water systems
- Process water systems
- Specialty water systems
- Fire protection system
- Wastewater
- Reused water



Describe and document

- Points where water enters the building
- How water is distributed and circulated
- How water is processed
- How water is used
  - Consider volume, duration and frequency that water is used, future uses, and installation of new equipment, replacement of old equipment

Describe Water Systems

Water meter and backflow prevention device

Recirculating hot water heaters in series

How water is processed

- Heated
- Cooled
- Stored
- Disinfected
- Distilled

- Purified
- Pressurized
- Filtered
- Mixed
- Or otherwise treated

Hot water for distribution

Thermostatic mixing valve

How water is used

- Food preparation and sanitation
- General personal care, showering, bathing, handwashing
- Housekeeping and environmental services
- Laundry
- Drinking fountains and ice machines
- Fire suppression/emergency eyewash
- Process water, heating & cooling -- cooling towers
- Decorative fountains
- Pools, spas and hydrotherapy
- Landscaping
- Ultra clean water -- hemodialysis, surgical irrigation, laboratories, pharmacy, respiratory therapy, Nebulizers, CPAPs
- Dental
- How water is discarded – wastewater and sanitary sewer
- Others?

Thermostatic Mixing Valve?

How water is used

Long term care facilities are big water users

- Design guidance for total water usage can be 100 gallons per bed per day and 20 gallons per staff person per day or more
- Hot water use can be estimated by counting and estimating consumption standardized consumption rate and use factors for
  - Dishwashers
  - Laundry machines
  - Kitchen sinks
  - Public lavatories
  - Utility sinks
  - Private lavatories
  - Showers
  - Bathtubs
  - Others?
- Cold and hot water use is intermittent
  - Peak demand versus average demand

4. Hazard and risk assessment

Occupant characteristics

- Age
- Pre-existing disease
- Immune status

Interactions with

- Accreditation requirements
- Licensing requirements
- Building codes
- Infection Control and Clinical services
- Construction, Operations, and maintenance
- Environmental services
- Environment Safety & Health (EHS)
- Public relations
- Accounting

Building Characteristics

- Age/condition of building
- Age/condition of water systems
- Places in water systems where Legionella could amplify, or biofilms could form
- Places in water systems that create aerosols
- Existing maintenance plans and activities
- Staff knowledge & expertise
- Variability of occupancy rates
- Future changes in use, additions, renovations

5. Control points

Detailed description of water systems is necessary to identify control points

Control points are places where actions are taken to prevent, reduce, or eliminate hazards

- Point of Entry -- Coordinate with your utility –understand what compliance with requirements of the Safe Drinking Water Act means
- Places in water system where temperature is within optimum range for range for *Legionella* amplification
- Water storage and recirculation
- Places where water may stagnate, flow may be reduced, water is infrequently used, and “dead legs”
- Places where biofilms may form
- Places where using water may generate droplets or aerosols
- Construction activities that disrupt water system
- Other incidents that might disrupt water systems

6. *Apply control measures and monitor them*

At each control point water management team decides on control methods, control limits, and how they will be monitored.

Control measures are the actions to limit growth and spread of *Legionella* in the water system

Control Limits are range acceptable values or conditions at each control point

- Quantitative or qualitative
- Measurable or observable
- Water Management Plan should describe in detail when, where, and how control limits will be monitored with standardized practices and procedures
- If services are contracted hold contractors accountable
- Follow Cooling Technology Institute guidance for operations and maintenance

Monitoring – Quantitative

Measurements of temperature, pH, residual disinfectant, water pressure and other water quality indicators

Temperature

- Hot water systems >140°F in storage tanks and >124°F in distribution piping
- Temperature limits at point of use (100 to 116°F) for lavatories and bathing facilities
- Cold water systems < 68°F minimum to extent practicable

- pH between 6.5 and 8.5
- Residual disinfectant levels
  - Safe Drinking Water Act disinfectants in drinking water at 0.2 mg/l and maximum of 2 mg/l
- Residual disinfectant levels decrease with “age” of water and as temperature of water increases –for hot water, temperature is the major control strategy

Considerations when Measuring Water Temperature

Use appropriate, accurate, and calibrated thermometer

When, where, how often, how may places, and the time of day when water temperature is measured.

Standardize practices for example

HOT water at a fixture

- Measure temperature at the tap furthest from the hot water heater, the sentinel outlet. measure other representative points in a chosen pattern and repeat so that every tap is checked monthly
- Hold thermometer in hot water flow for one minute and record temperature < 116 °F
- If fixtures have thermostatic mixing valves temperature at inlet to TMV should be > 122°F and tap <116°F .

COLD water at a fixture

- Follow similar pattern for hot water to rotate through different cold taps each month:
- Hold the thermometer in the cold-water flow for two minutes <68 °F and record

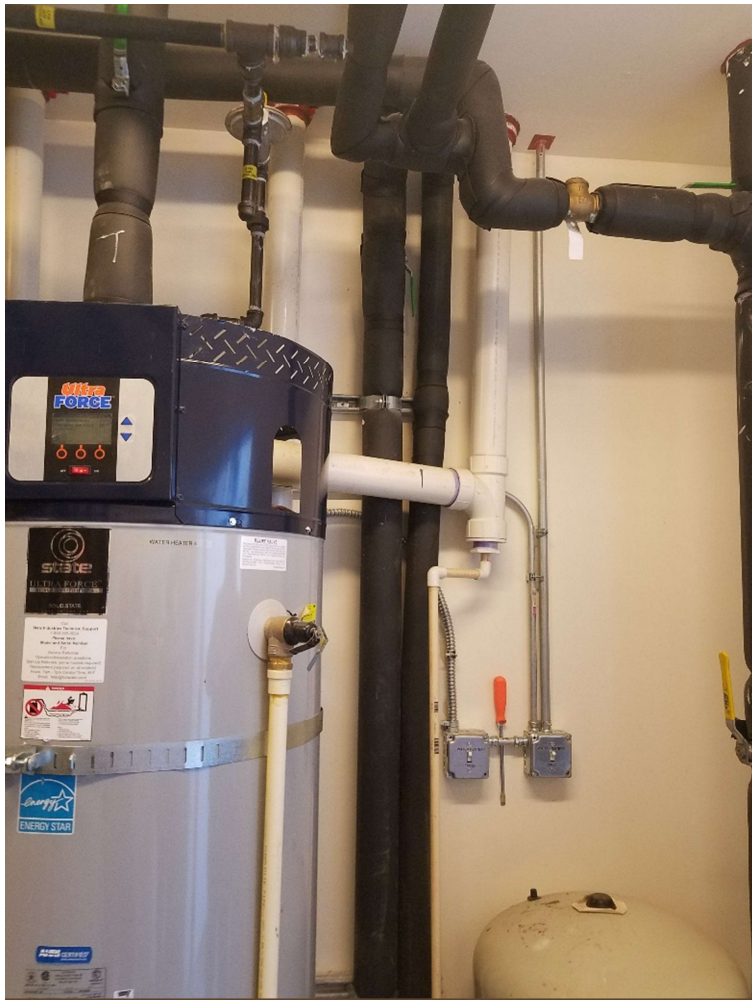
Engineering and maintenance -- details on how to measure temperature "behind the scenes" -- hot water heater, hot water storage tanks, incoming cold water, and any cold- water storage tanks

Monitoring -- Qualitative

- Inspections and/or observation for rust, sludge, organic matter, biofilms, sediment, scale, unusual turbidity and unusual odor
- Inspections and/or observation for “dead legs” or places with reduced flow
- Maintenance to plumbing system components
- Filter changing schedules
- Routine, standardized, and documented protocols for cleaning and disinfecting fixtures (outlets) and equipment
- Notification process for intended/unintended disruption of water supply
- Determine monitoring frequency based on hazards, risks, costs of equipment and supplies, staff training, staff time recordkeeping, and documentation

Labels, record keeping, and documentation

- Keep water networks, systems, components, equipment labelled in a clear and uniform manner
- Set up and use a record keeping system for inspections, as-needed and preventive maintenance, repairs, and when corrective actions are implemented
- Keep previous versions of water management plans as new plans are updated
- Keep water management team meeting minutes
- Training for workers implementing the plan – involve workers in quality improvement and verification
- Storage, handling, and use of cleaning chemicals and process chemicals



Flushing water systems

Why flush water systems

- Disrupts biofilms, removes, sediments, deposits, and prevents stagnation
- Regulates and maintains temperature

Considerations of a flushing programs

- Age and condition of system
- Preexisting water quality issues
- Worker and patient safety and health
- Costs – increased water use in the facility, increased energy use for hot water, and time and labor

Flush cold-water lines for at least two minutes

Flush hot-water for two minutes after maximum temperature is reached

Flush storage tanks and infrequently used fixtures once a week

7. Predetermined actions when deviations from control limits occur

Tie into facility emergency water plan

Cleaning, disinfection, and flushing

Water use restrictions, shut down equipment or close facilities

Point of use filtration with 0.2 µ filters

- Install on showers and faucets--consider when other methods are not feasible and/or for high-risk patients

Professional Remediation

- Thermal shock treatment-- > 160° F in tank and flush each outlet for at least 30 minutes. Hot water > 140°F for at least 30 minutes at each outlet
- Shock disinfection – increase residual chlorine to > 2 mg/liter at all outlets and maintain throughout the system by continuous flushing for at least two hours

In extreme situations implement system-wide treatment and disinfection

- Facility must meet requirements for Non-transient, Non-Community Public Water System

https://www.cdc.gov/healthywater/emergency/pdf/emergency-water-supply-planning-guide-2019-508.pdf

8. Verification

Is Water Management Plan working as designed and intended?

- Recordkeeping and documentation
- Track incidents when deviations from control limits occur
- Investigations and after-action reviews to reduce number and severity of incidents when deviations control limits occur, or corrective actions occur
- Document costs for monitoring
- Document costs for interventions when deviations from control limits occur
- Engage people implementing the program
  - Are elements of water management program feasible given available resources and workflow
  - Ask if resources, time, tools and equipment, training are adequate to meet program needs and provide addition resources as needed
  - Ask for recommendations to make changes to practices and procedures that improve worker safety and efficiency

9. Validation

- Is the program meeting the goals?
- Is sampling for Legionella required for validation?
  - Maybe – routine environmental sampling for Legionella or other waterborne pathogens should only be performed as part of the water management program.

Sampling for Legionella

- Sampling and testing is one way to validate effective water management plans
- A decision by the water management team to routinely sample for *Legionella* for validation should be careful and deliberate
- Keep records and documentation
- *Do not sample to "see what we have" or conduct unplanned, unsystematic or undirected sampling*

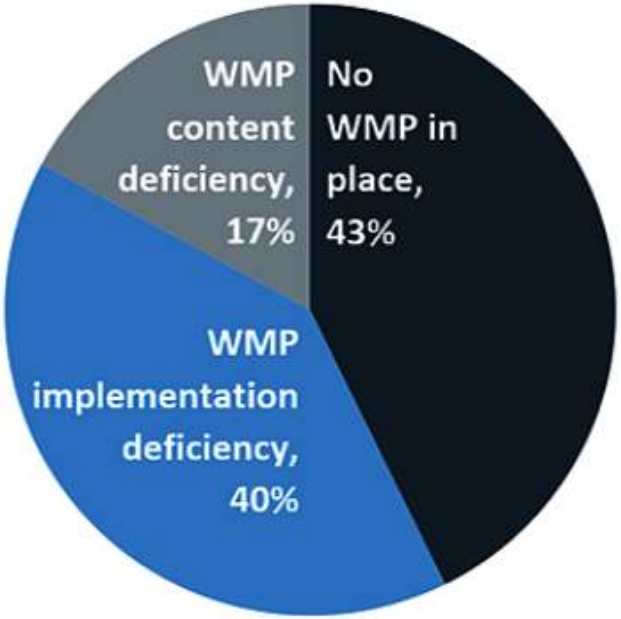
If routine sampling is part of the plan:

- *Go All out !!!*
- Nonrandom, part of a carefully designed sampling plan
- Set pre-determined thresholds to interpret results
- Set pre-determined threshold limits to implement corrective actions
- *Devote enough resources*
- Work out technical concerns
- Select appropriate laboratories

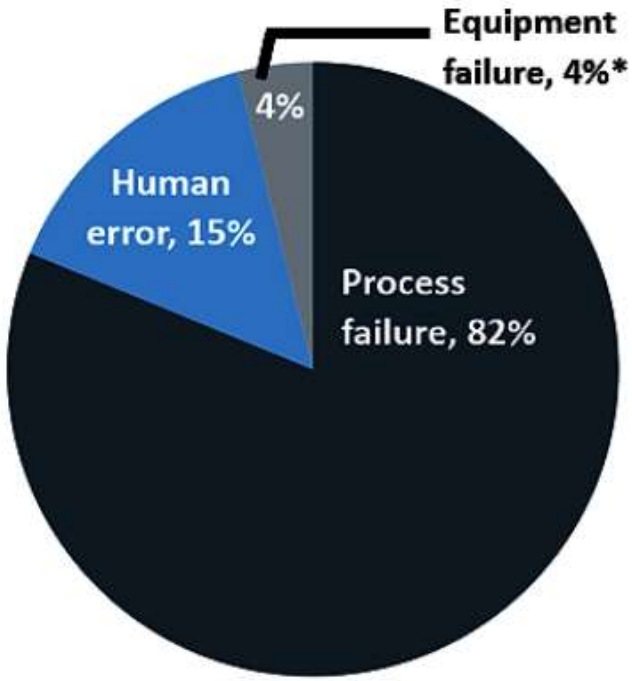
Water Management Plans and Disease Outbreaks

Findings from a review of CDC-led Legionnaires' disease outbreak investigations, 2015–2019

Most WMP deficiencies associated with outbreaks were due to missing or improperly implemented WMPs.



Most environmental deficiencies were due to process failure.



Environmental Sampling

Potential sampling sites

- Point of entry
- Holding tanks
- Centralized hot water heaters supply & returns
- Expansion tanks
- Before and after filters or water softeners
- Showers
- Faucets
- Whirlpools
- Cooling towers
- Decorative fountains
- At distal ends of hot and cold-water systems
- Ice machines
- Dead legs
- Fixtures used infrequently

Measure temperature, pH, and residual disinfectants wherever samples are collected

Molecular tests (PCR) and antibody assays can be used for verification in the absence of outbreaks or sentinel cases

In outbreaks and sentinel case investigations --Follow CDC guidance for Sampling Procedure and Potential Sampling Sites
https://www.cdc.gov/Legionella/downloads/cdc-sampling-procedure.pdf
1 liter water samples and biofilm samples with culture-based analysis by CDC ELITE laboratory is the 'gold standard"

Interpreting Results

Highly probable to occasionally find a few colony forming units at point of entry over multiple samples

Sample results need to be interpreted in the context of the WMP goals

Some Benchmarks to interpret sampling results

Source	Acceptable	Requires additional investigation and actions	Requires immediate action	reference
Cooling tower	<10CFU/ml	10-1000 CFU/ml	>1000 CFU/ml	New York City
Potable water	<1 CFU/ml	10-100 CFU/ml	>100CFU/ml	AHIA 2015
Decorative fountains	<1CFU/ml	1-10CFU/ml	>10CFU/ML	AIHA 2015
Hot tubs/spas	<1 CFU/ml	1-10 CFU/ml	>100CFU/ml	AIHA 2105

Final Remarks

- Time, energy, resources, and management commitment are needed to an effective water management plan.
- *Complete elimination at all times of Legionella from a water system is not a realistic goal*
- Facilities depend on their PWS to deliver high quality water with adequate residual disinfectants
- Facilities depend on water temperature, maintenance, cleaning, and preventing stagnation (time, flow, and dead legs) as main control methods
- *There will be places in every water system within the optimum temperature range for Legionella to grow and amplify*
- In the absence of cases linked to the facility CMS expects that healthcare facilities have established a WMP Team and gone through the steps to implement a plan. CMS does not require sampling
- A verified WMP allows enables informed decisions to reduce hazards, risks, optimize costs, and improve efficiency

Online references

CDC vital signs– Legionnaires Disease a problem for health care facilities
https://www.cdc.gov/vitalsigns/Legionella/index.html

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

Considerations When Working with Legionella Consultants
https://www.cdc.gov/Legionella/maintenance/consultant-considerations.html

Centers for Medicare & Medicaid Services, S&C 17-30, 06/09/2017 Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease (LD)
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Legionella Consultants

This list was compiled by the North Carolina Division of Public Health; however, our agency does not endorse, suggest, or recommend any specific consultant or company on this list. This list is not exhaustive, is intended for informational use only, and may not be up to date

Phigenics, https://info.phigenics.com/. Contact Scott Whip, Regional Manager (704) 236-1357 or swhipp@phigenics.com.

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Chem-Aqua (Environmental Sampling Only – will subcontract with a Consulting firm) P.O Box 152170, Irving, TX 75015 800-476-4262, http://chemaqua.com

Point of Use Filters - Pall Filter Company
Christopher Connolly, North American Hospital Water Sales Manager, Pall Medical- Hospital Group, 973-632-1920 (cell) 215-383-4351 (fax) chris_connolly@pall.com www.pall.com/medical

Purologix Water Services, Inc, Russ Elmore, Water Specialist/Consultant/Manager
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AquaMedix LLC, J. Brady Benson CleanSpray Water Filtration Systems
952-479-0636 (office) 612-819-8005 (cell) bbenson@aquamedix.net, www.aquamedix.net

Questions?

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