

***LEGIONELLA* EPIDEMIOLOGY, PREVENTION CONTROL, AND COMPLIANCE WITH REQUIREMENTS**

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(SPICE)

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OBJECTIVES

At the conclusion of this presentation, you will be able to:

1. Identify the epidemiology of *Legionella* and other opportunistic pathogens in premise plumbing (OPPP).
2. Describe the components of CMS Survey and Certification (S&C) Memo 17-30, “Requirement to Reduce *Legionella* Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires’ Disease (LD).”
3. Discuss resources and national guidelines available to implement the requirements and assess for compliance with the CMS S&C *Legionella* prevention and control memo.

LEGIONELLA EPIDEMIOLOGY

Reported US Cases of Legionnaire's Disease:

- Rate of reported cases increased 350% from 2000 to 2015
- 20% of outbreaks associated with nursing homes

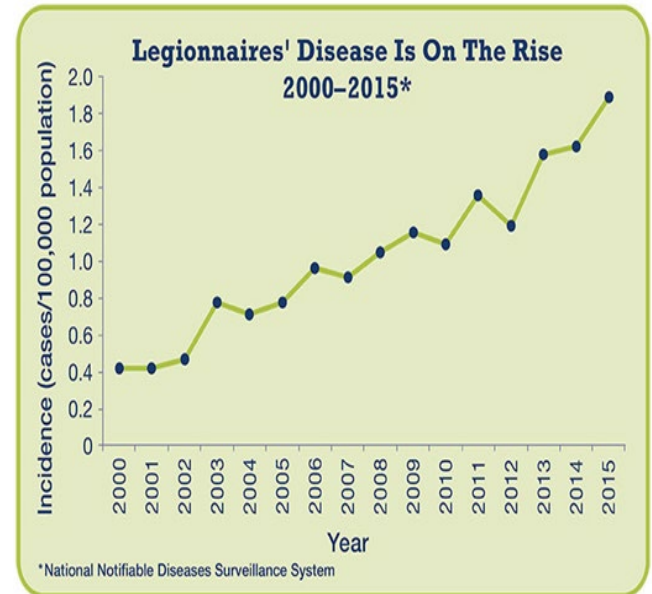
US Mortality rates:

- Overall: approximately 9% - 10%
- Healthcare-associated (HCA) cases 25%

https://www.cdc.gov/mmwr/volumes/66/wr/mm6622e1.htm?s_cid=mm6622e1

https://www.cdc.gov/mmwr/volumes/65/wr/mm6522e1.htm#T1_up

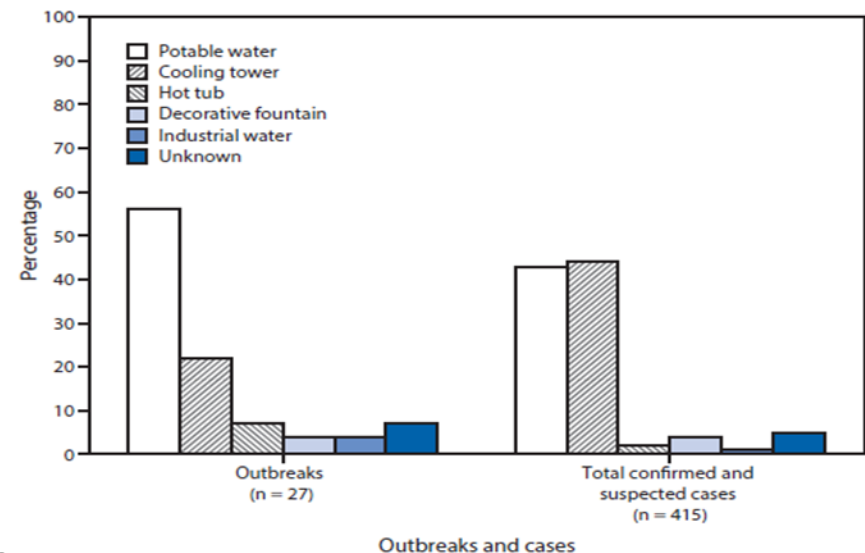
<https://www.cdc.gov/legionella/downloads/fs-legionella-clinicians.pdf>



UNITED STATES OUTBREAKS

Centers for Disease Control (CDC) field investigations of (LD) outbreaks- in the United States, 2000 –2014 ($n = 27$):

- 15% of outbreaks associated with hospitals.
- 19% of outbreaks associated with nursing homes.
- Deficiencies in water system maintenance contributing to growth and transmission of *Legionella* among outbreaks of Legionnaires' disease ($n = 23$)



LEGIONNAIRES' DISEASE HISTORY

- First identified in 1976.
- Outbreak associated with American Legion reunion.
- 221 cases with 34 deaths.
- Pneumonia due to inhalation of water droplets contaminated with *Legionella pneumophila* serogroup 1.



LEGIONNAIRES' DISEASE EPIDEMIOLOGY

- **Persons at highest risk:**
 - Age >50 Years.
 - Smoker (history of smoking).
 - Underlying conditions, especially. chronic lung disease, immunocompromising conditions (e.g., organ transplant).
- **Diagnosis:**
 - Urinary antigen and lower respiratory sputum culture (requires special media, and cultures take 10 to 14 days).



LEGIONNAIRES' DISEASE EPIDEMIOLOGY

Common symptoms:

- Fever, gastrointestinal (GI), headache, lethargy, confusion, shortness of breath (SOB), neurologic abnormalities.

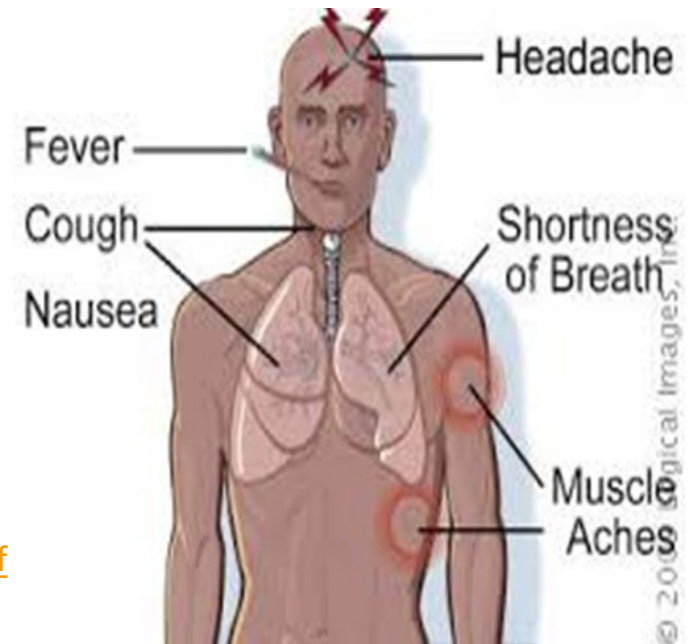
Time between exposure and symptoms:

- 2 to 10 days
- Person-to-person transmission extremely rare:

<https://www.cdc.gov/legionella/downloads/fs-legionella-clinicians.pdf>

Treatment:

- Antibiotics.



OPPORTUNISTIC PATHOGENS OF PREMISE PLUMBING (OPPP)

OPPP are germs that grow well in drinking water distribution systems.

Examples of these include:

- Gram-negative bacteria: *Pseudomonas*, *Acinetobacter*, *Burkholderia*, *Stenotrophomonas*.
- Nontuberculous mycobacteria, (e.g. *M. abscessus* and *M. mucogenicum*, and *fortuitum*).
- And various species of fungi, (e.g., *Fusarium spp.*).

ROUTES OF TRANSMISSION

Legionella and other OPPP:

- **Inhalation of aerosols:** heating, ventilation, and air conditioning (HVAC) (cooling towers), plumbing (showers), respiratory equipment, devices that produce an aerosol (hydrotherapy equipment).

Other OPPP:

- **Direct contact:** with the water through ingesting, bathing, and showering contact with mucous membranes or surgical site.
- **Indirect contact:** with contaminated surfaces or equipment (e.g., open-wound irrigation, reusable basins or splashing from water outlets or basins, or healthcare workers' hands if washing in contaminated water).

FACTORS ENHANCING *LEGIONELLA*/OPPP GROWTH

Changes in municipal or facility water quality: Low disinfectant levels, increased turbidity, fluctuations in water temperature, or pH outside recommended ranges.

Water main breaks: Dislodging biofilms can introduce dirt into the system that uses up disinfectant.

Construction (including renovations and installation of new equipment): Vibrations or changes in water pressure can dislodge biofilm and release *Legionella* and/or OPPP.



FACTORS ENHANCING *LEGIONELLA*/OPPP GROWTH

Factors (within buildings) promoting biofilm growth include:

- Water stagnation and age (occupancy), scale and sediment, dead legs/dead ends.
- Complex systems (multiple entry points and interconnections).
- Low flow (flow restrictors).

Plumbing and fixture materials:

- Electronic (sensor) sink design (sink basins, drains, and traps), aerators, hand-held showers and hosing, and piping.

GUIDELINES FOR *LEGIONELLA* AND OPPP

CDC/HICPAC: Guidelines for environmental infection control in healthcare facilities (2003). (pages 141-144)

<https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmental-guidelines.pdf>

CDC/HICPAC: Guidelines for preventing health care-associated pneumonia, 2003(2004)

<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>

Environmental Protection Agency:

[Technologies for *Legionella* Control in Premise Plumbing](#)

ASHRAE 188: Legionellosis: Risk management for building water systems, June 26, 2015. ASHRAE: Atlanta.

www.ashrae.org

CDC Legionella Water Management Program Toolkit

<https://www.cdc.gov/legionella/water-system-maintenance.html>

Minimizing the Risk of Legionellosis Associated with Building Water Systems

[ASHRAE Guideline 12-2000](#)



CMS RESPONSE: S&C *LEGIONELLA* MEMO

[HTTPS://WWW.CMS.GOV/MEDICARE/PROVIDER-ENROLLMENT-AND-CERTIFICATION/SURVEYCERTIFICATIONGENINFO/DOWNLOADS/SURVEY-AND-CERT-LETTER-17-30.PDF](https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/downloads/survey-and-cert-letter-17-30.pdf)

DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
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Baltimore, Maryland 21244-1850



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)
****Revised to Clarify Provider Types Affected****

Memorandum Summary

- ***Legionella* Infections:** The bacterium *Legionella* can cause a serious type of pneumonia called LD in persons at risk. Those at risk include persons who are at least 50 years old, smokers, or those with underlying medical conditions such as chronic lung disease or immunosuppression. Outbreaks have been linked to poorly maintained water systems in buildings with large or complex water systems including hospitals and long-term care facilities. Transmission can occur via aerosols from devices such as showerheads, cooling towers, hot tubs, and decorative fountains.
- **Facility Requirements to Prevent *Legionella* Infections:** Facilities must develop and adhere to policies and procedures that inhibit microbial growth in building water systems that reduce the risk of growth and spread of *legionella* and other opportunistic pathogens in water.
- *This policy memorandum applies to Hospitals, Critical Access Hospitals (CAHs) and Long-Term Care (LTC). However, this policy memorandum is also intended to provide general awareness for all healthcare organizations.*

Background

CMS S&C *LEGIONELLA* MEMO

- S&C *Legionella* memo released on June 2, 2017, with clarification on June 9 regarding provider types affected:
 - Hospitals.
 - Critical access hospitals (CAHS).
 - Long Term Care (LTC).
- Facilities must develop and adhere to policies and procedures that inhibit microbial growth in building water systems and reduces the risk of growth and spread of *Legionella* and OPPP.

CMS S&C *LEGIONELLA* MEMO

Expectations for Healthcare Facilities and Surveyors

Review policies and procedures and reports documenting water management implementation results to verify that the facility has:

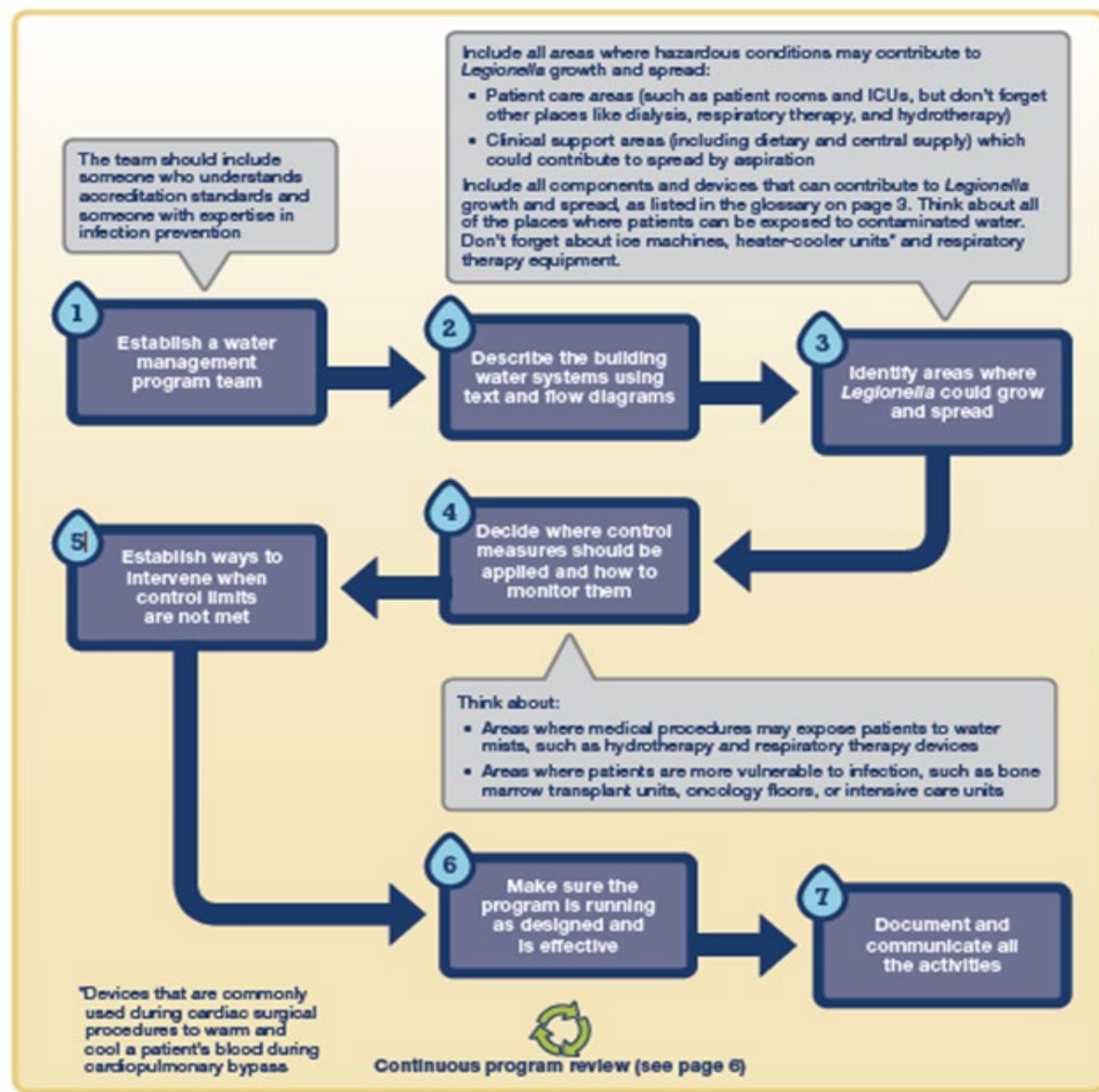
Conducted **risk assessment** for potential areas of growth and spread.

- Implemented a **water management program** that considers the ASHRAE industry standard and CDC toolkit and that includes control measures (e.g., physical controls, temperature management, disinfectant level control, visual inspections, and environmental testing).
- Specified **testing protocols** and acceptable ranges for control measures and documented the results of testing and corrective actions taken when control limits are not maintained.

LEGIONELLA AND OPPP RISK ASSESSMENT

- Conduct facility **risk assessment** for potential areas of growth and spread
- Environmental assessment.
- <https://www.cdc.gov/legionella/downloads/enviro-assess-instrument.pdf>
- Identify buildings at increased risk for *Legionella*.
- <https://www.cdc.gov/legionella/maintenance/wmp-risk.html>
- Will also need to consider patient risk groups and healthcare reservoirs (e.g., patient care devices, medical equipment, and healthcare workers).

7 STEP WATER MANAGEMENT PROGRAM



WATER MANAGEMENT PROGRAM

- 1. Establish a water management program (WMP) team.**
2. Describe the building water systems using text and flow diagrams (schematic).
3. Identify areas where *Legionella* and OPPP 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.

<https://www.cdc.gov/legionella/downloads/toolkit.pdf>

WATER MANAGEMENT PROGRAM (WMP) TEAM

- **Infection preventionist.**
- Facility management.
- Risk management.
- Hospital epidemiology.
- Occupational health.
- Department representatives (Medicine, Surgery, Intensive Care Unit (ICU), Nephrology, Cardiac, Oncology, etc.).
- C-Suite.
- Possibly a laboratory representative.
- Possibly a consultant.

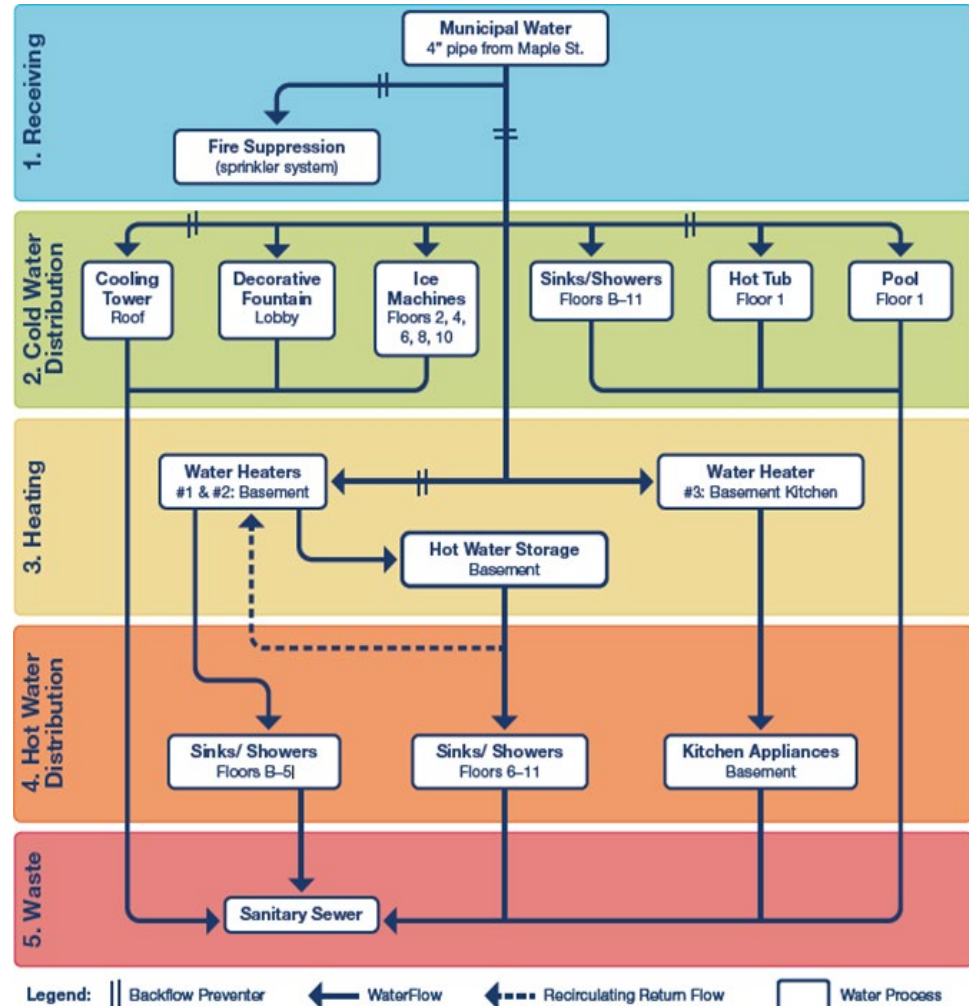
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STEP 2

Develop a simple schematic that visually describes the building water system using text and flow diagram.



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WATER MANAGEMENT PROGRAM

Develop a simple schematic that visually describes the building water system using text and flow diagrams (i.e. risk assessment) to identify where *Legionella* and other opportunistic waterborne pathogens can grow.

High risk resident care areas:

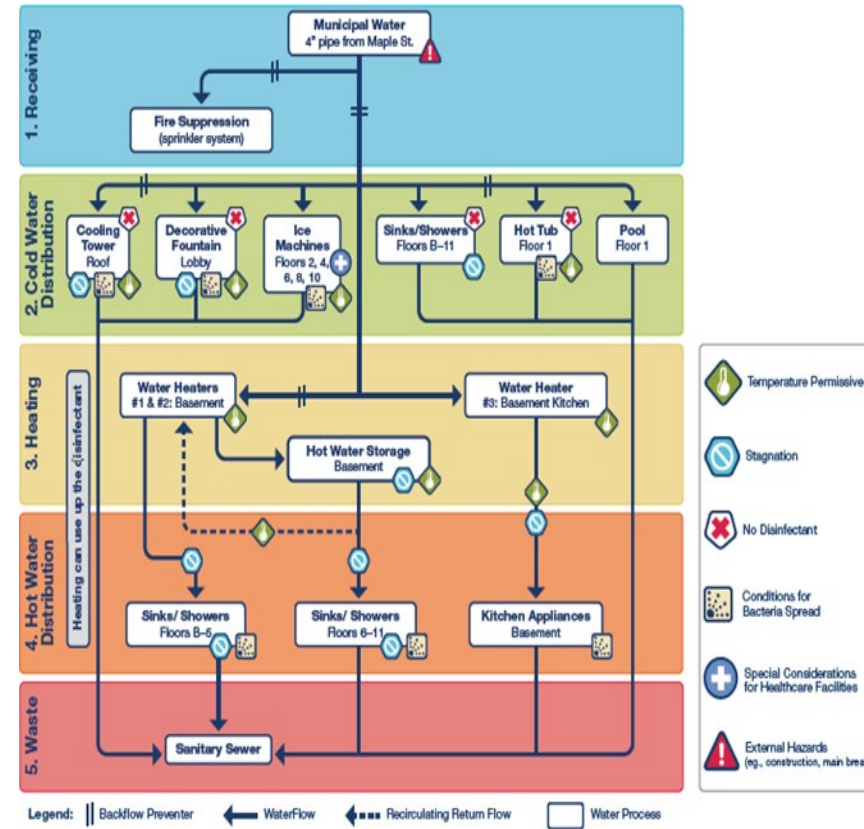
- Ventilator dependent and dialysis.

High risk non-resident care areas:

- Dietary and central supply.

High risk components and devices:

- Ice machines.
- Respiratory therapy equipment.



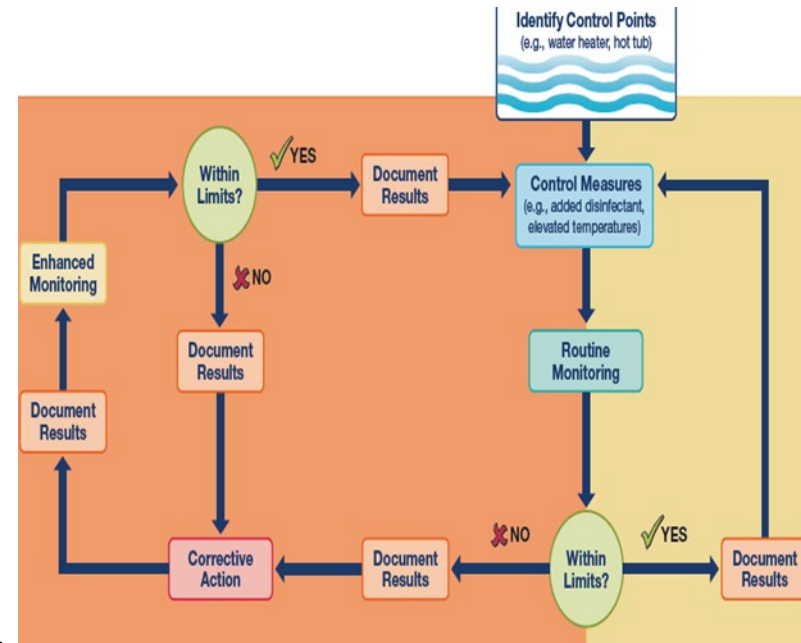
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WATER MANAGEMENT PROGRAM

Control Measures - WMP must document control measures to prevent growth of opportunistic waterborne pathogens which may include:

- visible inspections,
- disinfectants,
- certain temperature levels that may require mixing valves to prevent scalding.
- how to monitor control measures (i.e., testing protocols, acceptable ranges, document results of testing); and
- established ways to intervene if control measure limits are not met.



IDENTIFY CONTROL POINTS AND LIMITS

Water management program team should ensure regular monitoring of water quality parameters, such as disinfectant and temperature levels.

Possible control limits:

- Water temperature.
- Water chemistry.
- Residual disinfectant.*
- Heterotrophic plate counts (HPCs) as an indicator of overall water quality (<500 colony-forming units (CFU) per milliliter (mL))

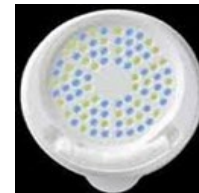
Millipore filtration



Millipore sampler



SimPlate



GAPS IN HPC TESTING

- Many of these opportunistic pathogens of premise plumbing are members of the HPC bacteria group.
- HPC counts may not be reflective of presence of *Legionella* or slow- growing nontuberculous mycobacteria.
- No direct association between presence of these OPPP in hospital water systems and patient outcomes; only direct association between microbial contamination and water and patient outcomes is in hemodialysis.
- Presence alone may not be sufficient to indicate transmission.

TESTING PROTOCOLS

Is water testing required...how often and where?

- No, CMS does not require routine testing (i.e. culture) of water for *Legionella* or OPPPs.
- Per CDC/ASHRAE recommendations, the water management program team should ensure regularly monitoring water quality parameters, such as disinfectant and temperature levels.
- CDC also recommends healthcare facilities perform clinical surveillance for *Legionella* and other waterborne opportunistic infections, to validate the water management program.

CDC/HICPAC: Guidelines for preventing health care-associated pneumonia, 2003(2004)

- <https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>

2003 CDC ENVIRONMENTAL GUIDELINE

“Recommendations--Water” section, II. Routine Prevention of Waterborne Microbial Contamination Within the Distribution System

A. Maintain hot water temperature at the return at the highest temperature allowable by state regulations or codes, preferably **≥124°F (≥51°C)** and maintain cold water temperature at **<68°F (<20°C)**.
Category IC (ASHRAE: 12:2000)

B. If the hot water temperature cannot be maintained **at ≥124°F (≥51°C)**, explore engineering options (e.g., install preset thermostatic valves in point-of-use fixtures) to help minimize the risk of scalding.
Category II

Sehulster, L., et al., Guidelines for Environmental Infection Control in Health-Care Facilities, Morbidity and Mortality Weekly Report (MMWR), 2003

<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm>

2003 CDC ENVIRONMENTAL GUIDELINE

C. When state regulations or codes do not allow hot water temperatures above the range of **105°F—120°F (40.6°C — 49°C)** for hospitals or **95°F — 110°F (35°C — 43.3°C)** for nursing care facilities or when buildings cannot be retrofitted for thermostatic mixing valves, follow either of these alternative preventive measures to minimize the growth of *Legionella* spp. in water systems. Category II.

1. Periodically increase the hot water temperature to >150°F (>66°C) at the point of use. Category II.
2. Alternatively, chlorinate the water and then flush it through the system.

Sehulster, L., et al., Guidelines for Environmental Infection Control in Health-Care Facilities, *Morbidity and Mortality Weekly Report* (MMWR), 2003

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POTENTIAL INTERVENTIONS

- Shock treatments (thermal, hyperchlorination, etc.).
- Develop flushing protocols in areas at risk for stagnation.
- Identify and remove “dead legs” or other unused branches of plumbing.
- Supplemental disinfection (chlorine [Cl₂], ammonium chloride [NH₃Cl], chlorine dioxide [ClO₂], etc. (see 2016 EPA review).
- Additional water treatment (installing other point-of-use systems).
- Point-of-use filtration (sometimes used first until remediation can occur; risk management unit may decide to keep these in place after remediation).

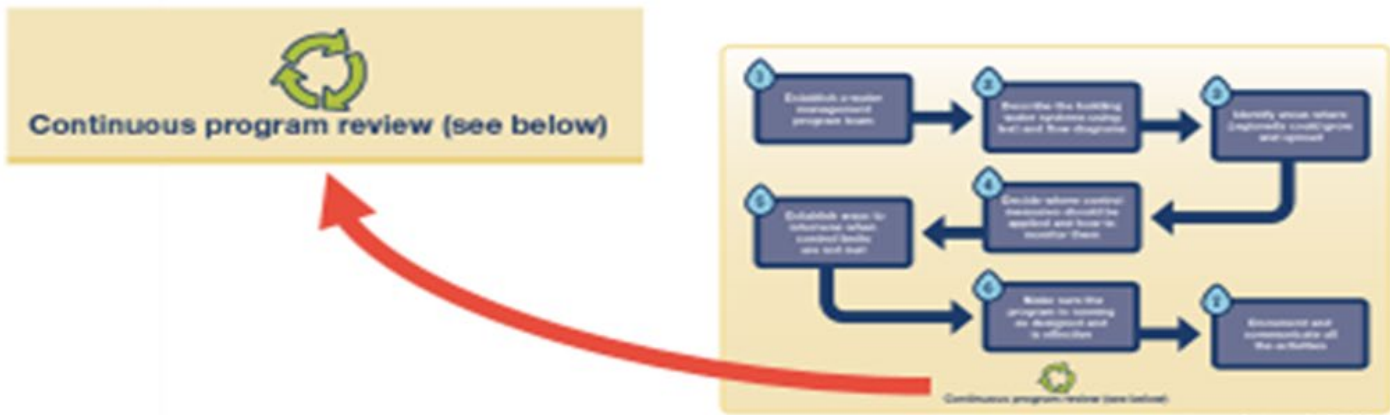
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STEP 6: CONTINUOUS PROGRAM REVIEW

Water management: basic principles

- Keep hot water hot (and cold water cold)
- Keep water moving
- Ensure adequate disinfection
- Maintain equipment



www.cdc.gov/legionsa/WMPtoolkit

VERIFICATION AND VALIDATION

Make Sure the Program Is Running as Designed and Is Effective

Verification – Is the plan being followed? Is the program being implemented as designed

Validation – Is the plan controlling the hazardous conditions in the water system?

- May include clinical surveillance for patients with infections due to LD or OPPP.
- May include environmental monitoring for *Legionella*; especially true in facilities with a history of LD case/s or with patients who are at increased risk for LD.
- May include environmental testing for other OPPP, especially following an outbreak

ENVIRONMENTAL TESTING PROTOCOLS

Specific decisions about sampling frequency, location, and methodology should be deferred to the WMP team.

Sampling plans are unique to each facility and are based on factors such as:

- Findings from the environmental assessment and any baseline *Legionella* test results.
- Overall performance of the water management program (e.g., water quality parameters [e.g., disinfectant, temperature] and trend analysis of *Legionella* test results).
- Building characteristics (e.g., size, age, complexity, populations served).
- Sites of possible exposure to aerosolized water.
- (CDC *Legionella* Toolkit, CDC Guidelines)

WATER TESTING

Most hospital laboratories do not provide environmental testing. Testing is recommended when a problem is identified by clinical surveillance (*Pseudomonas*, nontuberculous mycobacteria [NTMs], *Legionella*, etc.) or a history of water problems.

Water testing resources:

National Environmental Laboratory Accreditation Program (NELAC)
(certified drinking water):

<http://lams.nelac-institute.org/Search>

Environmental *Legionella* Isolation Techniques Evaluation (Elite)
Labs.

<https://wwwn.cdc.gov/elite/public/elitehome.aspx>

Potentially, state laboratories or local public utility water treatment.

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WATER MANAGEMENT PROGRAM

The WMP must be based on national guidelines, this can include but is not limited to guidelines from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers or ASHRAE, CDC, and/or EPA.



WATER MANAGEMENT PROGRAM (WMP)

Interview and record review questions includes:

- there were any diagnosis of legionellosis in residents since last survey?
- did the facility contact public health?
- what were the public health recommendations?
- what were the facility's actions on response to the recommendations?

DOCUMENTATION AND COMMUNICATION

- Team members' roles and responsibilities.
- Description of building:
 - Location.
 - Age.
 - Uses.
- Description of the plumbing system including process flow diagrams.
- Control measures and control points (where monitoring and controls can be applied).
- Document sampling, specimen transport, and laboratory performing testing (methods and procedures).

COMMUNICATION PLAN

- Verification/validation.
- When implemented, notify building occupants.
- Communicate regularly with staff.
- Provide training for those responsible for implementing and monitoring the plan.

CDC GENERAL STRATEGIES FOR PREVENTING LD

If one case of laboratory-confirmed, HCA LD is identified, or if two or more cases of laboratory-suspected, HCA LD occur during a six-month period:

- Report the cases to the state and local health departments where required.
- **If the facility is not treating immunocompromised patients:**
 - Epidemiologic investigation; retrospective microbiologic, serologic, postmortem review for additional cases.
 - If no evidence of continued HCA transmission exists, continue intensive prospective surveillance for ≥ 2 months after the initiation of surveillance.
 - If there is evidence of continued HCA transmission (i.e., an outbreak), conduct an environmental assessment to determine the source of *Legionella* spp.

CDC/HICPAC: Guidelines for preventing health care-associated pneumonia, 2003 (2004)

<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>

CDC GENERAL STRATEGIES FOR PREVENTING LD (CONT.)

If one case of laboratory-confirmed, HCA LD is identified, or if two or more cases of laboratory-suspected, HCA LD occur during a six-month period:

If the facility is treating immunocompromised patients:

- Collect water samples from potential aerosolized water sources.
- If a source is identified, promptly institute water system decontamination measures per recommendations.
- If *Legionella* spp. are detected in more than one culture (e.g., conducted at two-week intervals during three months), reassess the control measures, modify them accordingly, and repeat the decontamination procedures; consider intensive use of techniques used for initial decontamination, or a combination of superheating and hyperchlorination.

CDC/HICPAC: Guidelines for preventing health care-associated pneumonia, 2003 (2004)
<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>

SUMMARY

- People can get LD and OPPP from healthcare facilities, which often have large water systems and serve vulnerable patients.
- Certain conditions promote *Legionella* growth (e.g., warm temperatures, lack of disinfectant, poor water flow).
- Every building is different (depending upon the structure, the age, the location, surrounding conditions, unique areas of risk for *Legionella* growth and transmission, the population found within, and patient care equipment).

SUMMARY: EXPECTATIONS FOR HEALTHCARE FACILITIES

Compliance with S&C Memo 17-30 on *Legionella*: Review policies and procedures and reports documenting water management implementation results to verify that the facility has:

- Conducted **risk assessment** for potential areas of growth and spread.
- Implemented a **water management program** that considers the ASHRAE industry standards and CDC toolkit, and that includes control measures (e.g., physical controls, temperature management, disinfectant level control, visual inspections, and environmental testing).
- Specified **testing protocols** and acceptable ranges for control measures and documented the results of testing and corrective actions taken when control limits are not maintained.

OTHER HELPFUL RESOURCES

- **A Practical Guide to Implementing Industry Standards**

<https://www.cdc.gov/legionella/water-system-maintenance.html>

- **What Owners and Managers of Buildings and Healthcare Facilities Need to Know about *Legionella* Water Management Program**

<https://www.cdc.gov/legionella/water-system-maintenance/wmp-fact-sheet.html>

- **What Owners and Managers of Buildings and Healthcare Facilities Need to Know about the Growth and Spread of *Legionella***

<https://www.cdc.gov/legionella/water-system-maintenance/growth-and-spread.html>

- **Healthcare Water Management Program Frequently Asked Questions**

<https://www.cdc.gov/legionella/water-system-maintenance/healthcare-wmp-faq.html>