



Legionella Prevention, and Outbreak Response

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Legionella

- Legionnaires' disease is becoming an increasing concern in the United States and worldwide
- Legionnaires' disease is caused by the *Legionella* bacterium
- *Legionella* is a naturally occurring bacterium that occurs in freshwater lakes and streams, however the quantities in natural water bodies are generally insufficient to cause disease

Legionella Growth

- Growth or amplification of *Legionella* can occur under different environments in water systems.
- Conditions that promote amplification:
 - Water stagnation
 - Warm temperatures (25 - 51° C [77° - 124° F])
 - Presence of scale and sediment
 - Presence of organic matter (biofilms)
 - Protozoa
 - Lack of residual disinfectant

Legionella Transmission

- *Legionella* is dispersed through aerosolization.
- Sources include:
 - Showers and faucets
 - Cooling towers
 - Hot tubs
 - Decorative fountains
 - Large, complex water systems



Legionella - Prevention

- Keeping *Legionella* out of water systems in buildings is key to preventing infection.
- The CDC has identified that there is no safe level of *Legionella* in potable water systems.
- The mortality rate for healthcare acquired infections is 25% (1 in 4) and 11% in the general population
- CDC investigations show almost all outbreaks were caused by problems preventable with more effective water management.

Legionnaires' Disease

Use water management programs in buildings to help prevent outbreaks

CDC investigated the first outbreak of Legionnaires' disease, a serious lung infection (pneumonia), in 1976. An increasing number of people in the US are getting this disease, which is caused by breathing in small water droplets contaminated with *Legionella* germs. About 5,000 people are diagnosed with Legionnaires' disease and there are at least 20 outbreaks reported each year. Most identified outbreaks are in buildings with large water systems, such as hotels, long-term care facilities, and hospitals. *Legionella* grows best in building water systems that are not well maintained. Building owners and managers should adopt newly published standards that promote *Legionella* water management programs, which are ways to reduce the risk of this germ in building water systems.

Building owners and managers can:

- Learn about and follow newly published standards for *Legionella* water management programs.
<http://bit.ly/1Ph3wQP>
- Determine if the water systems in their buildings are at increased risk of growing and spreading *Legionella*.
- Develop and use a *Legionella* water management program as needed. www.cdc.gov/legionella/WM/Toolkit
- Monitor and respond to changes in water quality.

Want to learn more? www.cdc.gov/vitalsigns/legionnaires

National Center for Immunization and Respiratory Diseases
National Center for Environmental Health



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

4x

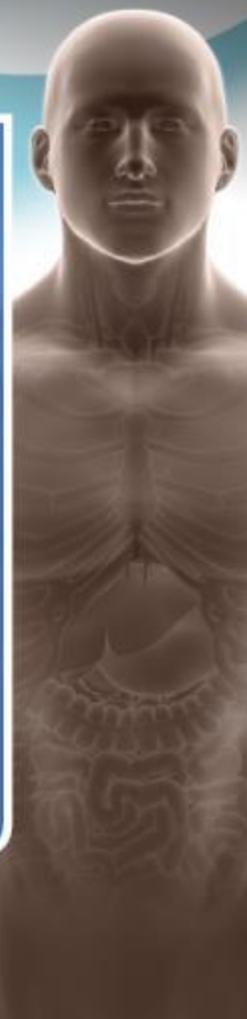
The number of people with Legionnaires' disease grew by nearly 4 times from 2000–2014.

1 in 10

Legionnaires' disease is deadly for about 10% of people who get it.

9 in 10

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



Legionella can grow and spread in many areas of a building.

Effective water management programs can **REDUCE** the risk of Legionnaires' disease.

Legionella can make people sick when the germs grow in water and spread in droplets small enough for people to breathe in.

Legionella grows best in warm water that is not moving or that does not have enough disinfectant to kill germs.



At-risk facilities

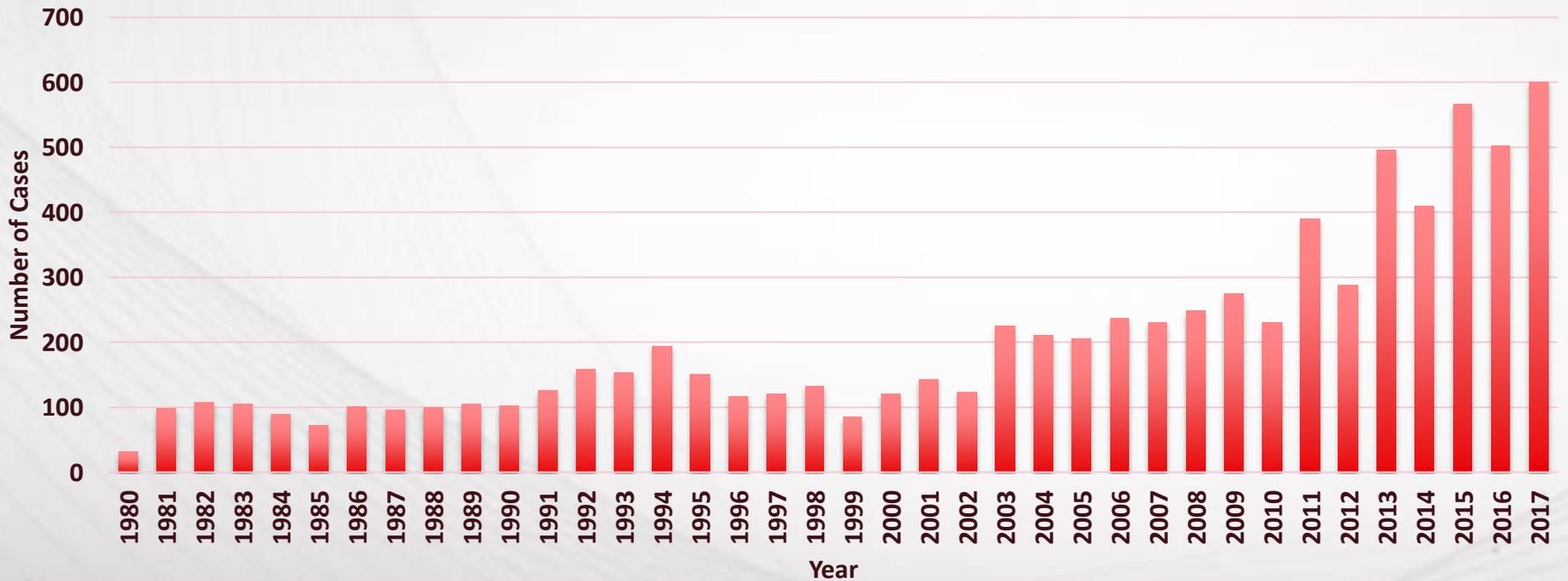
- Facilities housing sensitive populations such as hospitals and long-term care facilities
- Buildings with more than 10 stories
- Buildings with cooling towers
- Building with large, complex hot water distribution systems
- Hospitals
- Nursing Homes
- Senior living/assisted living facilities
- Hotels
- Office buildings
- Commercial operations using misting/spray
- Churches
- Dental equipment

Cause of Outbreaks

- About 1 in 2 (48%) are due to more than one of the following problems.
- About 2 in 3 (65%) are due to process failures, like not having a *Legionella* water management program.
- About 1 in 2 (52%) are due to human error, such as a hot tub filter not being cleaned or replaced as recommended by the manufacturer.
- About 1 in 3 (35%) are due to equipment, such as a disinfection system, not working.
- About 1 in 3 (35%) are due to changes in water quality from reasons external to the building itself, like nearby construction.

Water management problems can lead to Legionnaires' disease outbreaks.

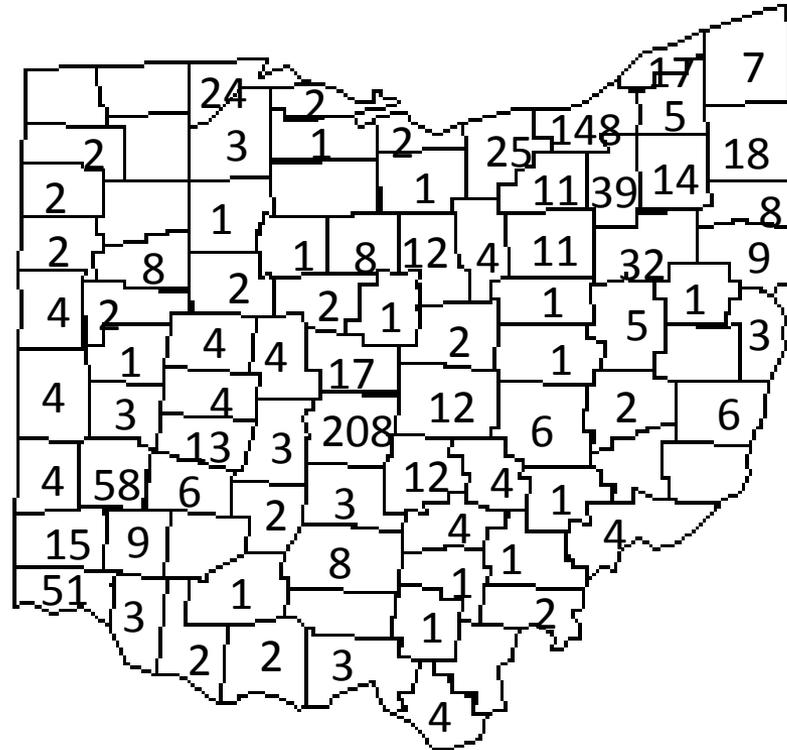
Legionnaires' Disease Ohio 1980-2017



Source: ODRS

Legionnaires' disease in Ohio: 2018

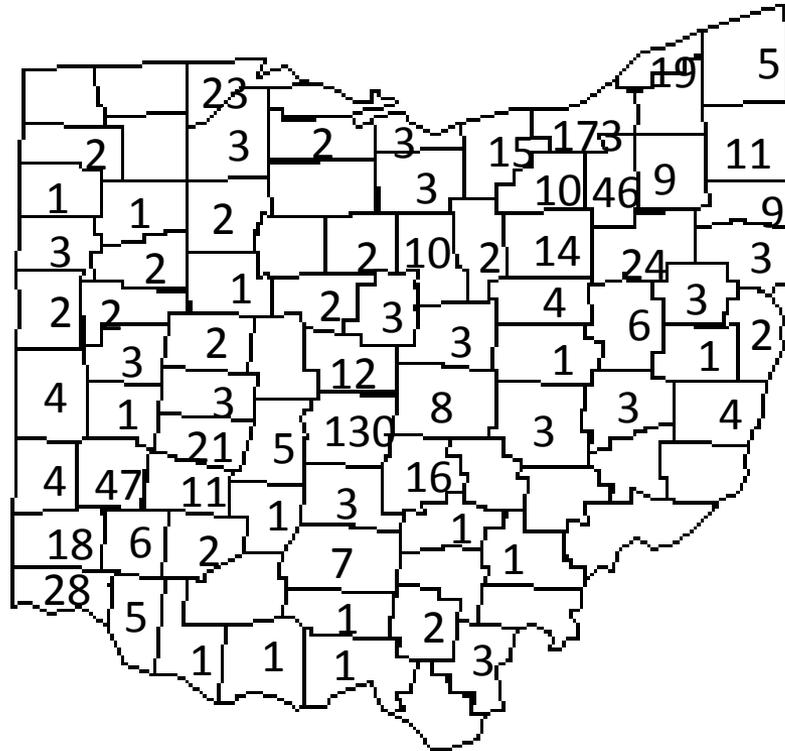
930 cases



Source: ODRS

Legionellosis in Ohio: 2019

785 cases



Source: ODRS

Legionella Response and Risk Reduction in Healthcare and Other Facilities in Ohio

- Implementation of a pro-active approach by healthcare and other facilities to evaluate Legionella exposure risk in their building
- Implementing a robust water management plan tailored to the facility
- In the event of cases or outbreaks, implement immediate protective measures including water use restrictions, installation of filters, and remediation.

Defining Healthcare-associated Legionnaires' Disease

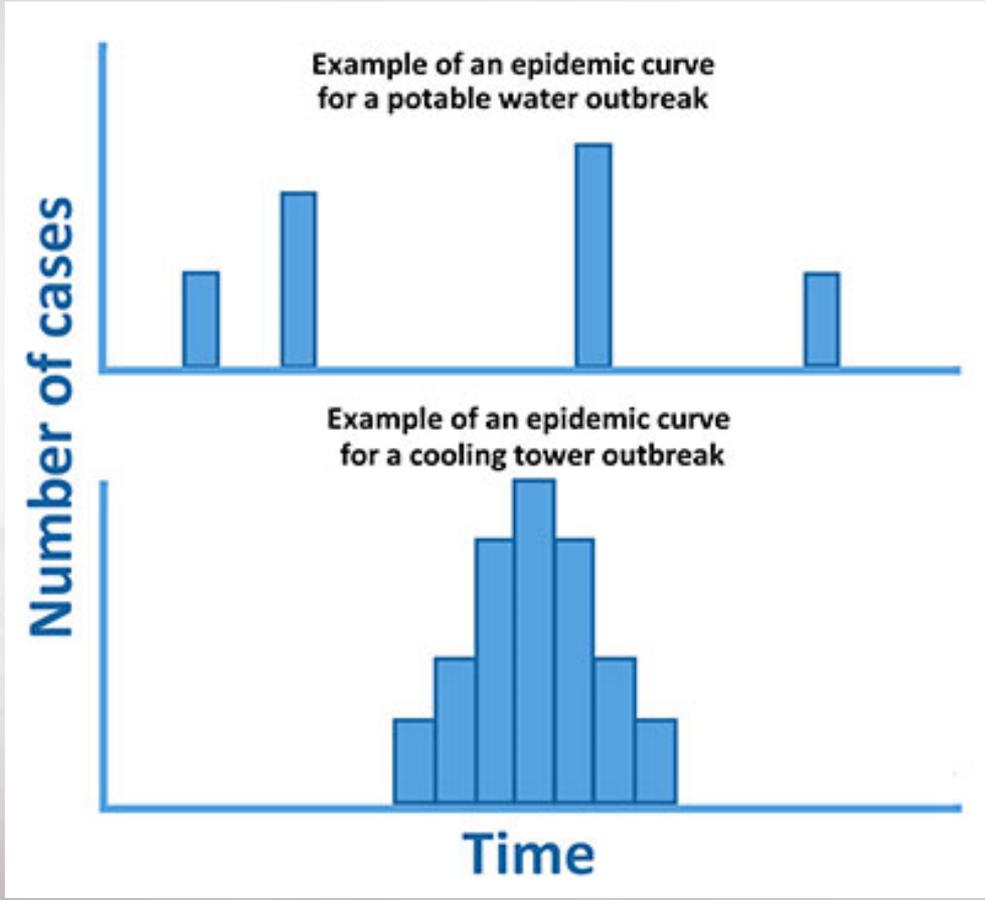
It is important to understand the CDC case definitions for healthcare facilities and be current with CDC recommendations on how to respond to each.

- **Presumptive (formerly Definite healthcare-associated):** the patient spent the entire 10 days of the 14 day incubation period before date of symptom onset in a healthcare facility.
- **Possible healthcare-associated:** the patient spent a portion of the 10 days before date of symptom onset in a healthcare facility.

Healthcare and Facility Associated Outbreaks

- For healthcare-associated cases or outbreaks, conduct a full investigation when:
 - There is 1 or more definite healthcare associated cases at any point.
 - There are 2 or more possible healthcare associated cases within a 12 month period.
 - Even if it is determined that a full investigation is not needed, facilities should still consider performing an environmental assessment to identify potential risk areas.
 - This step is strongly recommended if there have been past cases in the facility, cases in the area, a disruption in the facility's water system, or recent positive *Legionella* identification in the water system.
 - For non-healthcare facilities, consider conducting an investigation when there are 2 or more possible associated cases in a 12 month period.

Cases and Outbreaks



Source:
CDC

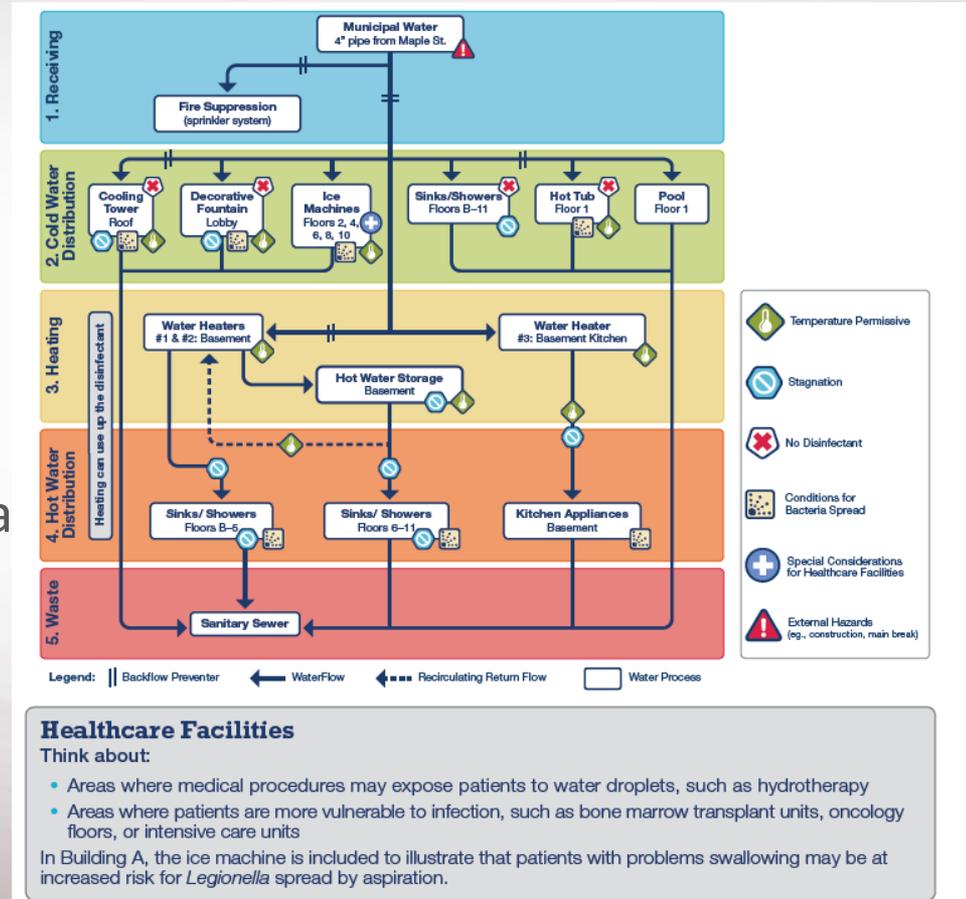
Prevention and Response

Legionella Prevention for Facilities

- Continued awareness and surveillance
- Development and implementation of a robust and effective water management plan
- Validation of the plan through periodic environmental sampling
- Conducting remediation actions when required
- Long term disinfection to control *Legionella* growth in the water systems

Prevention

- Water management programs identify hazardous conditions and take steps to minimize the growth and transmission of *Legionella* and other waterborne pathogens in building water systems.
- Developing and maintaining a water management program is a multi-step process that requires continuous review.



Water Management Programs

Seven key elements of a *Legionella* water management program are to:

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



Water Management Plans

In general, the **principles** of effective water management include:

- Maintaining water temperatures outside the ideal range for *Legionella* growth
- Preventing water stagnation
- Ensuring adequate disinfection
- Maintaining devices to prevent scale, corrosion, and biofilm growth, 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 responses to remediate such conditions if the team detects them.
- For healthcare facilities, validation of the water management plan through periodic sampling for *Legionella* is recommended.

Legionella - Response

- Importance of case surveillance, testing and reporting.
- Quick identification of definite healthcare associated cases and/or outbreaks.
- Coordination between the facility, the local health district and the Ohio Department of Health is critical.
- Quick implementation of measures to reduce further exposures and additional cases of disease.

Coordination is Key

Legionella Cases/Outbreaks

- Facility reports the case or outbreak
- Early engagement with local health district and ODH via conference call to assess the case or outbreak situation
- Ohio Department of Health program areas involved in the initial response:
 - Bureau of Infectious Diseases
 - Bureau of Environmental Health

Facility Response Actions

- Enhanced disease surveillance
- Implementation of immediate water use restrictions and/or installation of point of use medical grade filters to remove *Legionella*
- Implement plan for provision of alternative water sources and communicate with building occupants/visitors
- Obtain the services of a qualified *Legionella* consultant/engineer.
- Conduct environmental facility assessment and identify risk conditions
- Conduct pre-remediation sampling for *Legionella* following the CDC sampling protocols
- Remediation of water source (plumbing corrections), cooling tower or other sources of exposure.
- Conduct post remediation sampling
- Review and modification of the facility water management plan.
- Implement continuous disinfection if necessary (may require Ohio EPA license to operate).
- Implementation of post outbreak sampling regime.

Local Health District Response Actions

- Conduct epidemiological evaluation
- Investigate potential sources and contact facility managers.
- Work with facility managers on-site in investigating *Legionella* cases.
- Ensure implementation of protective measures.
- Assist with and/or conduct the environmental facility assessment.
- Assist with identification of sampling locations.
- Oversee remediation efforts.
- Make recommendations and document all actions taken by both the facility and the LHD.
- Communicate with ODH on case/outbreak information.

ODH - Bureau of Infectious Diseases

Response Actions

Bureau of Infectious Diseases

- Legionnaires' Disease is a class B reportable disease.
- Responsible for case surveillance and disease monitoring.
- Supports epidemiology investigations and gives training to local health districts.
- Provides clinical assistance in case and outbreak response.
- Can request EPI-Aid from CDC.
- National reporting of disease occurrence.

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ODH – Environmental Health Response Actions

Bureau of Environmental Health and Radiation Protection

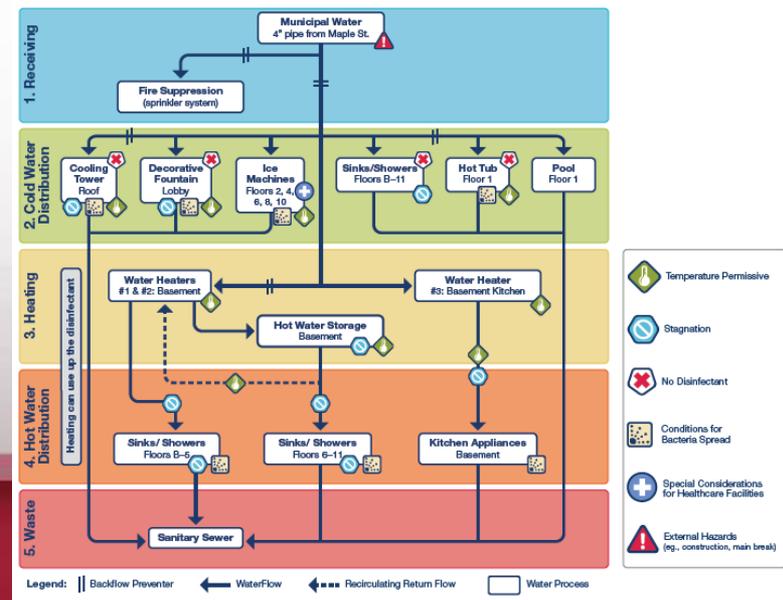
- Provides technical assistance to local health districts, healthcare facilities, building managers on *Legionella* prevention.
- Provides on-site or remote environmental technical assistance on cases and outbreaks.
- Ensure implementation of protective measures.
- Guidance for response environmental sampling and remediation.
- Review of water management plans.
- Guidance and review of post-remediation sampling.
- Guidance and review of continuous disinfection options
- Work with facility and local health district to identify timeframe for filter removal and lifting of water use restrictions.

Environmental Facility Assessments

- Environmental assessments include detailed water system information and environmental parameters that can be used to identify exposure sources.
- Indicators of a potential source include:
 - Low disinfectant residual in the cold and hot water system.
 - Hot water or cold water within the *Legionella* range of growth.
 - Identified dead end plumbing legs or areas of stagnation.
 - Poor balance of hot water distribution in the water system.
 - Presence of thermal mixing valves.
 - Presence of cooling towers, decorative fountains, water features that are not properly maintained.
 - Lack of backflow prevention and plumbing cross-connections.

Finding Exposure Sources

- Water system flow diagrams allow investigators to determine places where aerosols may generate and potential risk factors.
- Any locations with aerosol generation and lower hot water temperatures should get special attention. These areas should be identified in the environmental facility assessment.
- Knowledge of patient history during the incubation period makes locating potential exposures easier.
- Locations should also be investigated for any previous case history or other hospitalized individuals with pneumonia who may share the same source.



Environmental Sampling

- The environmental assessment should be used along with epidemiologic information to determine to identify locations for *Legionella* environmental sampling and to develop a sampling plan.
- The objective of *Legionella* environmental sampling during an outbreak is to characterize the type and extent of *Legionella* colonization within the building water system(s) and fixtures.
- Environmental sampling is important for verifying that remediation activities are working to control the hazard.

Water sampling for Legionella

- The facility will work with their consultant and state/local agencies to identify sampling locations.
- Sites should be selected based on risks identified in the environmental assessment and the location of cases.
- Samples may be collected from incoming water mains.
- Expect collection of both water and swab samples at high-risk sites.
- Follow CDC Sampling Procedure and Potential Sampling site Guidance <https://www.cdc.gov/legionella/downloads/cdc-sampling-procedure.pdf>
- Refer to CDC sampling training videos for proper sampling protocols. <https://www.cdc.gov/legionella/videos.html>.
- See CDC list of ELITE certified labs to send samples at <https://wwwn.cdc.gov/elite/public/memberlist>.

Subtyping and Comparing Isolates

- *Legionella* is a diverse genus, although *L. pneumophila* serogroup 1 causes most cases of Legionnaires' disease. Other species of *Legionella* may also cause disease.
- *The urine antigen test only identifies infection from L. pneumophila serogroup 1.*
- During an investigation, it is common to find more than one type of *Legionella* in several possible sources.
- If *Legionella* strains are identified other than the presumptive outbreak strain through environmental sampling, this should be considered as evidence that conditions supporting *Legionella* growth and transmission exist within the building water system(s).
- **Negative sampling results do not necessarily indicate that *Legionella* is not present.**
- **Water sampling is ONLY a snapshot in time.**

ELITE Certified Laboratories

- ELITE certified laboratories will be able to provide identification of *Legionella* to the species and serogroup level (if *L. pneumophila*).
- Molecular comparisons of *Legionella* isolates recovered from clinical specimens and possible environmental sources are useful aspects of Legionnaires' disease outbreak investigations.
- Combined with patient exposure information, these data can further support the identification of a specific environmental source.

End of an Outbreak

- The end of an outbreak should be reviewed on a case-by-case basis.
- No new cases of Legionnaires' disease identified during a period of careful monitoring for new cases.
- Identification and correction of possible hazards and high risk conditions.
- Implementation of post remediation sampling regime with consideration of HICPAC guidance with no detection of *Legionella* in post-remediation environmental samples.
- An effective (revised if necessary) and robust water management program to prevent ongoing and future exposure to *Legionella* is being implemented.
- Implementation of continuous disinfection where necessary to control risk and possible Ohio EPA licensure
- Water use restrictions and/or filters have been removed and subsequent *Legionella* sampling shows no detections.

Long-term control measures

Temperature

- Cold water should be maintained below 77° F)
- **Hot water above 120° F**
- Monitor and log temperature and time to reach highest temperature

Chlorine

- Most common chemical method
- **Maintain residual levels of 0.5-1 mg/L minimum**
- Monitor and log Chlorine residual

Remediation and long-term control

Thermal flushing – raise water temperature to 160 degrees, flush through all lines and fixtures for minimum of 30 minutes

Monochloramine

- Used in hot water systems for both short term remediation and long-term control
- Normal residual rates between 1.0 – 3.0 mg/L

Chlorine dioxide

- Used in hot water systems for both short term remediation and long-term control
- Normal residual between 0.1 and 0.5 mg/L

Long-term control

Copper-Silver Ionization

- Water flows through electrically charged flow cells with copper and silver anodes releasing copper and silver ions into the water
- Most commonly used on recirculating hot water systems
- Recommended residual of 0.3 – 0.8 ppm for copper and 0.01 – 0.08 ppm for silver

Long-term control

Ultraviolet (UV)

- Best when used along with another measure

Filtration

- Point-of-use and point-of-entry
- Reverse osmosis, nanofilters, ultrafilters, and certain microfilters

Ozone

- Almost never used, provides no residual

ODH Actions to Reduce Legionella Cases/Outbreaks

Short-term actions:

- Develop draft LD case and outbreak response criteria
- Develop draft LD case and outbreak response checklist
- Implement training (surveyors, health districts, facilities)
- Conduct outreach to consultants and engineers
- Coordination with Dept. of Commerce and commercial licensed plumbers

ODH Actions to Reduce Legionella Cases/Outbreaks

Long-term Actions (early to mid 2020):

- Convene workgroups of stakeholders and constituents to review and develop key recommendations/procedures for:
 - Potable water systems
 - Heating/cooling systems
 - Hot tubs/water features
- Develop a state Legionella Response Strategy
- Develop a state Legionella Primary Prevention Strategy

Resources

Refer to CDC guidelines and recommendations for any further information of *Legionella* and case management

<https://www.cdc.gov/legionella/index.html>

Further ODH trainings, factsheets and resources can be found on the ODH *Legionella* webpage

www.odh.ohio.gov/legionella

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