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Legionella

I. Introduction

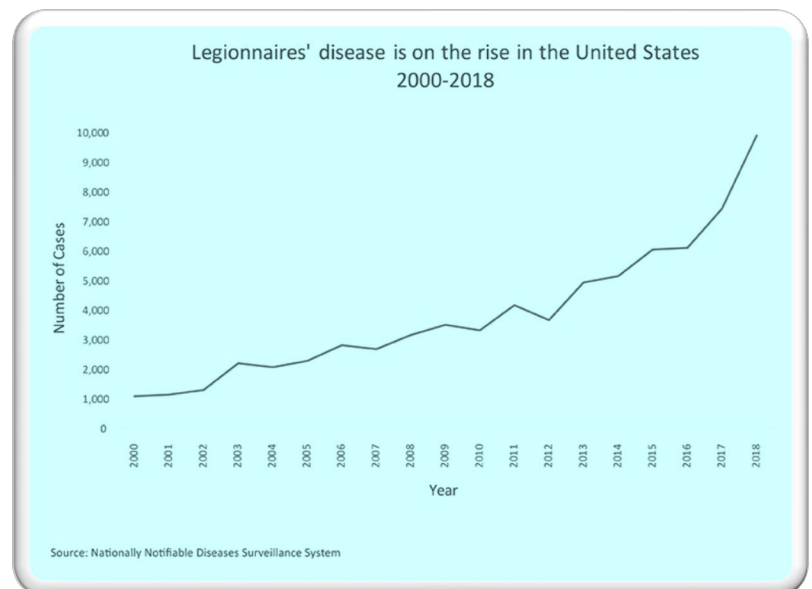
Legionellosis, or Legionnaires' disease is a type of pneumonia (lung infection) that was first identified in 1976 during an outbreak among people who attended a Philadelphia convention of the American Legion. In the following year, the bacterium responsible was identified and named *Legionella*.

After the identification of *Legionella*, public health officials were able to show that the same bacterium was also the cause of Pontiac fever; a mild, flu-like illness that had been previously observed in 1968 in Pontiac, Michigan, among people who worked at and visited the city's health department.

In the United States, the rate of reported cases of Legionnaires' disease has grown by nearly nine times since 2000. It is unclear whether this increase represents artifact (due to increased awareness and testing), increased susceptibility of the population, increased *Legionella* in the environment, or some combination of factors.

The number of cases reported to the Centers for Disease Control and Prevention (CDC) has been on the rise since 2000. Health departments reported about 10,000 cases of Legionnaires' disease in the United States in 2018.

However, because Legionnaires' disease is likely underdiagnosed, this number may underestimate the true incidence. More illness is usually found in the summer and early fall, but it can happen any time of year.



<https://www.cdc.gov/legionella/images/national-incidence.jpg>

This *Sompo Advisor* was developed from information contained on the website of the [Centers for Disease Control and Prevention \(CDC\)](#) and related documents.

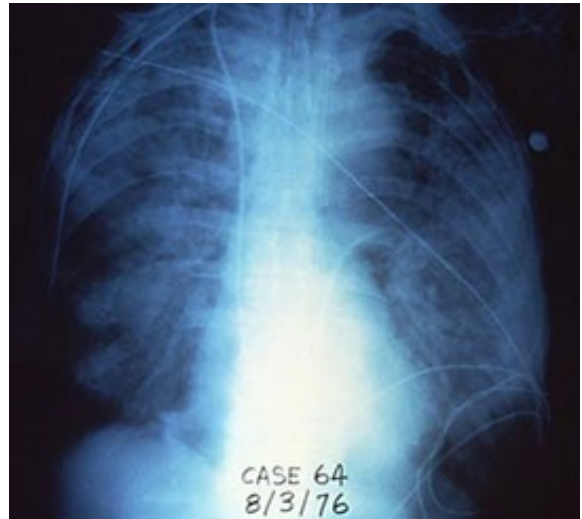
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II. Legionnaires' Disease

Legionnaires' disease is very similar to other types of pneumonia, and often looks similar on a chest x-ray. Symptoms include:

- Cough
- Shortness of breath
- Fever
- Muscle aches
- Headaches

Legionnaires' disease can also be associated with other symptoms such as diarrhea, nausea, and confusion. Symptoms usually begin 2 to 10 days after being exposed to the bacteria, but it can take longer so people should watch for symptoms for about 2 weeks after exposure.



<https://www.cdc.gov/legionella/about/signs-symptoms.html>

Pontiac fever symptoms are primarily fever and muscle aches; it is a milder infection than Legionnaires' disease. Symptoms begin between a few hours to 3 days after being exposed to the bacteria and usually last less than a week. Pontiac fever is different from Legionnaires' disease because someone with Pontiac fever does not have pneumonia.

III. Causes and Common Sources of Infection

Legionella is a type of bacterium found naturally in freshwater environments, like lakes and streams. It can become a health concern when it grows and spreads in human-made building water systems like:

- Showerheads and sink faucets
- Cooling towers (structures that contain water and a fan as part of centralized air cooling systems for building or industrial processes)
- Hot tubs that aren't drained after each use
- Decorative fountains and water features
- Hot water tanks and heaters
- Large plumbing systems

Home and car air-conditioning units do not use water to cool the air, so they are not a risk for *Legionella* growth.

After *Legionella* grows and multiplies in a building water system, water containing *Legionella* then has to spread in droplets small enough for people to breathe in. People can get Legionnaires' disease or Pontiac fever when they breathe in small droplets of water in the air that contain the bacteria.

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Less commonly, people can get sick by aspiration of drinking water containing *Legionella*. This happens when water accidentally goes into the lungs while drinking. People at increased risk of aspiration include those with swallowing difficulties.

Most healthy people exposed to *Legionella* do not get sick. People at increased risk of getting sick are:

- People 50 years or older
- Current or former smokers
- People with a chronic lung disease (like chronic obstructive pulmonary disease or emphysema)
- People with weak immune systems or who take drugs that weaken the immune system (like after a transplant operation or chemotherapy)
- People with cancer
- People with underlying illnesses such as diabetes, kidney failure, or liver failure

In general, people do not spread Legionnaires' disease and Pontiac fever to other people. However, this may be possible under rare circumstances.

IV. Water Management Programs

There are no vaccines that can prevent Legionnaires' disease. Instead, the key to preventing Legionnaires' disease is to make sure that building owners and managers maintain building water systems in order to reduce the risk of *Legionella* growth and spread.

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. Such programs are now an industry standard for large buildings in the United States.

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

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.

Building Factors

Each program has to be tailored for each particular building at a particular point in time. Building factors to take into consideration include:

- Structure and size
- Age
- Location and surrounding conditions
- Unique areas of risk for *Legionella* growth and spread
- Susceptibilities of the people found within

Options may vary depending upon state and local building codes, water treatment regulations, healthcare accreditation and survey requirements, and public health reporting requirements. For example, anti-scald regulations may limit maximum allowable water temperatures.

In some settings, such as hospitals and other large buildings with complex water systems, you need a water management program for the entire building. In other settings, such as small buildings with simple water systems, you may only need a water management program to cover the devices that aerosolize water. Examples of these devices include fountains, hot tubs, cooling towers, and respiratory equipment intended for nebulization.

ASHRAE 188

In 2015, ASHRAE (formerly the American Society of Heating, Refrigerating, and Air Conditioning Engineers) developed a new Standard aimed at preventing the growth and spread of *Legionella*. Created as a voluntary consensus Standard, ASHRAE 188 provides guidance that does not have regulatory authority unless it is incorporated into local building codes, and was developed by a committee comprised of academic, industry, and government subject matter experts. By creating a framework for proactively managing building water systems and reducing the potential for *Legionella* growth in these systems, following this Standard can help building and facility managers prevent many but not all cases of Legionellosis.

ASHRAE 188 defines:

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- Types of buildings and devices that need a water management program
- Minimum components of a water management program
- Devices (e.g., hot tubs, cooling towers) that need to be controlled in order to prevent the growth and spread of *Legionella*
- Who should be on a water management program team
- When and how often water management programs should be reassessed and updated

It also includes an annex with special considerations, such as clinical surveillance, for healthcare facilities.

ASHRAE 188 is a copyrighted document that can be [purchased from ASHRAE](#).

CDC Toolkit

The Centers for Disease Control and Prevention (CDC) has developed a toolkit to help building owners and managers develop and implement a water management program to reduce their building's risk for growing and spreading *Legionella*. This toolkit may be [downloaded from CDC](#) at no charge.

The toolkit aims to provide an easy-to-understand interpretation of ASHRAE Standard 188 to help building owners and managers evaluate the water system and devices in their building(s) to see if they need a program, and then develop an effective water management program if one is needed.

The toolkit includes:

- A simple [yes/no worksheet](#) to determine if an entire building or parts of it are at increased risk for growing and spreading *Legionella*
- A basic walkthrough of the elements of a *Legionella* water management program
- Scenarios describing common water quality problems and examples of how to respond to them to reduce the risk for *Legionella*
- Special sections and considerations for those who work in healthcare facilities

Monitoring Water Quality Parameters

The water management program team should regularly monitor water quality parameters, such as disinfectant and temperature levels. By monitoring these parameters, the team can ensure that building water systems are operating in a way to minimize hazardous conditions that could encourage *Legionella* and other waterborne pathogens to grow.

Routine Environmental Sampling

Routine environmental sampling for *Legionella* (i.e., sampling that is performed proactively as part of an effort to reduce risk of *Legionella* growth and transmission in building water systems, not in the context of an outbreak investigation) is one way to validate the efficacy of a water management program (i.e., to confirm that the water management program is working as intended). The team should base decisions about routine environmental sampling

for *Legionella* on a variety of factors, including the building environmental assessment and water quality data supporting the overall performance of the water management program.

Sampling Plans and Approaches

If the team decides to perform validation using environmental sampling for *Legionella*, they should not sample in isolation but as a part of a comprehensive water management program. The team should make specific decisions about sampling frequency, location, and methodology. Sampling plans are unique to each facility and based on factors such as:

- Findings from the environmental assessment and any baseline *Legionella* test results
- Overall performance of the water management program, trend analysis of *Legionella* test results, and water quality parameters (e.g., disinfectant, temperature)
- In healthcare facilities, correlation of environmental test results with clinical surveillance data
- Building characteristics (e.g., size, age, complexity, populations served)
- Sites of possible exposure to aerosolized water
- Available resources and supplies to support sampling

The team can adjust the sampling approach over time based on trend data and system changes. Organizing these data in a format that is sortable by date, location, and result can be helpful when trying to analyze trends over time.

Assessment and Sampling

The following environmental assessment and sampling tools are available from the CDC to assist in the environmental component of Legionnaires' disease outbreak investigations.

- [Legionella Environmental Assessment Form](#)
Use this form to document a facility's water systems, help determine whether to conduct *Legionella* environmental sampling, and, if so, develop a sampling plan.
- [CDC Sampling Procedure and Potential Sampling Sites](#)
Use this protocol to collect environmental samples for *Legionella* culture during an outbreak investigation or when cases of disease may be associated with a facility (includes sampling supply checklist).
- [Sample Data Sheet](#)
Use this form to keep track of environmental samples taken for *Legionella* culture during an investigation.
- [Environmental Investigation Videos](#)
Watch six instructional videos for information on various environmental aspects of Legionnaires' disease outbreak investigations.

The Occupational Safety and Health Administration (OSHA) [Technical Manual](#) also contains detailed instructions for sampling, as well as specific guidelines to assess the effectiveness of water system maintenance

A [consultant](#) with *Legionella*-specific environmental expertise may sometimes be helpful in implementing and operating water management programs or when you desire additional remediation resources.

Legionella and Hot Tubs

Legionella grows best in warm water, like the water temperatures used in hot tubs. However, warm temperatures also make it hard to keep disinfectants, such as chlorine, at the levels needed to kill germs like *Legionella*. Disinfectant and other chemical levels in hot tubs should be checked regularly and hot tubs should be cleaned as recommended by the manufacturer.

Low water volumes combined with high temperatures and heavy bather loads make public hot tub operation challenging. The result can be low disinfectant levels that allow the growth and spread of a variety of germs that can cause skin and respiratory Recreational Water Illnesses (RWIs). Operators who focus on hot tub maintenance and operation to ensure continuous, good water quality are the first line of defense in preventing the spread of RWIs.



<https://www.cdc.gov/healthywater/pdf/swimming/resources/operating-public-hot-tubs-factsheet.pdf>

The Model Aquatic Health Code (MAHC)



<https://www.cdc.gov/healthywater/swimming/aquatics-professionals/index.html>

The [Model Aquatic Health Code \(MAHC\)](#) is a voluntary guidance document based on science and best practices that can help local and state authorities and the aquatics sector make swimming and other water activities healthier and safer.

If you are involved in hot tub maintenance, you should

- Obtain state or local authority-recommended operator and chemical handling training. Read a list of [national training courses](#).
- Read and adhere to the [Operating Public Hot Tubs fact sheet for pool staff/owners](#).

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V. Taking Corrective Actions When You Find *Legionella*

There is no known safe level of *Legionella* in building water systems. Cases of Legionnaires' disease have been associated with very low levels of *Legionella* in building water systems. The intent of a water management program should be to manage building water systems to reduce the hazardous conditions that allow the *Legionella* to grow and spread to susceptible people. If the team decides to incorporate routine environmental sampling for *Legionella* as part of their water management program, they will need to decide how and when to respond if these bacteria are found in their water systems.

If the team finds *Legionella* during routine environmental sampling (in the absence of disease), CDC suggests exploring possible reasons for the growth. Corrective actions, such as adjusting temperature levels or flushing the pipes, might be sufficient. Additional actions may be necessary if there are concerning trends (e.g., persistently positive samples at a single location, positive samples in a central distribution point, positive samples in multiple points-of-use, diversity in the types of *Legionella* detected).

If cases of Legionnaires' disease or Pontiac fever that are linked to a hot tub, it is important to take samples for laboratory testing before disinfecting the hot tub. However, the hot tub should be turned off immediately to prevent more people from getting sick. Detailed instructions for disinfecting hot tubs are available on the fact sheet [Disinfection of Hot Tubs that Contain *Legionella*](#)

VI. Assistance

For additional information or assistance in the development and implementation of a Legionella control program to meet the needs of your organization, contact your Sompo International Risk Control Team or email us at: GRSRiskControlQuestions@sompo-intl.com.