

Legionnaires' Disease

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Introduction

Ever since its first documented outbreak (34 deaths and 221 reported cases) at the 1976 American Legion Convention in the Bellevue-Stratford Hotel in Philadelphia, Legionnaires' Disease has received a lot of attention. In addition to outbreaks affecting several people, many sporadic cases continue to be reported from identified and unidentified sources. This RiskTopic discusses the causes of this disease and common areas where the bacteria may be found. It also offers guidance on preventative measures.

Discussion

Legionnaires' Disease is caused primarily by the bacterium Legionella pneumophila, although there are now other known species of Legionella. Legionella bacteria are found naturally in the environment, usually in water; though the bacteria grows best in warm water, like that found in cooling towers, hot water tanks, hot tubs (spas), or large plumbing systems. The potential to contract disease occurs when the bacteria are carried into the lungs with aerosolized water mist/vapor. Since there are many virulent strains of Legionella bacteria and wide variations in individual susceptibility, there is no specific "danger" or "safe" dose or level of exposure. Although the bacteria can attack anyone, persons at higher risk include people of 50 years of age or older, smokers, individuals with a weakened immune system, or those who have a chronic lung disease (like emphysema).

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Two distinct forms of Legionellosis exist. For both forms, pneumonia-like symptoms generally appear within 2-10 days of initial exposure.

- **Pontiac Fever** is a milder version of the illness that is accompanied by fever and muscle aches similar to influenza. For most healthy people, recovery from Pontiac Fever typically occurs within 2-5 days without treatment. Onset of the disease is within a few hours to three days of exposure.
- **Legionnaires' Disease** is the more severe form. In addition to fever and muscle ache, headaches, loss of appetite, cough, shortness of breath, and tiredness may occur. Some patients may also get diarrhea and may show decreased kidney function. A chest x-ray may show pneumonia. Symptoms are often confused with pneumonia, and other specific tests are required for proper diagnosis. An individual with a compromised immune system is more likely to get Legionnaires' Disease, which, if not diagnosed and treated promptly, can be fatal.

Legionella occurs naturally in fresh water environments, like lakes and streams, where it generally is not a health concern. It can become a concern when it grows and spreads in human-made building water systems. The key to preventing infection is keeping *Legionella* out of water systems in buildings.

Although the ecology of *Legionella* in water is not fully understood, biofilm formation, sludge, sediments and organic material provide suitable conditions for its survival and growth. Warm standing water is the ideal environment for survival and propagation of *Legionella* bacteria. They are found in many water systems, but they reproduce in high numbers in warm (68°-113° F) stagnant water. Exposure to the diseases is associated with inhaling aerosols of water containing the bacteria. Cooling tower water and evaporative condensers of large air-conditioning systems have been the primary sources of these bacteria in many past major outbreaks. The 1976 outbreak at the American Legion Convention was attributed to contaminated cooling water in the hotel's HVAC system. Since then, other outbreaks and incidents of Legionnaires' Disease have been reported from hot tubs, whirlpool units, potable water, interior building use of pressure washers, mock rain forests, and interior waterfalls and spas.

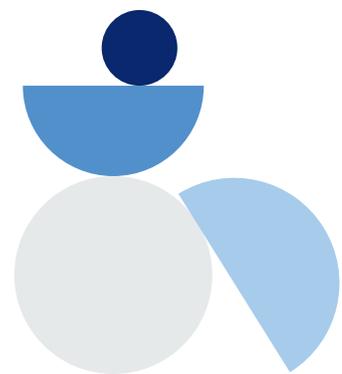
Typically, cooling systems in commercial occupancies, such as hotels, office buildings, hospitals, nursing homes and high-rise residential apartment buildings are known for Legionnaires' Disease exposure. In addition, industrial process water cooling tower operations in diverse processes ranging from large injection molding to food processing and petrochemical operations are some of the less frequent exposure sources that are usually underestimated.

Although there is no evidence of transmission of Legionnaires' Disease associated with drifts from golf courses, lawn and garden irrigation sprays, the possibility of exposure exists any time aerosolized droplets of water from a contaminated source are airborne and inhaled. A number of other sources with potential for aerosol or mist waters are also suspected of transmission of bacteria. The bacteria have been found in hot water tanks, recirculation industrial process water cooling systems, shower heads and faucets. It can also be found naturally in ponds and small lakes. There is no evidence of transmission of disease from drinking contaminated waters or people-to-people transmission.

Additional less common but possible exposure examples include:

- Indoor decorative water features and fountains;
- Ultrasonic mist machines; respiratory therapy equipment;
- Spas and whirlpools
- Rinse water spray in dentist offices
- Industrial process cooling water systems
- Mist sprays for fresh produce at supermarkets.

Home and car air conditioning units do not use water for cooling the air, so they are not at risk for *Legionella* growth.



Guidance Considerations

It is important to take a comprehensive risk management approach that starts with a risk assessment by regular testing of water samples to detect the level of Legionella organisms (colony forming units/mL), specific strains of bacteria, and identifying critical control points in flow diagrams for potential growth, aerosolization and transmission. Since cooling water systems in large air conditioning systems are the primary known source of spread of Legionella, proper testing, maintenance and operation of cooling water systems is essential for prevention of the diseases in the vulnerable occupancies described earlier.

Microbiological controls using many available biocides, individually or in combination is the key to prevention of Legionella colonization and proliferation. Cooling towers, condenser coils, condensate trays and air filters should be inspected and cleaned regularly. Cooling water should be treated with recommended disinfectants, such as chlorine, bromine, or quaternary ammonia compounds.

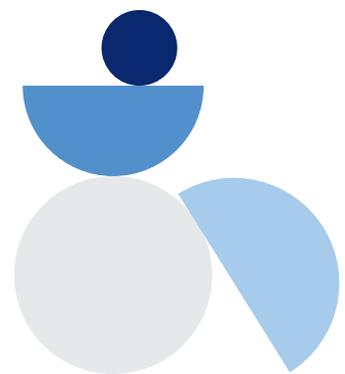
For hot tubs and spas, regular testing for bacteria and proper disinfecting of water and filters are important precautions to take for prevention. The Centers for Disease Control (CDC) is now recommending maintaining 2-4 parts per million of residual chlorine or 4-6 parts per million of bromine and pH levels of 7.2-7.8 for hot tubs and whirlpools.⁴ Although routine testing is not recommended by the CDC for potable waters, water quality should be sampled periodically to check for the presence and growth of Legionella bacteria in irrigation spray waters, decorative water fountains, water falls, or flowing waters. Consideration should be given in the design and installation of water systems to reduce any potential for airborne aerosols. In addition, the cooling water system should be designed to reduce the potential for standing water, and the building air intakes should be located away from cooling towers to reduce the potential for aerosols from drifts entering the ventilation system.

Regular testing of water and use of recommended disinfectants to treat the water is the primary preventive measures recommended by experts. Water systems and filters should be flushed and cleaned periodically. In addition to many common sense mitigation steps, such as elimination of stagnant standing water and controllable sources of nutrients and avoidance of drifts and aerosolization.

Useful resources that provide additional guidance on prevention and mitigation of Legionnaires' Disease are offered by The Cooling Tower Institute² and The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)³.

Conclusion

Since the 1976 outbreak of Legionnaires' Disease in Philadelphia, the awareness of Legionnaires' Disease has increased significantly. The US Centers for Disease Control (CDC), UK Health and Safety Executive (HSE) and organizations like The Cooling Tower Institute and The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASRAE) have created a lot of guidance for prevention and mitigation of this known biological risk of harm. Even if these requirements may not be mandated in all situations and for all occupancies, it is prudent for all companies to take reasonable steps to control this known risk to their employees, visitors, customers and guests. An awareness of potential exposure to Legionnaires' Disease and regular follow up of recommended preventive measures are essential key elements of an effective risk management program for controlling outbreaks and incidents of Legionnaires' Disease to help minimize exposure to potential litigation.



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