

# Emerging Liability Risks: Legionellosis

Risk bulletin

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Legionellosis – a bacterial infection that can cause symptoms ranging from a mild flu to a deadly strain of Legionnaires' disease (LD) – is fast emerging as a serious threat to the public and businesses. This risk bulletin reviews the current understanding of *Legionella* bacteria, legionellosis, possible risk exposures, and the potential impacts of the disease for businesses and the insurance industry. It has been prepared by **Allianz Global Corporate & Specialty** and **Praedicat**, a leading science-based risk analytics company.

## Executive summary

The *Legionella* bacteria is fast emerging as a serious threat to the public and businesses. *Legionella* bacteria, which thrive in warm, moist, freshwater environments, can cause symptoms ranging from a mild flu-like episode to full-blown Legionnaires' disease (LD), a severe pneumonia with an average fatality rate of 5% to 10%. The number of individuals with LD grew by nearly four times between 2000 and 2014.



*Scientists have identified more than 50 Legionella species.*

Scientists have identified more than 50 *Legionella* species, the most commonly studied of which is *Legionella pneumophila* (*L. pneumophila*). The conditions under which these bacteria survive and multiply are subjects of intense study.

US Centers for Disease Control and Prevention (CDC) investigations show that 90% of outbreaks would have been preventable with more efficient water management, presenting an opportunity to reduce the number of future outbreaks. **Hospitals** and other healthcare facilities are

frequently mentioned as sources of *Legionella* exposure, particularly among the elderly and immunocompromised.

**Hotels** also provide several potential exposure pathways in which outbreaks are often found, linked to cooling towers, air conditioners, recreational water facilities, drinking water and fountains. Control relies on real-time diagnosis, identification of the source and implementation of control measures. Studies have shown that the vast majority of outbreaks are preventable, although outbreaks continue to occur, baffling authorities.

The **insurance implications** of legionellosis are such that significant risks of third party bodily injury and property damage exist, with a focus on **public and products liability (PPL)** as well as **environmental impairment liability (EIL)** insurance. There are a number of third party claims scenarios in which claimants could assert that the policyholder (i.e. the insured) is legally responsible for the loss the third party has suffered. For each scenario, insurance solutions exist.

AGCS developed this paper in partnership with **Praedicat**, an InsurTech company that applies science-based analytics to emerging liability risks for insurers and reinsurers.

Working closely with clients and brokers, AGCS aims to better understand how companies mitigate the potential risks associated with *Legionella* in order to provide appropriate insurance solutions that protect businesses and their brand.

AGCS has partnered with Praedicat to identify next generation liability risks through big data.

## Legionellosis explained

*Legionella* bacteria thrive in freshwater environments. Inhalation of certain bacterial subtypes can cause legionellosis, including Legionnaires' disease (LD), a severe pneumonia with an average fatality rate of 5% to 10%. Though outbreaks are rare relative to the frequency of exposure, the number of cases has quadrupled in the past 15 years, most commonly associated with hospitals, cooling towers, and air conditioners, but new settings are frequently identified. The World Health Organization (WHO) estimates that about 20% of the legionellosis cases detected in Europe are [travel-related](#). Most of these cases were associated with hotels or cruise ships. The Centers for Disease Control and Prevention (CDC) estimates that 90% of all outbreaks would be preventable with more efficient water management, presenting an opportunity to reduce the number of future outbreaks. Exposure to *Legionella* is a potential risk to the insurance industry, as this is a global phenomenon that affects the risk profile of a number of businesses.



*Legionella* bacteria thrive in hot, moist, freshwater environments.

Pathogenic species of *Legionella* are linked to outbreaks of legionellosis, a broad type of community-acquired pneumonia. *Legionella* subtype *L. pneumophila* is the leading cause of illness, accounting for up to 92% of clinically recognized legionellosis infections in the US and Europe. Legionellosis is the most common waterborne disease in the US, with an estimated 8,000 to 18,000 persons hospitalized each year. Reported US cases are much lower than the estimate, with only 4,000 reported in 2011. Researchers estimate the number of global cases ranges between 56,000 to 113,000 annually. There are two types of legionellosis: LD and [Pontiac fever](#).

*Legionella* passes through freshwater water systems and into manmade environments, like ventilation and air conditioning units, fountains, hot tubs, and showers. Human exposure via these environments is common, but exposure alone is not sufficient to contract the disease. Additionally, there are many unknown factors that contribute to the risk of an outbreak like climate change and bacterial virulence.

## History of legionellosis

In 1976, the US celebrated its bicentennial. Many people traveled to celebrate in Philadelphia, a city with great historical significance to the founding of the nation. In late July, the American Legion, a wartime veterans' organization, hosted a three-day convention at the Bellvue-Stratford Hotel. A week after the conference, several attendees fell ill. Over the next few weeks, more than two hundred attendees became sick, and 34 of these patients died. Researchers were unable to isolate the source of the disease leading to confusion, public panic, and media speculation.

In the US, around 50% of large building water systems and 10% to 30% of home water systems are exposed to *Legionella*.

In December, researchers isolated the causative pathogen, a bacterium, from guinea pigs (They named it *Legionella* after the American veterans' association whose members represented the first known set of cases). Shortly after isolating the bacteria, researchers found *Legionella* in the air conditioners. They were also able to backtrack previous cases of the disease starting in 1947, including another outbreak at the same hotel in 1974. Through the examination of past outbreaks, the second type of legionellosis was identified, [Pontiac fever](#), which is an acute, shorter-duration, self-limiting, flu-like illness.

The initial panic over LD resulted in unprecedented research attention, which has led to our current understanding of *Legionella* bacteria and its related diseases.

## The bacterium and the disease

*Legionella* are aerobic bacteria that live in freshwater systems, like rivers and streams. *Legionella* bacteria are capable of moving from the natural environment to water distribution systems, including tap water supplies. It is estimated to be present in approximately 50% of large building water systems and 10% to 30% of home water systems in the US. The presence of *Legionella* in a water distribution system is not indicative of poor maintenance; however, it tends to proliferate in engineered habitats that have favorable conditions like warm water temperatures, surfaces for biofilm (groups of cellular microorganisms that stick together and adhere to a surface), and nutrients. Select *Legionella* species have also been identified in potting soil and compost piles.

The conditions under which these bacteria survive and multiply are subjects of intense study. The bacteria thrive in warm water, between 25°C to 37°C, though they can reproduce at temperatures outside this range as well. Survival is somewhat dependent on [biofilms](#). All species have demonstrated the ability to replicate inside freshwater amoebas. These symbiotic relationships might assist distribution and enhance survival in certain environmental conditions, such as excessive heat and chlorine.

Scientists have identified more than 50 *Legionella* species, the most commonly studied of which is *L. pneumophila*.

Inhalation of *Legionella* bacteria, primarily *L. pneumophila*, can lead to the development of LD. Symptoms of the disease include fever, cough, headaches, diarrhea, and delirium. *Legionella* is rare in children, but strikes older men with considerable frequency. Infections are also more likely to occur among people who are immunocompromised. The number of individuals with LD grew by nearly four times between 2000 and 2014.

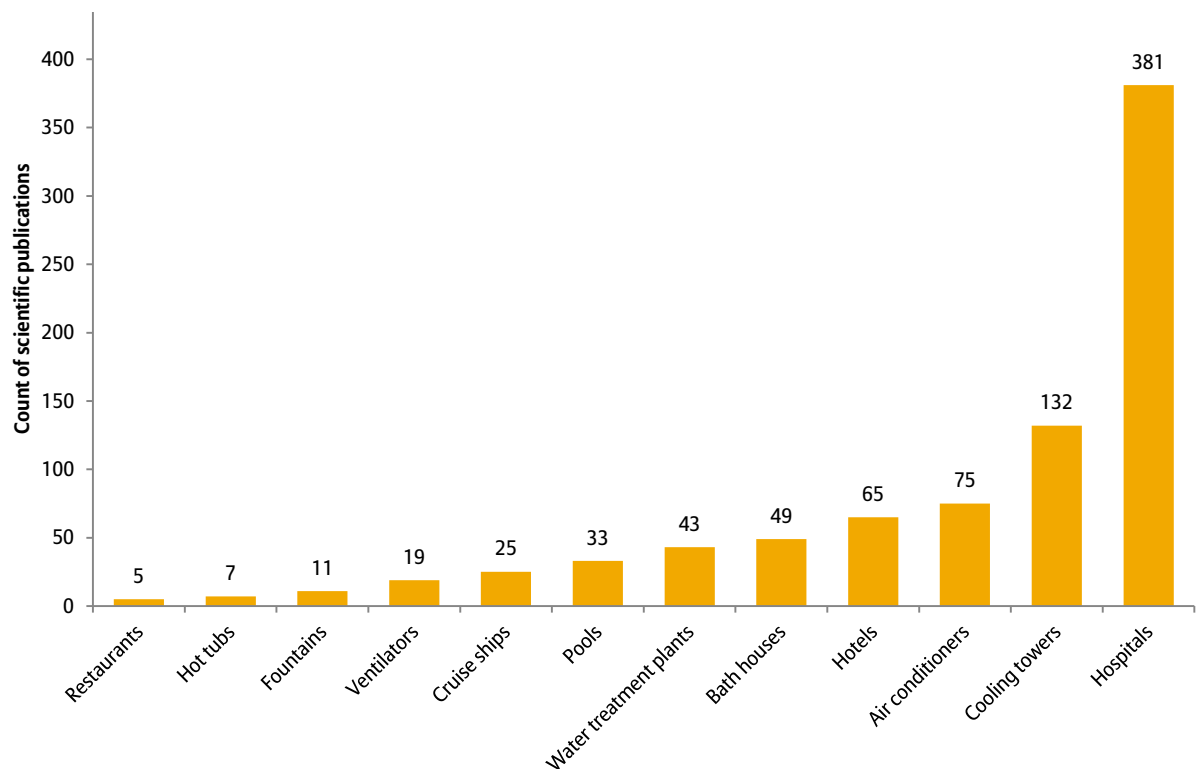
## Exposure Settings

After the Bellvue-Stratford Hotel's air conditioners had been implicated in spreading LD, researchers began to look at other exposure settings. Examining the number of scientific publications that mention an exposure setting is a proxy for scientific interest in an established or emerging exposure setting. The table below summarizes the number of scientific publications that mention various settings, areas, and devices related to *Legionella* exposure. This report focuses on the areas where outbreaks are most likely to occur and the devices that increase the risk of exposure.

## Hospitals and Hotels

Hospitals and other healthcare facilities are frequently mentioned as sources of *Legionella* exposure, particularly among the elderly and immunocompromised. This type of infection is considered hospital-acquired, or nosocomial. The first known hospital-based *Legionella* infection was identified via back-testing samples from a 1965 respiratory outbreak in Washington DC. The results, tested in 1977, identified the illness as LD. The outbreak had a mortality rate of 17% and underscored the dangers associated with an outbreak in an [immunocompromised population](#).

## Exposure settings



Source: Praedicat

The number of scientific publications listed by the National Library of Medicine that mention worldwide areas of potential *Legionella* exposure or devices that spread the disease

Studies examining hospital water distribution systems in the UK, US, Poland, and Canada, found *Legionella* in 12% to 75% of samples.

Once in the hospital, *Legionella* can transfer via many different pathways, resulting in exposure and outbreaks. Examples include cold mist humidifiers, towel steamers and decorative indoor fountains. There is also evidence linking legionellosis to respiratory devices, such as medication nebulizers and ventilators. This exposure pathway is particularly concerning because patients are directly breathing potentially high concentrations of bacteria and are often already immunocompromised.

Hotels also provide several potential exposure pathways. Outbreaks associated with hotels are often found linked to cooling towers, air conditioners, recreational water facilities, drinking water and fountains, as isolated exposure sources.

According to the CDC, with proper mitigation 90% of *Legionella* outbreaks are preventable.

The exposure pathways in both settings demonstrate the need to maintain a water distribution system that minimizes transmission, yet sometimes that is not enough. In 2011, the first cases of a legionellosis outbreak were identified in a hotel in Spain. During this epidemic, several control measures were adopted focusing on disinfecting the water system; however, these efforts were unsuccessful at containing the outbreak. Even after 30 weeks, cases were still emerging, including six that resulted in fatalities. The hotel was closed and dismantled. It was opened later with a new spa and air-conditioning ducts and no new cases have since been reported.

### Air Conditioners and Cooling Towers

Cooling towers and air conditioners are used to remove excess heat from buildings by spraying water down through the tower to exchange heat from the inside of the building. They are used in large office buildings, schools, hospitals and other industrial buildings. Air-conditioning units are also used in these settings, as well as private residences and smaller commercial spaces. Both have been linked to outbreaks of legionellosis, including the outbreak leading to its 1976 discovery. Additionally, scientific evidence has demonstrated that residential

proximity to industrial cooling towers can also increase the risk of community-acquired infections. One study demonstrated that aerosols emitted from cooling towers could disperse the infectious agent at least 6 km from the tower.

### Emerging Exposure Settings

*Legionella* is naturally found in most water systems, and aerosolization of water droplets can result in exposure. Multiple studies have demonstrated that people can contract LD from various human-made aquatic environments, including water treatment plants, hospitals, restaurants, bathhouses, and wastewater facilities (see page 3). However, several studies have highlighted new and emerging areas as well as new devices that hold potential risk. Recent case studies have identified garden hoses, dental unit waterlines, household water heaters and shower heads as possible sources of *Legionella* outbreaks.

There is also concern about the contraction of LD from *Legionella* species that reside in soil, like *L. longbeachae*. Beyond *L. pneumophila*, there are multiple strains linked to fatal cases of LD, including *L. jamestowniensis* and *L. bozemanii*. Because elimination of the bacteria is impossible, steps must be taken to understand the conditions under which the bacteria can multiply and cause disease, as well as the treatments and measures that can be taken to minimize *Legionella* overgrowth.



Cooling towers are leading exposure settings and have been linked to *Legionella* outbreaks.

## Prevention and treatment

Control of LD outbreaks relies on a quick diagnosis, supporting epidemiological data, and identification of the source and implementation of control measures. Preventing outbreaks means careful management of human-made water systems. Treatment solutions include [maintenance of constant high temperatures](#), [use of filters](#) and [application of chemical treatments](#). A recent risk assessment found systems in which water temperature coming out of the water heaters kept consistently above 60°C and maintained above 55°C across the network were negative for *Legionella*. In larger municipal systems, [monochloramine](#), a combination of chlorine and ammonia which is widely used as a drinking water disinfectant, has been used successfully to prevent legionellosis and may be useful in hospital settings. Additional evidence suggests that filters, copper-silver ionization and ultraviolet light are effective in reducing *Legionella* in hospital-based environmental samples.

## Complications to containing legionellosis

With nearly four decades of research, the global increase in outbreaks has left public health professionals concerned. Researchers at Public Health England have determined that, despite the clinical consequences of LD, little progress has been made in the past 30 years to appropriately define the burden of disease, the factors that affect susceptibility, key sources of infection and differences in the virulence of strains.

Two factors are likely to blame for the continued rise:

- *Legionella* bacteria have a [complicated life cycle](#) that increases their resistance and persistence, even in harsh environments
- The actual incidence of legionellosis is unknown because of [underdiagnoses and lack of understanding](#). These issues stifle both the professional medical community and proactive efforts to prevent disease spread.

First, *Legionella* bacteria have a complex lifecycle that includes symbiotic relationships with amoebas and with other bacteria in biofilms. *Legionella* can replicate within amoebas, where they are naturally protected from adverse conditions and biocides. In water distribution systems, *Legionella* growth is nearly always detected in association with biofilms. Biofilms help to protect the bacterium and increase its survival. Its relationship with biofilms also increases its resistance to biocides. The complexities continue with human exposure. After inhalation, *L. pneumophila*, the most common strain linked to LD, can resist phagocytosis, or the uptake of foreign particles by immune cells, in the lung. This resistance allows the

bacteria to avoid certain immune system defenses. If the bacterium is taken up by a macrophage, a type of white blood cell that would normally kill a bacterium, *Legionella* is capable of reproducing inside the host cell (much like its ability to multiply within an amoeba). Replication leads to tissue damage, inflammation and eventually the symptoms of LD. Increased understanding of the lifecycle will help researchers determine how best to combat outbreaks.

Second, the actual incidence of legionellosis is unknown. Several European studies suggest that 2% to 5% of cases of community-acquired pneumonia are actually LD, an amount that is about 10 times higher than in reports received through national surveillance systems.

Worldwide, researchers estimate the number of cases ranges between 56,000 to 113,000 annually.

There are several factors contributing to this underestimate:

- Pontiac fever is an acute, shorter-duration, flu-like illness with a high attack rate. Currently, it accounts for less than 1% of *Legionella* infections reported in the US. However, most cases are likely unreported due to a lack of clinician knowledge and its similarity to other common, better-understood conditions.
- *Legionella* is a reportable disease in the US and Europe, so all lab-confirmed cases of legionellosis should be reported to state or national health departments; however, reporting is not mandatory worldwide. In its 2007 report on legionellosis prevention, the WHO reported that data from developing countries is scarce. The first report of an LD outbreak in a resort in Mexico was published in 2010. Upon closer investigation, researchers identified nine cases of LD in this outbreak, starting in early 2008, but they believe this total is likely an underestimate because the infected population is highly mobile and LD is not a reportable disease in Mexico.

All countries should promote effective LD prevention and surveillance measures and should be prepared to cooperate in detecting and responding to LD outbreaks. Underestimates likely minimize the general public's understanding of the disease and its potential risk to health.



## Insurance implications

The industries mentioned previously are likely to have already identified the potential risk of *Legionella* as part of their enterprise risk management (ERM) and considered how to finance its mitigation. Risk transfer to insurance companies has been the model of choice since the early days. There are also significant risks of bodily injury to third parties, staff, third party property and the business's property, such as contamination of structures and possible diminution in values.

The question becomes how the insurance industry can support businesses as part of their ERM with a focus on [public and products liability \(PPL\) insurance](#) as well as [environmental impairment liability \(EIL\) insurance](#).

PPL and EIL insurance respond in two ways: They pay for the defense in case there is a covered claim for which the insured is not liable, or they indemnify the insured up to the agreed policy limit based on the scope of insurance coverage. An insurer's claims service also helps in negotiating an appropriate amount of indemnity with the claimant. There are many ways in which the liability of the business could be established such as breach of the duty of care.

In the context of *Legionella* exposure and the PPL policy, there are a number of possible scenarios which could lead to third party claims asserting that the policyholder (i.e. the insured) is legally responsible for the loss the third party has suffered.

### Insurance examples of *Legionella* exposures

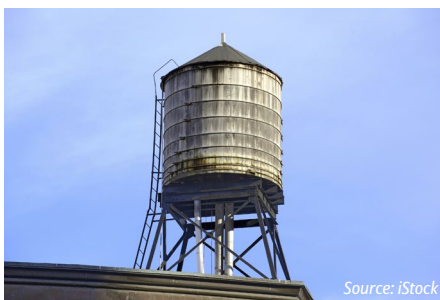
Three examples:



1. Several hotel guests suffer from LD due to a defect in the air conditioning system. The source of the defect is poor maintenance of the water distribution system, so a court finds the hotel operators legally liable. The hotel operator may be confronted with claims for costs of medical treatment and other damages. The hotel turns to its liability insurer and seeks coverage under the [Public Liability](#) policy.



2. A water utility company operates a water treatment facility. Due to an oversight by one of the technicians, the water gets contaminated with *Legionella* and numerous people with pre-existing health conditions become ill or die. In this scenario, the operator of the water utility company seeks compensation in excess of \$10m depending on the number of people effected from its [Products Liability](#) policy.



3. In 2015, multiple incidents of LD broke out in New York City. In total, 130 people were infected with LD. One of the incidents was tied to a co-op's cooling towers. Another incident was traced back to a large swath of properties, including a hospital and a hotel. The damages sustained included third party bodily injury and decontamination of buildings and structures, which could be addressed by an [EIL](#) policy.

Unfortunately, the scenarios above have actually happened. To help prevent incidents like these, an underwriter should ensure that a business that could be indemnified in a *Legionella*-related suit is complying with industry standards.

## Regulatory response

A prominent revision of industry standards in the US occurred in 2015 when the [American Society of Heating, Refrigerating, and Air-Conditioning Engineers \(ASHRAE\)](#) published a new standard, with the hope of preventing legionellosis, which applies to human-occupied buildings, excluding single-family residences, and defines the minimum risk management practices for the design, construction, commissioning, operation, maintenance, repair, replacement and expansion of new and existing building systems.

A core aspect of the standard identifies the development of a site-specific management plan for the control of legionellosis in a building. It includes a description of the building's water systems, analysis of risk of the water systems, applicable control measures, verification procedures, validation and documentation. Since every building is different, the plan should be customized to address specific building-related issues. However, the standard leaves the development of specific control strategies to the building's management team.

Although the ASHRAE standard is not enforceable like an [Occupational Safety & Health Administration \(OSHA\)](#) regulation, several states drafted model rules for management of water systems. The ASHRAE benchmark establishes an enforceable standard of care essential to a defense in *Legionella* claims. It helps to outline what steps should be taken to protect employees and building occupants and provides a level of protection when the management plans are implemented. [Chapter 7 of the OSHA Technical Manual](#) specifically addresses controlling legionellosis by identifying the source of potential contamination, implementing controls and raising awareness of staff. The [General Duty Clause of the OSHA regulation](#) requires that employers protect their employees and visitors from known hazards.

In 2013, UK health and safety legislation was also adapted to confront the risk of *Legionella* by the national regulator for work-related health and safety, the [Health and Safety Executive \(HSE\)](#), via an update of the "[Approved Code of Practice, Legionnaires' Disease and the Control of Legionella Bacteria in Water Systems](#)". With the new code in practice, the requirements for appropriate risk assessment and preventive action with respect to water systems now also extends to all businesses providing residential accommodation. The findings of the assessment are kept for 60 months and reviewed every 18 months.

*Legionella* maintenance solutions can include constant high water temperatures, use of filters and chemical treatments.

## Legionellosis mitigation

*Legionella* is a global risk and could have a significant impact on the financials of businesses if not managed well. Businesses can prevent outbreaks with careful management of human-made water systems. Treatment solutions can include maintenance of constant high temperatures, use of filter and chemical treatments. Any business with an exposure of *Legionella* bacteria seeking to manage its third party liability exposure should explore if the risk management standards are appropriate and state of the art.

The [PPL](#) and [EIL](#) solutions that AGCS offers are tailor-made to reflect the individual situation of the business seeking to transfer the risk. Within [Allianz Risk Consulting \(ARC\)](#) there is a team of over 30 dedicated risk professionals focused on liability exposures. AGCS also works with top industry experts such as [Hydro-Environmental Technologies Inc. \(HETI\)](#) and as part of its insurance solutions can assist in assessing a facility's risk of *Legionella* exposure, developing site-specific management plans, conducting risk characterization assessments and developing controls or measures to reduce the risk of legionellosis.

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## Further information



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Allianz Global Corporate & Specialty (AGCS) is the Allianz Group's dedicated carrier for corporate and specialty insurance business. AGCS provides insurance and risk consultancy across the whole spectrum of specialty, alternative risk transfer and corporate business: Marine, Aviation (incl. Space), Energy, Engineering, Entertainment, Financial Lines (incl. D&O), Liability, Mid-Corporate, Allianz Risk Transfer (ART), and Property insurance (incl. International Insurance Programs).

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