



RISK BULLETIN

Legionella and Risk Management

INTRODUCTION

Legionella is a naturally occurring organism named for its identification with Legionnaires' Disease, (Legionellosis), the lung infection and form of pneumonia that caused 34 deaths at a 1976 American Legion Convention in Philadelphia. It has been estimated that 50 to 70

percent of large buildings are colonized to some extent with *Legionella*. Serious illness may result when the bacteria grow, or amplify, in water systems. *Legionella* bacteria are one of the top three causes of non-epidemic, community-acquired pneumonia, and are cited as the indoor building contaminant bacteria most likely to result in mortality.



Healthy non-smokers rarely contract Legionnaires' Disease, which occurs in approximately 5 percent or less of people who are exposed. However, the fatality rate is higher compared to other forms of pneumonia: approximately 15 percent in community-acquired cases, and 40 percent in healthcare settings. In the United States, approximately 12,000 to 30,000 community-acquired (non-healthcare) cases of pneumonia are caused by *Legionella* each year. An additional 25,000 cases are estimated to occur within healthcare facilities. Water systems that are not properly maintained to

control *Legionella* bacteria have the potential to result in bodily injury and property damage claims and legal defense expenses for building owners and property managers. Responding to an outbreak is considerably more costly than being proactive. Reports of the initial costs to respond to an outbreak of Legionnaires' Disease range between \$500,000 to \$1 million within the first 30 days of the initial response. A *Legionella*-free water source is not likely feasible; therefore, implementing a proactive program that strives to maintain a *Legionella* concentration and incidence as low as reasonably achievable is essential.

EXPOSURE SOURCES

Illness is often associated with cooling towers and potable water systems. Legionnaires' disease has been linked to exposure to contaminated water supplies in residences, commercial office buildings, rehabilitation centers, nursing homes and industrial water supplies. The source of the bacteria in a domestic hot water system is commonly the city water supply, with the bacteria present at low, usually undetectable concentrations. *Legionella* may survive the water treatment process due to relative resistance to low levels of chlorine. In the building water systems, the bacteria may grow in concentration and spread to increase the risk of exposure.

Improper operation and maintenance of water disseminating devices or systems increases their

potential to harbor, amplify and transmit *Legionella*. Water systems associated with Legionnaire's Disease include:

- Domestic hot water distribution systems: the *primary source* of infections that develop in healthcare settings and a significant source for other sporadic cases
- Cooling towers and evaporative condensers (swamp coolers)
- Spas and whirlpools (on display or otherwise in use)
- Humidifiers
- Supermarket reservoir misters
- Respiratory therapy equipment
- Water fountains
- Hot springs (artificial waterfalls)
- Dental hygiene equipment
- Cold water systems (ice machines, storage tanks)
- Fire suppression systems

Legionella may also be spread through an HVAC system that is not properly treated and well-maintained. For this to occur, water contaminated with the bacteria must enter the system, through a humidifier, poorly placed air intake unit, or other pathway.

TRANSMISSION

Current data suggests that the risk of disease is influenced not by the quantity of *Legionella* present in one given (sample) location, but rather the extent of contamination – the *number and percentage of sites* testing positive in a building. An individual may be exposed by inhaling aerosols, fine sprays, mists or other microscopic droplets of water contaminated with *Legionella*. Exposure may also occur when choking spontaneously during drinking, ingesting, and swallowing (aspiration), which is a greater risk in a health care setting. Legionnaires' Disease is not known to pass from person to person.

BUILDING SYSTEMS AND EQUIPMENT RISK FACTORS

Understanding the causes and likelihood of growth throughout a building system is necessary to reduce the risk of disease. Data from hospital-based studies indicate that when *Legionella* contamination was detected in more than 30 percent of all the sites sampled, cases of disease were often identified. The major factors that contribute to *Legionella*'s growth and amplification include:

- 1 Stagnant water conditions and/or systems design configurations that produce stagnation, such as side-arm and dead leg piping.
- 2 Warm water temperatures from 68 to 122°F (optimal growth at 95 to 113°F)
- 3 Bulk water pH in the range of 5.0 to 8.5
- 4 Sediment, scale, deposits, and biofilm, which also support growth of very important supporting microbiota (including algae and many bacteria) that supply essential nutrients for *Legionella*
- 5 The presence of certain amoebae and other protozoa that harbor *Legionella* as endosymbionts – allowing *Legionella* to thrive and amplify by resisting biocides.

Because they typically operate at 85-95° F, cooling towers provide habitat for *Legionella*, and therefore should be located more than 25 feet from air intakes or windows of adjacent buildings. Installing drift eliminators on cooling towers can reduce potential dissemination of *Legionella*. Biocide dosing systems in water systems have also proven effective. Generally it is understood that the risk is a function of a particular building or water system feature, weighted by the type of population exposed to the risk.



WATER TESTING AND SAMPLING

There is consensus that in buildings with a highly susceptible population (e.g., health care), routine testing of hot water systems is advisable; it is recommended for cooling towers, hot tubs and water distribution systems especially where people at high risk might be exposed. Routine testing in the absence of disease remains controversial (as to utility) for other settings. An extensive sampling program is probably not called for outside the health care environment. For commercial properties, concentrating on the hot water heater drain point and distal (discharge) points may be more appropriate and feasible.

Experience is required to interpret results and determine what actions to take in the case of a positive result. The presence of *Legionella* within a water system does not necessarily require immediate action if the percentage of sites positive is low. A qualified consultant experienced in *Legionella* water system sampling and laboratory analysis interpretation should be retained.

GUIDELINES AND ACTION LEVELS

There is no federal *standard* pertaining to *Legionella* concentrations in water systems or for verification, assessment and auditing of these systems for *Legionella*. However, in February of 2008, the Veterans Health Administration (VHA) issued Directive 2008-010 to provide for annual evaluation of its inpatient facilities for *Legionella* risk. This document appears to be consistent with recent data indicating that percentage of positive test sites is a significant indicator of risk. This presents a departure from earlier, unverified, guidance that focused solely on the concentration in a given sample (e.g., as promulgated by the U.S. Department of Occupational Safety and Health Administration), and is the first such well-established national guidance to gain prominence on the subject. As such it may represent emerging federal guidance.



The VHA Directive indicates that a threshold percentage of sites testing positive should trigger certain response actions. Definition of the threshold is left to the specific facility, but recommended to be 30 percent (positive results). The directive offers an alternative in the annual screening of the facility's healthcare-acquired pneumonia patients for *Legionella*. Clearly, this latter approach would be less practical in a non-healthcare setting.

PREVENTIVE MEASURES AND MAINTENANCE

Risk management strategies for *Legionella* should incorporate a multi-level approach aimed at controlling the growth, survival and dissemination of the bacteria. Incorporating this type of redundancy will maintain a safe environment if one preventive measure is ineffective. Specific elements include:

- Managerial responsibilities and reporting requirements
- System assessment of buildings and devices that are potential sources of *Legionella*. This assessment should consider the susceptibility of those who may be exposed.
- Control measures to prevent the growth, survival and dissemination of *Legionella*
- Construction/renovation controls to ensure that

system modifications or new installations do not create pipework with intermittent or no water flow

- Operational monitoring to ensure that control measures/equipment are functioning properly whenever devices are in use
- Verification procedures and mechanisms for surveillance and audit of risk management plans
- Proper training on the above elements for responsible individuals

The risk of Legionnaires' Disease may be reduced by implementing a **Waterborne Pathogens Control Program**, which may include operational controls that address the temperature to be maintained for circulating water systems; disinfection for cooling towers and HVAC pipes; water system disinfection methods and frequency; and maintenance for water filters and water tanks. Additional controls for whirlpool spas and similar features may include water replacement intervals, and special controls for disinfection and filtration.

Detection of *Legionella* should trigger a review of risk management procedures. Written procedures for decontamination of devices should be available to deal with an outbreak of illness or for other conditions that have been specified as constituting a substantial risk.

Creation of a Waterborne Pathogens Control Program is an effective tool for increasing building owner and property manager awareness of *Legionella* risks and appropriate controls. The elements of the plan can be used to create a training program for staff responsible for building water systems and maintenance. Effective implementation of a water safety plan and periodic review of controls will establish a standard of care and should help reduce potential liabilities and claims costs.

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