

Legionella: hazards in the mist

Legionnaires' disease, long thought to be a disease of the seventies, has surfaced once again — in an auto plant. Two workers died. Both were men, ages 53 and 61.

Four confirmed cases of Legionnaire's disease occurred at a Ford Motor plant just outside of Cleveland, Ohio. The 2,500-employee casting plant was shut down for approximately one week while the U.S. Centers for Disease Control (CDC) conducted an investigation and disinfected mechanical systems.

The plant, which makes cast iron parts for engines manufactured in North America, was closed after the third case of Legionnaire's disease was confirmed. Authorities investigated 10 cases of pneumonia among workers at the Brook Park complex, focusing on a cooling tower after two subcontractors who were working on the tower both contracted pneumonia.

One of two workers who died, worked near the tower. For this reason, authorities believed the tower may have been the source of the bacteria. The area was clouded in mist rising from a large tank. The tank provided steam for the 48 year-old plant's heating system. Once health officials analyzed water samples taken from the tank, it was disinfected. It's estimated that several people were exposed to the bacteria while working in and around the cooling tower, which had been shut down for maintenance.

What risk does Legionella pose?

In 1981, a large number of employees working in Ford's Windsor, Ontario engine plant #2 reported similar symptoms of headaches, fevers, muscular aches and nausea. The work area was eventually shutdown. After a 10-month investigation the CDC determined that another strain of Legionella known as *Pontiac fever* had caused the illness. Over 317 workers were affected. Although not fatal, this strain affects a large majority of people who come into contact with it. The route of entry is inhalation of airborne mists.

Recently, another plant in Windsor, Ontario found what they considered unacceptable levels of the Legionella bacteria (under 200 colony forming units [CFU] per ml. of water) in the tooling water system after a routine test. The standard level considered safe by many authorities is fewer than 1,000 CFUs. Employees were notified and the system was treated. This time, no one was affected as proper precautions were in place.

Legionnaire's disease, a form of bacterial pneumonia, was first recognized in an outbreak at a convention of the American Legion in Philadelphia in 1976. Some 221 people attending the convention became ill. Thirty-four of those people died.

Outbreaks of Legionnaire's disease have been associated predominantly with the inhalation of contaminated aerosols from cooling towers, hot water systems including showers and whirlpool spas. People can be exposed to these aerosols in the home, workplaces, hospitals, public places and office buildings.

The Centers for Disease Control and Prevention (CDC) in the U.S. estimate there are about 18,000 cases of Legionnaire's a year but the numbers may be higher as many are reported as pneumonia or flu of undetermined origin. While it is impossible to eliminate all *Legionella* bacteria from their natural environments, Legionellosis can be prevented through routine testing and regular maintenance of man-made aquatic systems.

What is Legionnaires' disease?

Legionellosis is an infection caused by the bacterium *Legionella pneumophila*. The disease has two distinct forms. The most serious form is a pneumonia illness that is commonly referred to as **Legionnaires' disease**. The other form, **Pontiac fever**, is a milder flu-like illness.

Legionnaires' disease acquired its name in 1976 when an outbreak of pneumonia at an American Legion convention in Philadelphia claimed the lives of 34 'legionnaires'. *Legionella pneumophila* is one of 39 species of bacteria within the group *Legionella*. To date around half of these species have been associated with infection in humans.

Outbreaks of Legionnaires' disease receive significant media attention. However, this disease usually occurs as a single, isolated case not associated with any recognized outbreak. When cases do occur, they happen year-round although most incidences take place in the summer and early fall.

The proportion of people exposed to *Legionella* who contract Legionnaires' disease is five per cent or less. However, fatality rates in outbreaks have averaged about 15 to 30 per cent. Risk factors such as age, smoking, underlying disease, and compromised immunity play a major role in susceptibility.

What are the symptoms?

Patients with Legionnaires' disease usually report the following:

- high fever;
- chills;
- cough;
- muscle aches;
- headache;
- tiredness;
- loss of appetite; and
- diarrhea (occasionally).

Those suffering from Pontiac fever experience fever, chills, headache and muscle aches but do not have pneumonia. They generally recover in two to five days without treatment.

It is difficult to distinguish Legionnaires' disease from other types of pneumonia by symptoms alone. The diagnosis of Legionellosis requires special tests not routinely performed on those with fever or pneumonia. It is only after a physician suspects the possibility of Legionellosis that these special tests are performed.

People of any age may get Legionnaires' disease, but the illness most often affects middle-aged and older persons, particularly those who smoke cigarettes or have chronic lung disease. Also at increased risk are persons whose immune system is suppressed by illness. Those that take drugs that suppress the immune system are also at higher risk.

Pontiac fever most commonly occurs in people who are otherwise healthy.

The time between the person's exposure to the bacterium and the onset of illness for Legionnaires' disease is two to 10 days. For Pontiac fever, it is shorter, generally a few hours to two days.



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Where is it found?

Legionella bacteria are commonly found in water. They are natural inhabitants of ponds, streams, lakes, rivers, soil, mud and underground water. *Legionella* can also accumulate in many types of man-made water systems such as plumbing systems, hot water tanks, cooling towers, evaporative condensers of large air-conditioning systems and whirlpool spas.

Factors known to enhance growth of legionellae in man-made water environments include the following:

- a wet warm environment (range 20-45°C) especially at 35-37°C;
- stagnation or low water turnover;
- high microbial concentration including algae, amoebae, slime and other bacteria;
- biofilm, scale, sediment, sludge, corrosion products (zinc, potassium, iron) or organic matter; and
- some materials such as natural rubber fittings (may be a nutrient source).

Cases of Legionellosis have been identified throughout North America and in several other countries. In Australia it is a reportable illness. There is also a section of Australia's *Occupational Safety and Health Regulations 1996*, requiring the employer to submit a report when a worker contracts Legionnaires' disease.

How is it transmitted?

Legionella bacteria are usually transmitted through inhalation of aerosol mists of contaminated water, which transports the bacteria into the lungs. Drinking water and washing in water containing low numbers of *Legionella* is not known to result in infection. However, there has been evidence of transmission from ingesting the bacteria, which is rare. It is not spread from person to person.

In several hospital outbreaks, patients have been infected through exposure to contaminated mists generated by cooling towers, showers, faucets, and respiratory therapy equipment and room-air humidifiers. There has also been evidence of infection caused by exposure to mists from the following:

- cooling systems used in industrial processes like plastic injection molding;
- decorative fountains;
- fire sprinkler systems;
- supermarket vegetable misting machines;
- emergency eye washers and safety showers;
- machine shop cutting fluid systems; and
- parts washers.

A person's risk of acquiring Legionellosis following exposure to contaminated water depends on a number of factors, including:

- type and intensity of exposure;
- size of the aerosol particles (must be less than 10 microns [micrometres] to be inhaled into the lungs); and

- concentration of *Legionella* (Sufficient amounts of bacteria must be present in the aerosol to cause infection. The amount varies from person to person).

Maintenance workers and others working close to or handling cooling water systems are at highest risk of inhaling infective aerosols. Maintenance activities should only be carried out by trained, competent persons. They should be equipped with appropriate personal protective equipment, such as a half-face respirator mask equipped with HEPA or "Type H" filters. And they should also wear rubber gloves, goggles and protective clothing to prevent injury to their skin, eyes and lungs.

What control strategies can be used?

To prevent an outbreak of Legionnaires' disease, it is necessary to reduce or eliminate exposure to *Legionella*. Since total eradication of *Legionella* is not possible, an acceptable control strategy according to the Occupational Safety and Health Administration (OSHA), a U.S. government organization, is to minimize the number of organisms present in a water source as well as minimizing the production and release of aerosols containing these organisms. This is accomplished by eliminating the conditions that allow bacteria to thrive.

Analysis of water samples taken from areas suspected of being contaminated with *Legionella* is a valuable means of identifying potential sources. This alone will not prevent an outbreak of Legionnaires' disease. It takes seven to 10 days to obtain results from a qualified laboratory, while it takes as few as two days to develop the disease.

To reduce contamination of systems such as cooling water systems, hot and cold water supply systems and spa pools, attention must be paid to equipment design, installation, operation and maintenance. Guidelines prepared by OSHA and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) propose regularly cleaning cooling towers and evaporative condensers to prevent the growth of *Legionella*.

They also recommend the following:

- twice yearly cleaning and periodic use of chlorine or other biocides;
- completely draining systems that are not in operation for three or more days;
- treating systems with biocides or sodium hypochlorite before starting them up (fans should be turned on only after treatment);
- keeping detailed operation and maintenance records;
- maintaining domestic water heaters at 60°C. (the temperature of the water coming out of the faucet should be 50°C or higher);

- raising the temperature in hot water systems that need to be decontaminated, to 71-77°C and flush for at least five minutes from all taps;
- segregating or insulating cold water systems to avoid temperatures above 20°C;
- avoiding exposure of large water storage tanks to sunlight, which can cause stagnant water;
- flushing unused water lines and draining or eliminating unused plumbing sections;
- draining and regularly cleaning sumps and pans from heating, ventilation and air conditioning (HVAC) systems;
- cleaning showerheads and aerators;
- cleaning rubber hoses with spray attachments with chlorine bleach solution; and
- flushing safety showers and eyewash stations monthly.

An effective control program is one that emphasizes worker education, as well as routine monitoring and regular maintenance to ensure equipment is kept both clean and in excellent repair.

NOTE: The Workers Health & Safety Centre have developed a number of training programs on biological hazards. For more information contact a regional office near you.



RESOURCE LINES

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