LEGIONNAIRES' DISEASE

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by

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LEGIONNAIRES' DISEASE

History

Since 1979 the term "Legionnaires' Disease" has become synonymous with a serious and sometimes fatal respiratory illness characterized by fever, coughing, and pneumonia. It received its name as a result of an initial outbreak of pneumonia-like illness at the American Legionnaires' Convention at the Bellevue-Stratford Hotel in Philadelphia Pennsylvania where in July of 1976 of the 4,400 persons at that convention, 182 fell ill and 29 died. The disease was subsequently named Legionella Pneumophilia

An epidemic illness in Pontiac Michigan in July 1968 was caused by the same agent that caused the Legionnaires' Disease. Because the effects of the bacterium in the Pontiac cases produced a flu-like illness that was self-limiting in 3 to 4 days and not pneumonia, it was concluded that the disease caused by Legionella Pneumophilia bacteria could take two forms--Pontiac Fever and Legionnaires' Disease, the former being a less virulent version of the latter.

The first case of Legionnaires' Disease is thought to be in 1947, although other cases in the early 40's may also may have been linked to this disease, but escaped detection due to lack of analytical procedures at the time. Also, isolation of the organism is difficult because it is fastidious and slow to grow, so that if other organisms are present in the specimen that is cultured they will probably outgrow the legionella.

Therefore, contrary to impressions created by the press, Legionnaires' Disease is an old disease with a new name. It was simply one more unidentified killer until 29 people died from it at once in 1976. Actually, it is thought that Legionella Pneumophilia affects an estimated 25,000 people a year in the U.S. and 2,500 a year in Canada, but most of these patients are only suspected and not confirmed.

Characteristics

The Legionella Disease Bacterium are rod shaped with a diameter of 1 micron and a length of 2 to 4 microns (1 micron = 0.001 millimeters). Normally it has an incubation period of 7 to 10 days, although it could also be as low as 2 or 3 days.

The symptoms of Legionnaires' Disease include a cough, chills or fever, diarrhea, shortness of breath, chest pain, headache, sweats, nausea, vomiting, and muscle pain. Two forms of the disease may exist, a mild form referred to as "Pontiac Fever" (so called because it struck in Pontiac Michigan) when the victim has fever, aches, and other moderate symptoms, or the more severe pneumonia form when infection has settled into the lungs and in some cases the nervous system has been affected. The two forms of the disease seem to be independent of the dose of organism contracted.

As far as lasting effects are concerned, some patients with widespread pneumonia may be left with impairments such as bronchitis emphysema. Two years after the Philadelphia epidemic, 58% of the surviving victims complained of such lasting effects as easy fatigability, shortness of breath, and memory loss.

Since a large percentage of the cases which have been diagnosed have been associated with outbreaks, the disease has epidemic potential. However, there have also been sporatic cases reported.

Although the minimum number of bacteria which are necessary to cause the disease symptoms to appear in a human and the exact route of infection in humans have not been established, the risk factors which apply to both sporatic and outbreak cases include male sex, advanced age, cigarette smoking, alcohol consumption.

There is some disease activity year round , but most cases have been diagnosed in the late summer and early fall.

Although there is a lack of firm evidence to support person-to-person spread, data suggests a subclinical transmission (ie., slightly abnormal and not detectable with the usual clinical tests) to hospital personnel working with afflicted patients. However, according to follow-up testing, nearly 54% of the non-afflicted Legionnaires who attended the Philadelphia convention in 1976 may have had a subclinical form of the disease.

As far as treatment of the disease itself is concerned, early treatment with a drug called erythromycin at a Legionnaires' Disease outbreak at Wadsworth reduced the fatality rate from 55% for patients who did not receive the drug to 13% for patients who did receive the drug.

Origin

Legionella pneumophilia bacteria may be every where in the environment. It has been isolated in streams, ponds, mud at excavation sites, cooling towers, air conditioning systems (ie., humidifiers) and potable water systems (see Figs. 1, 2 & 3 overleaf)

However, in none of the outbreaks of Legionnaires' Disease to date has the source of the bacterium been determined--only its location at the time of sampling--although there is a strong suspicion that contaminated natural water or soil may be the origin and that transmission occurs through an airborne mechanism. Since cooling towers and evaporative condensers are effective air scrubbers they are also effective carriers of the disease.

For instance, in May of 1980 the possibility of a one-on-one correspondence between the occurrence of Legionnaires' Disease and direct exposure to cooling towers was significantly heightened by a series of outbreaks in a Burlington Vermont hospital where during that month 22 cases of Legionnaires' Disease was diagnosed and 6 of these resulted in death. A cooling tower just upwind of the hospital was found to be contaminated with Legionella Pneumophilia bacteria. After the outbreak, the cooling tower was treated with chlorine and there was only one incidence at the hospital during June of 1980. Chlorination was discontinued late in June and in July of 1980 another epidemic broke out in the same location involving 34 additional cases and 8 additional deaths. The June chlorination had been done on a periodic basis only, but after the latter outbreak the cooling tower was put on continuous chlorination. There were no more reoccurrences of the disease. It is interesting to note that one of the first cases at the hospital was a maintenance service worker whose work responsibilities had put him on and around the cooling tower.

The presence of Legionnaires' Disease bacteria in environmental sites does not equal human disease--cooling towers are colonized with high frequency but epidemics have been infrequent--cooling towers that were associated with an epidemic on at least one occasion were innocuous at other times when bacteria were also present--cultures have been negative even when clinical cases were occurring--no one has been able to estimate the infectious inoculum.

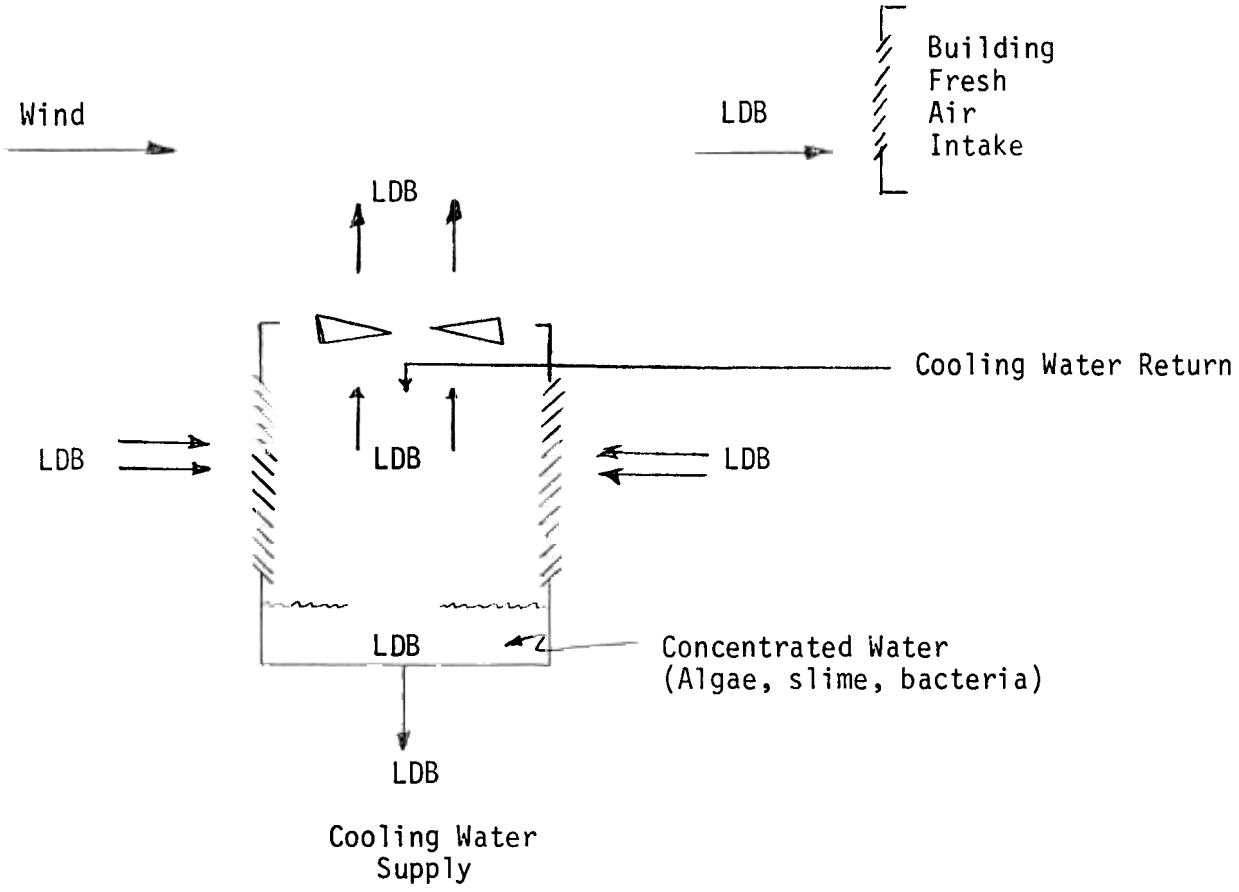


Fig. 1: Legionnaires' Disease Bacteria (LDB) in a Cooling Tower

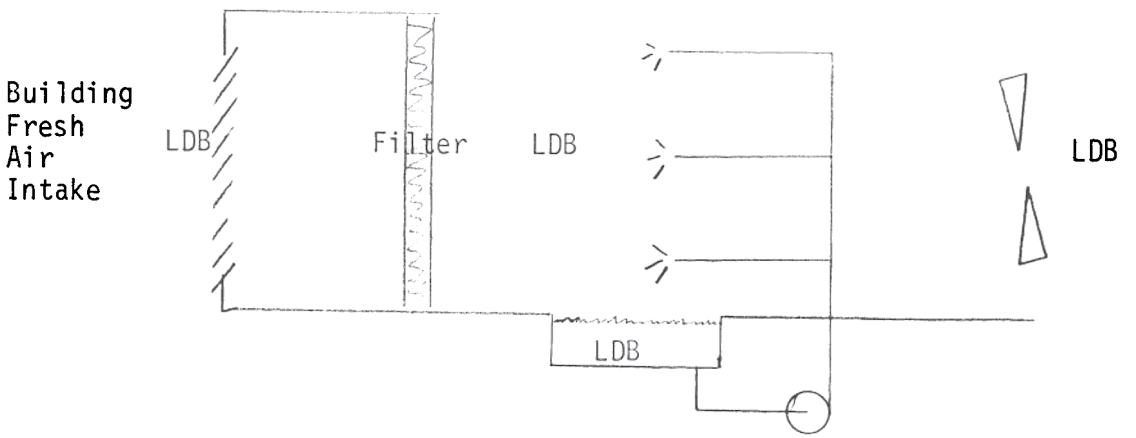
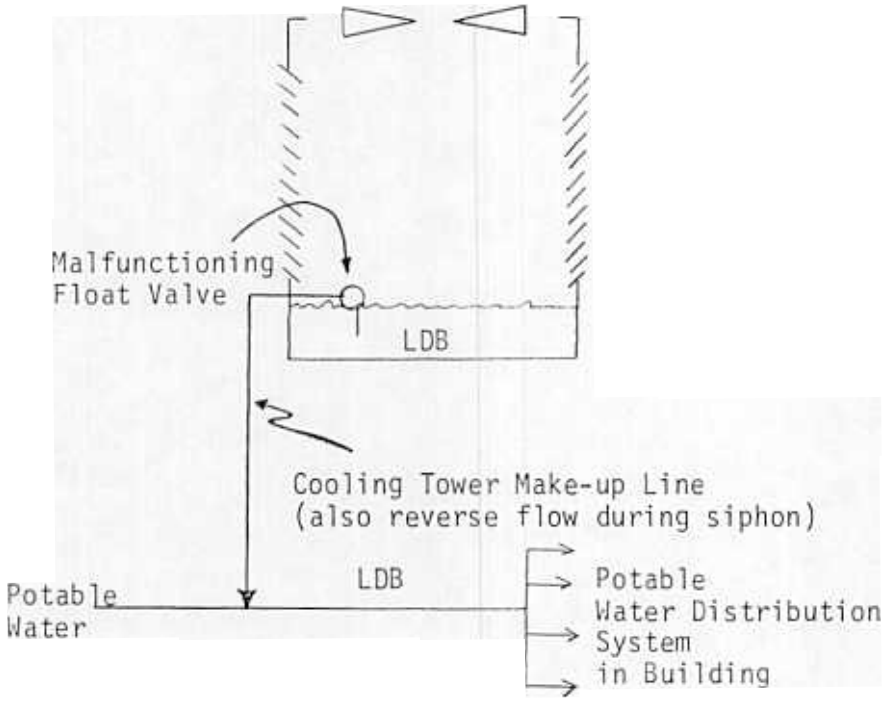


Fig. 2: Legionnaires' Disease Bacteria (LDB) in an Air Washer (humidifier) System



LDB

Fig. 3: Legionnaires' Disease Bacteria (LDB) in a Potable Water System

Prevention

Certain bacteria and algae can stimulate the growth of Legionella pneumophilia bacteria. Therefore, actions such as routine chemical treatment with biocides which are known to be effective in preventing slime, algae, and bacterial growth in cooling towers and air washer systems, as well as heating to 160 F and monitoring these systems on a routine basis are usually recommended. However, it should be recognized that these procedures will not kill or prevent Legionnaires' Disease bacteria.

The typical guidelines for systems which have had a bioanalysis are indicated in Table 1 below.

Table 1: Control Limits for Bacteria Counts in Non-potable Systems

Bacteria Count Range (colonies/ml)	Comment
0 - 10,000	essentially sterile
10,000 - 500,000	system under control
500,000 - 1 million	system may be under control but should be monitored
1 million - 10 million	system out of control, biocide required
over 10 million	serious fouling problems may be occurring, immediate biocide addition required

However, these guidelines are more applicable to corrosion control rather than bacteria control. Therefore, the lower range (ie., 0 - 10,000 colonies/ml) or preferably no bacteria at all should be used as a guideline for good bacterial control.

In conclusion, the following guidelines should be used to reduce the risk of an occurrence of Legionnaires' Disease in Alberta Government Buildings:

1 If there is a suspect case(s) of Legionnaires' Disease, have it confirmed by a blood test of the patient at a Provincial Laboratory (ie., contact Mr. Prasad, special pathogen, at Edmonton Provincial Laboratory, Phone: 432-8931);

2. Control the dissolved solids in the reservoirs of cooling towers and humidifier systems to the prescribed amount (each installation requires custom control limits due to different make-up water qualities across the province) by blowdown;

3. Add a biocide to the reservoirs of cooling towers and humidifier systems on a routine basis rather than wait until algae or bacteria are present (note: in most cases treatment with sodium hypochlorite is sufficient--if it is not, a proprietary biocide should be used--if sodium hypochlorite is used in a humidifier system, it should be shut down during this clean out and drain down);

4. Perform bacteria tests on water samples collected from the reservoirs of cooling towers and humidifier systems on a routine basis using "easy-cult" membranes for field testing--bacteria count should be zero--if it is not, increase biocide treatment;

5. Ensure that the make-up line to each system in the building has a backflow preventor valve in it in order to prevent the backflow of system water into the potable water system;

6. Perform bacteria tests on water samples collected from the potable hot water tank on a routine basis using "easy-cult" membranes for field testing--bacteria count should be zero--if it is not, increase the water temperature to 160 F for 72 hours and flush each tap and shower for 30 minutes during an off peak period.