

## THE CONTROL OF LEGIONELLA WITHIN BUILDINGS

### *Legionella* and Legionnaires' Disease

The causative agent of Legionnaires' disease is the bacterium *Legionella pneumophila* (Lp). This organism is just one species of the genus *Legionella*. To date more than 36 species of *Legionella* have been isolated and these are being further divided into serogroups and subgroups. Approximately 90% of cases of Legionnaires' disease have been associated with Lp serogroup 1, subgroup Pontiac. However about half of the known species of *Legionella* have caused serious disease and several fatalities in man. *Legionella* is a pathogenic genus and discovery of any species of *Legionella* in significant numbers in an engineered water system warrants immediate attention.

*Legionella* is a ubiquitous bacterium, which means that it is a naturally occurring organism widely found in nature. Most natural surface waters such as lakes contain *Legionella* and it can also be found in soil samples.

### Definitions

Strictly speaking, Legionnaires' disease is defined as 'a pneumonia caused specifically by *Legionella pneumophila*' (pneumophila meaning lung-loving). More recent research however has shown that several other species of *Legionella* cause pneumonia-like illnesses which could, arguably, also be called Legionnaires' disease but which are often referred to as "legionelloses". The other two specifically named illnesses caused by these organisms are Pontiac Fever, a flu-like illness, and Lochgoilhead Fever, a non-pneumonic form of legionellosis. Houseman laboratories carry out hundreds of *Legionella* tests on site samples every week and regularly isolate about a dozen species of *Legionella* which have been shown to harm man.

### Conditions for Growth

Despite being found widely in the environment, *Legionella* is difficult to cultivate in the laboratory. *Legionella pneumophila* grows most rapidly at 35°C in moist, slightly acidic conditions (pH 6.9) in the presence of ferric ions using certain amino acids as nutrient. This may sound simple, however in order to recover this particular organism from a water sample it must be encouraged to grow at the expense of the much larger number of other organisms present. To achieve this, precise laboratory procedures must be adhered to and specially developed nutrient media containing specific antibiotics used.

## **How is Legionnaires' disease contracted?**

The disease is normally contracted by inhalation of contaminated droplets of water. These *Legionella*-containing droplets must be less than five microns in diameter to allow them to pass into the tiny air sacs in the lungs. In a susceptible individual, the bacteria can then multiply, with illness being the unfortunate result.

## **Who is most likely to catch Legionnaires' disease?**

Certain susceptible groups have been identified. High risk groups include heavy smokers, people taking immunosuppressant drugs, those aged over 50 and people who have already experienced lung problems. Generally men are more susceptible to this disease than women by a factor of approximately 3:1.

## **What are the symptoms of this disease?**

In many respects, Legionnaires' disease produces similar symptoms to 'common' pneumonia: high fever, difficulty in breathing. It has an incubation period of 2-10 days and starts with a dry cough. Later symptoms include diarrhoea and vomiting, fever and mental confusion. Once diagnosed, it can be treated effectively with antibiotics in the early stages. Unfortunately, because of the similarity between LD and pneumonia, accurate diagnosis is difficult.

## **How many people are affected by the disease in the UK?**

This is difficult to quantify accurately, partly because of the difficulty in diagnosis, but also because most cases (75%) occur as isolated incidents. The generally accepted figure for the number of reported cases per year is between 200 and 300 cases in England and Wales - of this number, approximately 12% will not recover. To put this figure in perspective there are some 180 000 cases of pneumonia reported each year.

## **Why is Legionnaires' disease associated with Engineered Water Systems?**

Cases of Legionnaires' disease have been attributed to a wide variety of warm aerosol-producing devices such as shower heads, cooling towers, jacuzzis, spa baths, industrial coolants, ornamental fountains, dental mouth sprays, industrial car washes and respiratory therapy equipment.

It is not known how many droplets or organisms must be inhaled to cause the disease, but it is logical to assume that the greater the number of droplets produced by a contaminated water source, the greater the risk of the disease occurring.

The majority of LD cases are sporadic and not attributed to specific systems, however cooling towers have been linked with a number of actual outbreaks. During their normal course of operation, open evaporative cooling towers produce water droplets which can leave the tower as drift or windage and be spread over considerable distances by the wind. Within the drift, droplets reduce in size through evaporation, bringing some within the critical dimensions for inhalation mentioned above.

Modern cooling towers of this type are now fitted with extremely efficient drift eliminators which greatly reduce the amount of aerosol leaving the tower. Efficiencies greater than 99% have been quoted by some suppliers.

As mentioned above, legionellae multiply most rapidly in warm conditions and any aerosol-producing engineered water system operating at temperatures between 20°C and 40°C presents a potential risk.

While cooling towers have generally been well maintained in the past to ensure their efficiency, other engineered systems such as hot water services have not had the same degree of attention. It is not surprising therefore that calorifiers with sludge in the bottom and showers which are intermittently used have also been implicated in outbreaks and represent the greatest risk in terms of directly associated outbreaks.

The potential 'ideal home' of many bacteria, not just legionellas, can be created in systems such as this *if they are not adequately maintained*. Considerable advice regarding maintenance of hot and cold water services and industrial water systems is available and, at the very least, those responsible for such systems must be aware of the Health and Safety Executive Guidance Note HS(G)70.

### **Water System Maintenance**

Effective maintenance requires a clean, well designed system, an appropriate maintenance programme and regular monitoring. If these fundamental rules are applied to *any* engineered water system, the risks associated with *Legionella* contamination will be greatly reduced.

The means of minimising risk are well documented although practical application often requires the assistance of a specialist organisations.

British Standard BS 6700 details design criteria for hot and cold services and sterilisation procedures. These procedures are applied to new systems to ensure freedom from contamination prior to the system being taken in to use.

HS(G)70 recommends regular inspection, maintenance and monitoring of engineered water systems. Storage tanks and calorifiers should be inspected annually and, where appropriate, cleaned and disinfected. During the year these items of plant must be monitored to ensure that correct temperatures are being maintained and that microbial contamination is not occurring. This publication, and the BACS Code Of Practice, details appropriate disinfection and cleaning procedures for cooling towers and provides key information on water treatment programming.

In hot and cold water systems reliance has to be made on keeping systems clean whilst maintaining correct operating temperatures (60°C storage temperature in calorifiers and distribution temperatures of 50°C, and 20°C or less in cold water storage tanks). Cooling systems however can utilise the full range of control measures available including scale and corrosion inhibitors, biocides and dosage and control equipment.

The practical preventative measures which can be taken against the proliferation of legionellae must be supported by an appropriate management scheme as outlined in the Health and Safety Commission Approved Code of Practice, "The prevention or control of legionellosis (including legionnaires' disease), which came into force in January this year.

### **Legislation, Guidance Notes and Standards**

As engineered water systems have been identified as an area of potential risk, it is not surprising that legislation has been brought to bear to ensure that these systems are adequately and responsibly maintained. People who fail to maintain such systems may be prosecuted under Section 3 of Health and Safety at Work (etc) Act (1974).

Guidance Note HS(G)70 details minimum maintenance standards for cooling towers and hot and cold water services. This is supported by an Approved Code of Practice which discusses responsibilities and the importance of accurate record keeping. The ACOP is not a legal requirement in its own right but failure to comply with any provision of the code may be taken by a court in criminal proceedings as proof that a person has contravened the legal requirement which would then relate to the Health and Safety at Work etc. Act 1974 and the Control of Substances Hazardous to Health Regulations 1988.

HS(G)70 is more stringent and detailed than any other official information issued to date. Houseman, as recognised leaders in the field of water treatment contributed to the compilation of HS(G)70 which they see as another step forward to minimising the risks associated with *Legionella*.

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