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LEGIONELLA IN BUILDING WATER SYSTEMS RISK ASSESSMENT AND PROACTIVE MONITORING

Background

In July, 1976 in Philadelphia an outbreak of pneumonia affected 221 people, killing 34. Many were members of the American Legion attending a convention in the Bellevue-Stratford Hotel. The causative organism, *Legionella pneumophila*, is widely distributed in nature and although positively identified and named only several months after the outbreak of the illness that gave the disease its name, legionnaires' disease, it has probably been causing infections in humans for hundreds of years.

There are now identified more than 30 species of *legionella* and at least 14 serogroups of *Legionella pneumophila*, however the Pontiac sub-type (MAb2) of *Legionella pneumophila Serogroup One* is responsible for more than 90% of known infections. In recent years up to 300 cases of legionnaires' disease are reported each year in Australia alone.

Habitat

Legionella species occur naturally in soil, rivers and lakes and have the ability to successfully colonise man-made water handling and storage systems, which often provide ideal conditions of nutrition and temperature for their proliferation. *Legionella* infection is not transmissible from person to person; it is caused by the inhalation of water aerosols containing the bacteria by susceptible individuals. The numbers of organisms required to induce infection is not known but will vary according to age, general health and other predisposing factors.

The potential for *legionella* to become a hazard to the health of large numbers of people is greatly enhanced by conventional water and air conditioning engineering methods as used in re-circulating cooling towers, evaporative condensers, showers, water storage and distribution systems and other aquatic systems such as whirlpool spa baths.

Cooling Towers and Water Storage Systems

The single isolation of these bacteria from a water system does not mean that the disease will necessarily manifest itself but if the contaminated water becomes an aerosol the risk of human infection is greatly increased. Thus if man-made water systems produce jets, sprays or mists, as with cooling towers, showers and some types of humidifiers, it is important to minimise the chances of *legionella* colonising the water reservoirs, storage tanks and other aquatic systems serving them.

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Certainly cooling towers are of particular importance for their operating temperatures are at an optimum level, they are designed to aerosolise the water and they are easily and frequently contaminated by wind-blown dusts and soil particles which can carry with them disease producing micro-organisms including *legionella*.

The presence of these bacteria in water systems is therefore of prime importance to engineers, building managers and hygienists. The organisms can be controlled in such systems by the application of biocides and their detection and identification plays a vital role both in initial assessment of the water system and subsequent treatment effectiveness and ongoing water quality monitoring.

Legislation

The Public Health or similar Acts in most States make provision for dealing with *legionella* risks. Reference is made to Australian Standard 3666-1995 “Air-handling and water systems of buildings - Microbial control” which outlines design and maintenance requirements for minimising *legionella* risks.

In order to comply with their duty of care under Public Health and Occupational Health and Safety legislation, employers and those with responsibility for the control of premises should:

- identify and assess sources of risk;
- prepare a scheme for preventing or controlling the risk;
- implement, manage and monitor precautions;
- keep records of the precautions; and
- appoint a person to be managerially responsible.

Identification and Assessment of Risk

At the time of water sampling HBI Field Technicians evaluate all the relevant factors affecting the condition of the water source, such as, system design, accessibility to airborne contamination, exposure to light, circulation rate, pH, temperature, droplet formation, water treatment programme, etc.

Testing the sample will then identify if the source is safe or contaminated at the time of sampling. Assessment of the hazards then permits high-risk sources to be identified and ensures that responsible means of implementing precautions are undertaken.

As the likelihood of future contamination can be predicted this also allows maintenance regimes and water treatment protocols to be established on the basis of need rather than on guesswork.

Regular Monitoring

The HBI sampling protocol is designed to ensure accuracy, avoid ambiguity, and protect client confidentiality and to aid in diagnosis of contaminated water systems.

Water from cooling towers, spray-type humidifiers and other air conditioning associated equipment present the greatest degree of risk and a routine sampling procedure from their water storage reservoirs and from other water systems can be set up. This allows management to have up-to-date reports on the status of their building water systems and gives confidence that maintenance standards are being met. Tenants, staff and building users can then be assured that all reasonable precautions are being taken to avoid the spread of legionnaires' disease.

Furthermore, immediately prior to routine cleaning and maintenance, cooling towers and humidifiers can be tested for the presence of *legionella*. If it is found to be present then the necessary water treatment can be done, quickly verified for its effectiveness and engineering staff assured that they will not be exposed to microbial hazards as they carry out the work.

Hot and cold water services and other water systems can similarly be appraised for risk and a suitable system of maintenance, cleaning and testing implemented.

Because of its widespread presence in nature and its ability to thrive in man made water systems it is unlikely that *legionella* can be completely or permanently eradicated from these potentially hazardous systems. However, by suitable design, maintenance, treatment and testing of building water systems it is possible to control the conditions which allow this and other bacteria, fungi and protozoans to multiply, thus keeping the incidence of disease outbreaks associated with such systems at a minimum. Any Proactive Monitoring System applied to buildings and their water systems should therefore include regular monitoring for the presence of *legionella* at appropriate outlets.

The increased public awareness environmental health issues and the acceptance of the legislation now approved have ensured that risk assessment and appropriate preventative maintenance steps, should now be considered as the norm for every building.