

Executive Summary

Purpose of this Guide

This Guide is designed to assist industry develop risk management plans to control *Legionella* growth in cooling towers, particularly where the system is relatively simple in design and construction. *Legionella* bacteria can be spread through aerosol spray and cause outbreaks of Legionnaires' disease, a potentially fatal form of pneumonia.

The Guide follows a risk management approach, describing the actions necessary to meet these challenges.

Legionella Risk Management Strategy

The Victorian Government has developed a comprehensive strategy to reduce the incidence of Legionnaires' disease by strengthening the regulatory framework and improving the maintenance standards for cooling tower systems. Landowners and managers of cooling tower systems have new legal responsibilities.

Responsibilities of Landowners

The *Building (Legionella) Act 2000* places a number of obligations on the owner of any land on which there is a cooling tower system. These include registering that system with the Building Control Commission, developing a risk management plan and having that plan independently audited by an approved auditor.

The risk management plan must address the critical risks distilled from the relevant Australian Standard. This guide demonstrates the relationship between the risks associated with your cooling tower system and the development of an appropriate maintenance program for that system.

Responsibilities of Owners and Managers of Cooling Tower Systems

The Health (*Legionella*) Regulations 2001 describe the minimum requirements for maintenance of a cooling tower system. Testing for total bacterial counts is required monthly and in the event of adverse results, certain immediate actions must be taken to bring the system under control.

Key Challenges for Cooling Tower System Owners and Managers

The main challenge is to take immediate steps to minimise the risks associated with cooling tower systems on land for which they have responsibility. There are several other elements which are critical to the success of a risk management approach:

- **Commitment**

In larger organisations, this means management recognition that a cooling tower system is an asset requiring careful management.

- **Information Gathering and Forward Planning**

It is critical that any organisation with a cooling tower system has adequate information on which to base its decisions. This must include reviews of the cooling tower system to determine any shortfalls in design or performance and the development and implementation of an action/upgrade plan to address any deficiencies.

- **Control and Performance Measures**

Organisations must develop reliable management systems to ensure that the system is under effective and consistent control, especially monitoring of performance measures such as *Legionella* testing. Management reporting of

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variances from regulations or organisational targets is also important. Such reviews must look at more than just engineering solutions. They must also consider the people who may be exposed and ways to minimise their exposure.

- **Alternatives to Cooling Towers**

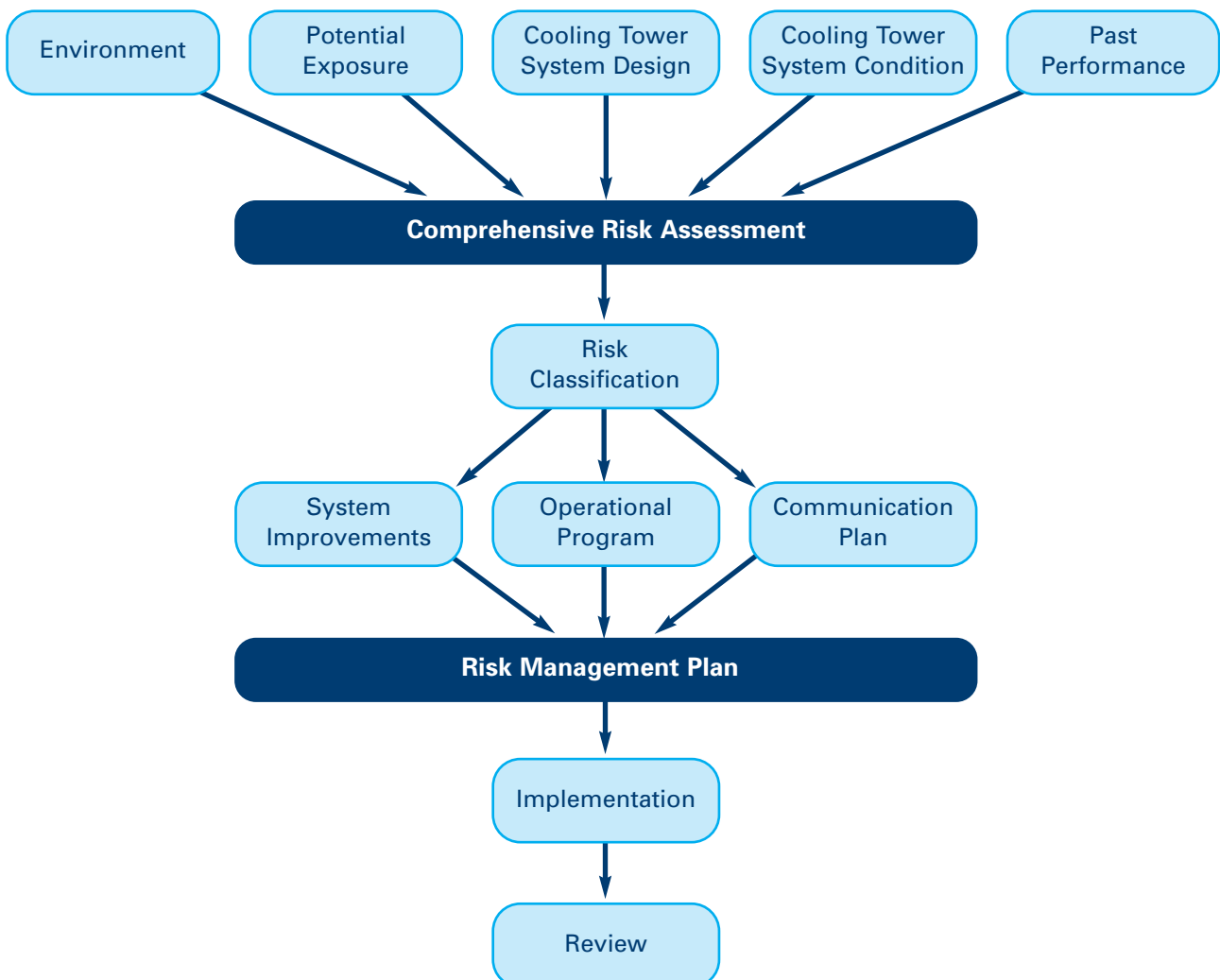
The only way to eliminate the risk from Legionnaires' disease associated with a cooling tower is to remove it. A review of viable alternatives should be conducted.

- **Communication**

Larger organisations need to carefully consider the contractual relationships between the landowner and those involved in management and maintenance of a building. It is critical that there is clear and rapid communication between the parties about safety related matters.

The final key challenge is to raise employee awareness about the cooling tower system and the programs in place to minimise the risks. This must include the development of communication plans detailing who will be informed if *Legionella* is detected in the cooling tower system.

Figure 1 Risk Management Process for Cooling Tower Systems



1 Introduction

Legionnaires' disease is a potentially fatal form of pneumonia caused by *Legionella pneumophila* bacteria. *Legionella* can also cause less serious illnesses which are not permanently debilitating. The group of infections caused by *Legionella* is known as legionellosis.

1.1 *Legionella* and Legionnaires' Disease

Legionella bacteria occur naturally in the environment. They are commonly found in lakes, rivers, creeks and soil. People usually contract Legionnaires' disease by breathing in *Legionella* bacteria in very fine droplets of water called aerosols. Artificial water systems, including showers, spa pools, fountains and cooling towers, may provide environments that allow *Legionella* bacteria to multiply in large numbers. *Legionella* can then be spread by aerosols.

The main risk factors for an outbreak of the disease are:

- The presence of *Legionella* bacteria.
- Conditions suitable for multiplication of the organisms: suitable temperature (20°C to 50°C) and a source of nutrients such as sludge, scale, rust, algae and other organic matter.
- A means of creating and spreading breathable droplets, such as the aerosol generated by a cooling tower, shower or spa.
- Exposure of susceptible people to these aerosols.

1.2 Who Is at Risk?

Most people exposed to *Legionella* bacteria do not become infected. The risk of disease increases with age, especially among smokers. People with chronic medical conditions that weaken the body's immune system (such as cancer, lung disease, diabetes and

transplant recipients) may be at increased risk of Legionnaires' disease.

1.3 Impacts on Health

Many people with Legionnaires' disease are admitted to hospital for long periods and spend some of this time in intensive care. For a minority of sufferers, the disease proves fatal. A small percentage may suffer some permanent disablement.

Between 1979 and 1999, 82 people died from Legionnaires' disease in Victoria. During the same period, 422 people were diagnosed with the disease and recovered. It is likely that a considerably larger number contracted the disease, but were not correctly diagnosed.

1.4 Potential for Legal Liability and Prosecution

Outbreaks of Legionnaires' disease associated with a particular cooling tower system can have devastating effects on a business.

Owners and occupiers of land may face prosecution for not complying with the Building, Health and Occupational Health and Safety Acts. There is also strong likelihood of legal action for damages suffered by individuals or companies as a result of the outbreak.

During an outbreak, the normal operation of a business is likely to be severely disrupted and, in some cases, the business may have to suspend all

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operations until the source of the outbreak is located and treated. There is likely to be negative media attention and the business may well suffer significant loss of trade and customer goodwill for a long time after the outbreak has been contained.

1.5 Do You Really Need a Cooling Tower System?

This Guide is focused on the very real risk that a cooling tower system may produce *Legionella* contaminated aerosols and cause an outbreak of Legionnaires' disease.

A basic principle of risk management is to first see if it is possible to eliminate the risk altogether. For as long as a cooling tower system exists on a site, it is possible to reduce and manage the risks, but not eliminate them.

At an early stage of a review of the risks associated with a cooling tower system, establish if the original purpose for the cooling tower system still remains. In the case of industrial processes for example, is the cooling tower system still crucial to the process or has it become redundant?

Also ask whether there are viable alternatives to the cooling tower system. Owners of land and businesses with smaller cooling tower systems with a heat rejection requirement of under 750 kW should consider a move to air cooled systems and so eliminate the public health risk associated with the system. Air cooled systems are not associated with Legionnaires' disease, because there is no reservoir of recirculating water. Not only can the risk of Legionnaires' disease be eliminated, but also the ongoing costs of water treatment and testing.

If once these possibilities have been explored, no viable alternative currently exists to your cooling tower system, it is time to begin the risk management process.

1.6 Legionella Risk Management Strategy

The Victorian Government has developed a comprehensive strategy to reduce the incidence of Legionnaires' disease by strengthening the regulatory framework and improving maintenance standards for cooling tower systems. Implementing the strategy is the responsibility of the Department of Human Services, Building Control Commission (BCC) and the Plumbing Industry Commission (PIC).

The key aspects of the strategy are to:

- Improve maintenance levels of cooling tower systems.
- Establish a comprehensive register of cooling tower systems, by amending the *Building Act 1993*.
- Require the owners of any land on which there is a cooling tower system to prepare and implement a risk management plan for the effective maintenance of that system.
- Require an annual audit of each risk management plan.
- Provide for inspections of cooling tower systems on the basis of risk assessment or information received through audits.
- Provide an enhanced technical advisory and outbreak investigation service through the Department of Human Services.
- Ensure that new cooling tower systems are constructed and installed to meet the relevant Australian Standards.

Amendments to the *Building Act 1993* and new building and plumbing regulations will require all owners of land where cooling towers are located to:

- Register the cooling tower system with the Building Control Commission. In the case of systems installed before the *Building (Legionella) Act 2000* was introduced, registration must be made within six months of that date. After that date, registration must occur before commissioning the systems. Registration is an annual process for which a fee is payable.

- Prepare and implement a Risk Management Plan (RMP) for each cooling tower system on the land.
- Have the RMP independently audited on an annual basis to confirm that it addresses the risk factors described in the Building (*Legionella* Risk Management) Regulations 2001, and that there is documented evidence that the plan is being satisfactorily implemented.
- Ensure that new cooling towers are constructed and installed meet the relevant Australian Standards (AS/NZS 3666).

The registration levy will fund:

- An education and awareness raising campaign targeting owners of land, industry representatives and cooling tower maintenance companies.
- Developmental and ongoing costs associated with the register.
- Random inspections of maintenance records and equipment checks by authorised health officers of the Department of Human Services.
- An enhanced technical advisory and outbreak investigation service within the Department of Human Services.
- Education and research activities relating to the control of *Legionella*.

Land owners who have a cooling tower system on their property and every business that owns or operates a cooling tower system will need to understand their responsibilities under Victorian law and carefully consider the risks relating to their cooling tower system and business.

Outbreaks of Legionnaires' disease in Victoria in 2000 resulted in ill health for individuals concerned and impacted on their families. There have also been significant economic losses reported by the businesses implicated in those outbreaks.

We have prepared this Guide and a template of an RMP to help businesses through this significant change to Victorian law, but ultimately the responsibility rests with the owner of the land and the businesses involved to maintain a safe environment for staff, contractors, customers and the general public. The recommendations contained in the Guide will assist you to comply with the new laws, but individual business needs and environmental conditions may require different or more stringent maintenance regimes, based on your individual risk assessment.

Disclaimer

This document is intended as a general guide to developing risk management plans for cooling tower systems. No warranty as to the completeness of the information is given. The Department of Human Services and its employees disclaim all liability and responsibility for any direct or indirect loss or damage which may be suffered through reliance on any information contained in or omitted from this document, and no person should act solely on the basis of the information contained in the document without taking appropriate professional advice about obligations in specific circumstances.

1.6.1 Key Contacts

For further information on this strategy, please contact:

Agency	Internet address	Telephone
Department of Human Services Public Health Division (Environmental Health Unit)	www.legionella.vic.gov.au	1800 248 898
Building Control Commission	www.buildcc.com.au	9285 6400
Plumbing Industry Commission	www.pic.vic.gov.au	9889 2211

2 How this Guide Works

This Guide has been designed to assist land owners, cooling tower system owners and managers provide a safe environment for their staff, contractors, customers and the public, and comply with their responsibilities under Victorian law.



Cooling tower system: A series of inter-connected cooling towers that form part of a cooling tower system

The guide will also help users develop cooling tower system maintenance programs and cooling tower system improvements within the Risk Management Plan (RMP) framework.

Many organisations with more complicated systems will decide to engage third parties such as consultant engineers and water treatment specialists to perform a risk assessment and develop the RMP as well as a risk-based maintenance program. Additional assistance can then be sought to manage the cooling tower system operation. The risk assessment for a highly complex system can best be performed in consultation with people such as:

- System designers
- Cooling tower suppliers
- Mechanical services maintenance contractors
- Water treatment provider
- Mechanical engineers
- Occupational hygienists
- Building and system owner.

In the absence of on-site expertise, it is essential that specialists in the treatment of cooling tower systems are engaged to provide and monitor appropriate water treatment.

The key competencies for individuals involved in the development of an RMP includes an understanding of:

- System design and components
- Water chemistry and water treatment principles including corrosion control
- Risk management principles.

As with all outsourcing of services it is important to confirm that adequate professional and public liability insurance for the task at hand is held by the contractors.

This Guide follows a risk management approach to help you make critical decisions about both cooling tower system improvements and maintenance and testing quality and frequency.

The Guide incorporates an RMP template that can be filled in quickly **once the necessary information has been obtained during a comprehensive risk assessment** and decisions have been made about improvements to the system concerned.

Publication Formats

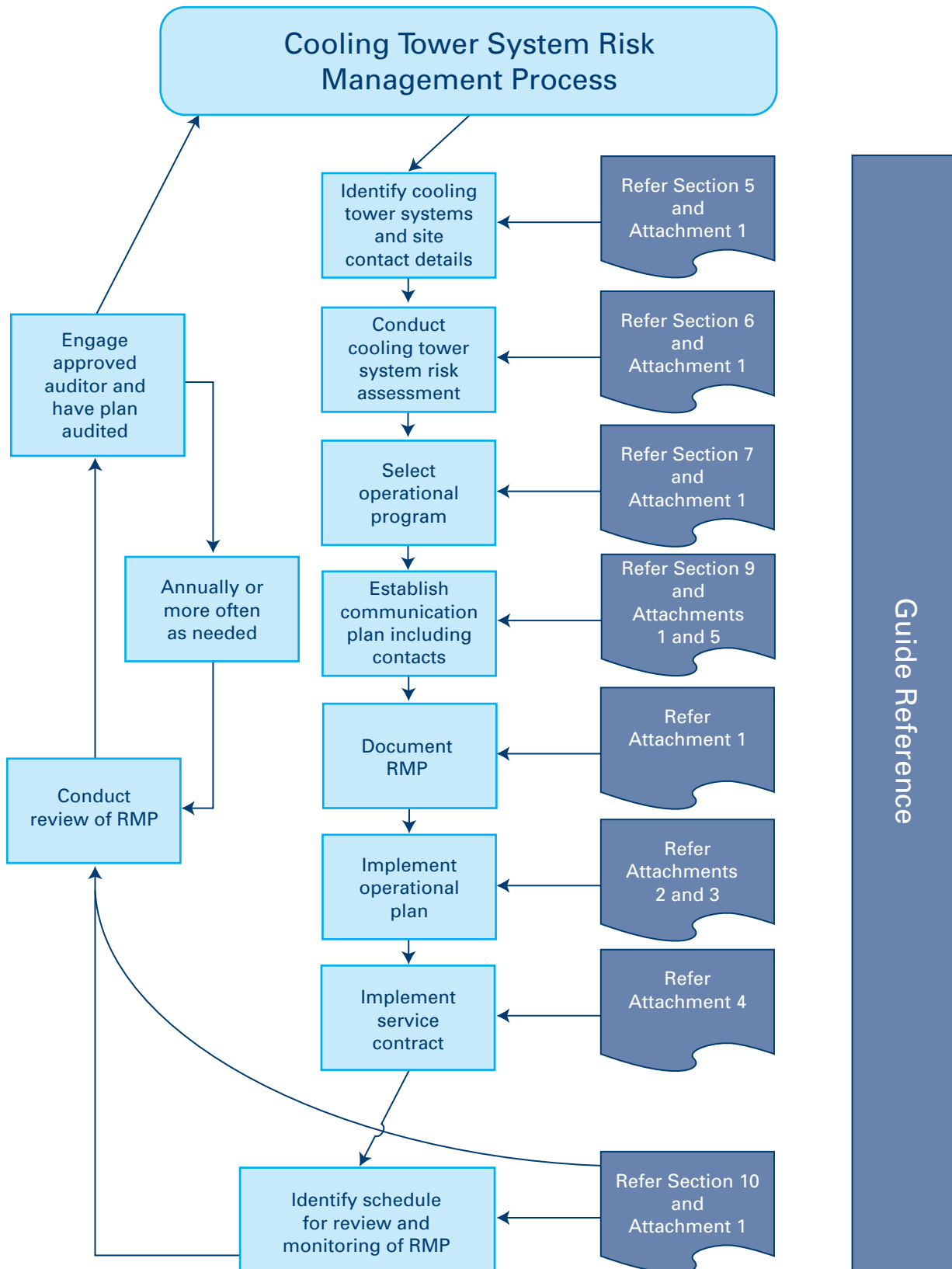
The Attachments and all Tables in the Guide are available on the Internet at www.legionella.vic.gov.au in Microsoft Word 2000 format.

The Guide will be supplied to every owner of land with a registered cooling tower system and is also available on the Internet at <http://www.legionella.vic.gov.au>

This Guide is also included in the *Cooling Tower System Legionella Risk Management Site Kit* that will be supplied to every site that is registered with the Building Control Commission. The Site Kit provides for essential documentation such as service reports and bacterial test results to be stored appropriately for annual audit purposes.

2 How this Guide Works

Figure 2 Cooling Tower System Risk Management Process



3 Your Legal Responsibilities

Under Victorian law, people responsible for cooling tower systems must meet a range of requirements. These are summarised below.

3.1 *Building (Legionella) Act 2000, Building (Legionella Risk Management) Regulations 2001 and Building (Cooling Tower Systems Register) Regulations 2001*

The Building Act and related Regulations require the owner of land on which there is a cooling tower system to:

- Register each cooling tower system with the Building Control Commission annually and
 - Develop an RMP for every cooling tower system on the site that considers the following critical risk factors:
 - **Stagnant water**, including the lack of water recirculation in a cooling tower system and the presence of dead-end pipework and other fittings in a system.
 - **Nutrient growth**, including the presence of biofilm, algae and protozoa in a cooling tower system, water temperature within a range that will support rapid growth of microorganisms in a system and the exposure of the water of a system to direct sunlight.
 - **Poor water quality**, including the presence of solids, *Legionella* and high levels of microorganisms in a cooling tower system.
 - **Deficiencies in the cooling tower**, including deficiencies in the physical design, condition and maintenance of the system.
 - **Location of and public access to a cooling tower or cooling tower system**, including the potential for environmental contamination of the system and potential for exposure of people to the aerosols of the system.
- and
- Have the RMP independently audited every year and
 - Review the RMP at least once every year and
 - Keep records of all repair, maintenance and testing work that is carried out on the system for at least seven years after the records were created and
 - Ensure that the RMP and the records referred to earlier are kept either at the building in which the system is housed or at a building on the land where the system is located.
 - Advise the Building Control Commission within 30 days of:
 - Addition or removal of a cooling tower to or from the system.
 - Removal or permanent decommissioning of the system.
 - Relocation of the system on the lot of land on which it stands.

The maximum penalty for failing to register is \$12,000. The maximum penalty for failing to complete a Risk Management Plan is \$6,000.

3 Your Legal Responsibilities

3.2 Plumbing (Cooling Towers) Regulations 2001

The Plumbing (Cooling Towers) Regulations 2001 require that new cooling tower systems be constructed to 'Australian/New Zealand Standard 3666: Air handling and water systems of buildings—Microbial Control'.

3.3 Health Act 1958

The Health Act requires all owners and occupiers of premises not to allow a condition to exist that is, or is liable to be, dangerous to health.

In addition, owners and occupiers of property should note that authorised officers under this Act have extensive powers of entry to sites to investigate potential breaches of the Act or threats to public health.

3.4 Health (*Legionella*) Regulations 2001

The Health (*Legionella*) Regulations 2001 requires the person who owns, manages or controls a cooling tower system to ensure that:

System Maintenance

- a) The system is maintained and tested as described later unless the system is shut down or is otherwise not in use and is completely drained of water.
- b) The water in the system is maintained in a clean condition.
- c) The water in the system is continuously treated with one or more biocides to effectively control the growth of microorganisms, including *Legionella*, as well as with other chemicals to minimise fouling and the formation of scale and corrosion.

- d) A chlorine-compatible biocides is added to the recirculating water of the system and that the system is disinfected, cleaned and re-disinfected:
 - immediately prior to initial start up following commissioning or any shut down period of greater than one month
 - at least every six months.
- e) The system is inspected at least monthly to ensure the system is operating without defects.
- f) The water in the system is laboratory tested for Heterotrophic Colony Count (HCC) at least monthly.
- g) A maintenance log book is kept up-to-date and on the premises with records of all maintenance activities and microbiological test results and produced on request to an authorised officer.

Adverse Test Results

- h) Within 24 hours of receiving a report that a sample was found to have a HCC of greater than 100,000 CFU/mL, the water in the system must be manually dosed with additional quantities of biocide or with an alternative biocide. The water treatment program, tower operation and maintenance program must be reviewed and any faults corrected to prevent a re-occurrence of the faults. Between two and four days after the manual dosing a second sample must be taken and tested for HCC.
- i) Within 24 hours of receiving a report that the result of the re-sampling described above was an HCC greater than 100,000 CFU/mL, the cooling tower system must be disinfected, cleaned and re-disinfected. Between two and four days after the disinfection process, a further sample must be taken and tested for HCC.

- j) If after taking the previous steps the HCC result is still above 100,000 CFU/mL, then the process in i) must be repeated until the HCC result is less than 100,000 CFU/mL in two consecutive water samples taken approximately one week apart, or the cooling tower system is closed until the problem has been remedied.
- k) Within 24 hours of receiving a report that *Legionella* has been detected in the water of the system, the system must be disinfected, and a review performed of the water treatment program, tower operation and maintenance program. Any faults must be corrected. Between two and four days after the disinfection a second sample must be taken and tested for *Legionella*.
- l) Within 24 hours of receiving that advice that *Legionella* was detected in the second sample, the system must be disinfected, cleaned and re-disinfected. Between two and four days later another sample must be taken and tested for *Legionella*.
- m) If, after following the previous steps *Legionella* is still present then the process in l) must be repeated until no *Legionella* is detected in two consecutive water samples taken approximately one week apart or the cooling tower system is closed until the problem has been remedied.
- n) If, while following the procedure described in these regulations *Legionella* is detected in three consecutive water samples taken from the same system, the responsible person must notify the Department of Human Services of the detection immediately by telephone, followed by a written notification within three days of the third detection of the organism.
- o) Decontaminated in the event that the system is implicated as the source of infection in a case or an outbreak of Legionnaires' disease.

The maximum penalty for not complying is \$10,000.

3.5 Occupational Health and Safety Act 1985

The Occupational Health and Safety Act requires an employer to maintain a safe working environment. It establishes a general duty of care that employers owe their employees. Liability arises when a person is 'exposed' to a risk of injury to health or safety.

The Act also requires employers and the self-employed to ensure that, as far as practicable, the health and safety of members of the public is not affected adversely by their business activities.

The State Government has announced plans to increase the penalties to a maximum of \$750,000.

This is expected to be debated in Parliament in late 2001.

3.6 Crimes Act 1958

Draft legislation is expected to be introduced to Parliament in late 2001, amending the Crimes Act to create an offence of industrial manslaughter.