

Managing the Risk of Legionnaires' Disease

Supplementary Notes for Hospitals

November 2001

Department of Human Services
Public Health Division

Feedback

The Department welcomes feedback on this document. Comments can be made in writing to the *Legionella* Risk Management Project within the Public Health Division, or via e-mail to lrmp@dhs.vic.gov.au

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1 Introduction

1.1 A Risk Management Approach to Controlling Legionnaires' Disease

Legionella bacteria are quite common in the environment. The possibility of *Legionella* presence and growth in cooling tower systems and to a lesser extent, in warm water systems, cannot be eliminated. However, the risks of *Legionella* growth and outbreaks of Legionnaires' disease can be managed, even in relatively high risk environments like hospitals. It is with this in mind that the Department has produced these *Supplementary Notes for Hospitals*.

1.2 Scope of Supplementary Notes

The contents of this publication:

- Are primarily intended for use by all Victorian health services and hospitals (public and private) as a supplement to the *Guide to Developing Risk Management Plans for Cooling Tower Systems*¹.
- Have a particular emphasis on the hospital environment, patient risk and management.
- Explain the risks associated with warm water systems.

The *Notes* should be read by:

- Those responsible for cooling tower and warm water systems, including hospital engineers, facility managers, maintenance and water treatment contractors.
- Infection control practitioners and teams.
- Hospital Boards, Chief Executive Officers and Managers.

The risk associated with *Legionella* in a hospital is not confined solely to cooling tower or warm water systems. Other causes of Legionnaires' disease have included spas, respiratory devices, humidifiers, food misting machines and contaminated ice. More

detail on the prevention of hospital-acquired pneumonia associated with other sources may be found in the United States Communicable Disease Control *Guidelines for the Control of Nosocomial Pneumonia*².

1.2.1 Risk-rating Tools

Two risk-rating tools are provided as Attachments to allow for a quantitative assessment of risk associated with both cooling tower systems and warm water systems. Hospitals are encouraged to use these tools and provide feedback. It is expected that the tools will be further refined in coming years to incorporate the findings of research and feedback.

1.3 The Legislative Environment in Victoria

The proclamation of the *Legionella*-related legislation and regulations (*Building (Legionella) Act 2000*, *Health (Legionella) Regulations 2001*, *Building (Legionella Risk Management) Regulations 2001*, *Building (Cooling Tower System Register) Regulations 2001* and *Plumbing*

¹ Department of Human Services Public Health Division November 2001

² *Guidelines for Prevention of Nosocomial Pneumonia* (<http://www.cdc.gov/mmwr/preview/mmwrhtml/00045365.htm>) Centre for Disease Control, January 1997

1 Introduction

(*Cooling Towers*) Regulations 2001) on 1 March 2001 has introduced requirements for:

- Registration of all cooling tower systems in Victoria. Registration enquiries can be made to the Building Control Commission directly on 9285 6498.
- Development and auditing of Risk Management Plans (RMP) for cooling tower systems.
- Construction of all new cooling tower systems in accordance with the Australian Standard (AS/NZS 3666.1).
- Compliance with increased minimum standards of maintenance and testing of both cooling tower systems and warm water systems.

1.4 Ministerial Direction to Public Hospitals

Due to the inherent risks of Legionnaires' disease associated with hospitals with cooling tower systems, the Minister for Health has written to all metropolitan health services and hospital boards of management, directing them to:

- Register their cooling tower systems with the Building Control Commission by 1 June 2001
- Develop risk management plans for each of their cooling tower systems by 30 September 2001.
- Have the plans reviewed and independently audited by September 2002, and annually thereafter.

It is important to note that this requirement extends to all cooling tower systems on hospital owned or controlled land regardless of whether they are operated or controlled directly by the hospital.

It is also recommended that hospitals engage skilled consultants to perform the necessary risk assessment which is part of the development of a risk management plan.

1.5 Private Hospitals

Private hospitals with cooling tower systems are urged to meet the same timelines as public hospitals, on a voluntary basis, in recognition of the risks associated with their patients.

1.6 How Does the Risk Management Plan Relate to Other Public Hospital Quality Improvement Projects?

The risks and consequences of *Legionella* infection in a hospital are one of many potential sources of infection that hospitals need to address through effective infection control and prevention programs.

In April 2000, a comprehensive plan to improve infection control and prevention in hospitals was tabled in Parliament by the Minister for Health. The range of infection control measures announced included the requirement that all hospitals and health services develop infection control strategic management plans.

The *Guide to Developing Risk Management Plans for Cooling Tower Systems* includes a template that can be used in a stand-alone format, but it is recommended that hospitals incorporate the plan into their overall infection control and prevention planning documents.

Risk Management Plans (RMPs) for cooling tower systems in a hospital setting should:

- Form part of an organisations overall integrated approach to risk management, continuous quality improvement and infection control and prevention.
- Be developed and reviewed with input from those responsible for:
 - Cooling tower system operation
 - Infection control.

A team approach is seen as crucial to the success of any *Legionella* control program.

- Be developed, reviewed and endorsed by the Chief Executive or Board of Management.
- Address the five critical risks described in the *Building (Legionella Risk Management) Regulations 2001*:
 - **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 micro-organisms 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 micro-organisms in a cooling tower system.
 - **Deficiencies in the cooling tower system** including deficiencies in the physical design, condition and maintenance of the system.
 - **Location 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.
- Be independently audited annually. The auditor will need to confirm that these critical risks have been addressed in the plan and that there is evidence that the plan has been implemented.

Where a risk management approach to warm water systems is taken, the same integrated approach to overall risk management should be used as is recommended for cooling tower systems.

The RMP when completed should be developed with input from, and be co-signed by, the various hospital stakeholders:

- Management (Chief Executive)
- Facility management
- Infection control practitioner/team.

1.7 Who Is at Higher Risk of Contracting Legionnaires' Disease?

Many patients run a higher risk of acquiring the disease because of their current health status. There may also be staff, contractors, visitors and volunteers at higher risk. Of these people, patients are clearly the most vulnerable. Those patients most at risk include those who:

- Have a weakened immune system (immunosuppressed) including organ-transplant patients or those recovering from organ transplants, patients with HIV/AIDS, and patients receiving systemic steroids
- Are over 50 years of age
- Have chronic underlying disease such as diabetes mellitus, congestive heart failure, chronic lung disease or chronic renal disease.
- Are undergoing treatment for cancer or lung disease.
- Smoke cigarettes (or who have until recently been heavy smokers)
- Consume alcohol heavily.

1.8 Nosocomial Legionnaires' Disease

The incubation period for Legionnaires' disease is generally between two and ten days. A confirmed case of Legionnaires' disease in a patient who has spent more than ten days continuously in the hospital prior to the onset of the illness is considered definitely to have contracted nosocomial (or hospital acquired) Legionnaires' disease. Infection that occurs two to nine days after hospitalisation is possibly nosocomial.

1.9 Hospitals Risk Classification

The *Guide to Developing Risk Management Plans for Cooling Tower Systems* describes hospitals as being of the highest risk in a four-class risk classification system and recommends the highest standards of maintenance be applied.

1 Introduction

1.10 Alternatives to Cooling Tower Systems

In February–March 2001, a survey by the Department of all public hospitals and health services was undertaken to identify the current state of cooling towers in these facilities. The Department has also completed an additional project that explores the issues that should be considered in selecting a cooling system. This project includes a comparison between water cooled systems and air-cooled alternatives. A paper entitled ‘Selecting a Cooling System for Acute Health and Aged Care Facilities’ has been produced and is available from the Department.

It is important to note that:

- Air-cooled systems may be a viable alternative to water cooled systems, particularly in situations of lower heat rejection.
- Replacing a cooling tower system with an air-cooled system eliminates the risk of Legionnaires’ disease, as well as the costs of ongoing maintenance and testing.

1.11 Potential Liability and Prosecution Issues

The hospital or health service may face prosecution and penalties for not complying with relevant legislation such as the Building, Health and the Occupational Health and Safety Acts. There is also a strong likelihood of litigation against the hospital/health service for damages suffered by individuals or companies as a result of the outbreaks of Legionnaires’ disease associated with a cooling tower system.

In addition, there is likely to be considerable media attention focused on the hospital associated with an outbreak of *Legionella*. Public confidence in the hospital concerned and indeed the entire health system may well suffer for a long time after the outbreak has been contained.

Communication strategies (including media relations) should be identified in the organisation’s critical incident risk management plan. These are discussed later in Section 2.

1.12 Key Messages for Hospital Management

1.12.1 Notification of Confirmed Cases of Legionnaires’ Disease

The *Health (Infectious Diseases) Regulations 2001* require the testing laboratory to notify the Department immediately when there is confirmation of a case of Legionnaires’ disease. The Communicable Diseases Unit of the Department investigates all cases to determine the likely source.

1.12.2 Cooling Tower Systems

Cases of Legionnaires’ disease associated with hospitals have illustrated that even when vigorous maintenance procedures are in place:

- The risks associated with cooling tower systems cannot be eliminated, only managed.
- There is a need to consider clinical and patient/visitor usage of the premises, as well as the engineering aspects of managing the risks of the cooling tower system.
- Communication amongst both internal and external stakeholders is critical, as is management of the system for reporting of testing results.
- There is a need to ensure that all agencies develop critical incident management systems and plans.

Introduction of the new legislation and regulations referred to earlier have introduced specific statutory requirements for those who own, manage or control cooling tower systems. These are described in detail in the *Guide to Developing Risk Management Plans for Cooling Tower Systems*.



1.12.3 Warm Water Systems

Warm water systems are described in the *Health (Legionella) Regulations 2001* as being any piped water system, including any thermostatic mixing valve, which is designed to supply water at a temperature between 30°C and 60°C.

Legionella has been detected in many hospital warm water systems³. There have been documented outbreaks of Legionnaires' disease associated with hospital warm water systems reported in Europe. To date, few cases of Legionnaires' disease in Australia have been plausibly linked to warm water systems.

The introduction of the *Health (Legionella) Regulations 2001* referred to earlier has introduced specific statutory requirements for those who own, manage or control warm water systems. In particular, warm water systems must be:

- Disinfected by heat, ultraviolet light, chlorination or automatic low-level chlorination, or any other method approved by the Secretary of the Department.

- Tested for *Legionella* every quarter (unless the method of disinfection is by ultraviolet light, in which case it must be tested monthly).
- Monitored and where an outlet is not used for more than a week, flushed until the temperature of the water has reached the temperature of the system.

However, where a hot water system heats water above 60°C and supplies water to one or more thermostatic mixing valves, the mandatory requirements are as follows:

- Where an outlet is not used for more than a week, it must be flushed until the temperature of the water at the outlet has reached the pre-determined temperature set by the thermostatic mixing valve.
- Every thermostatic mixing valve must be cleaned and maintained at least once in each calendar year.

³ Wadowsky RM, Yess RM, Mezmar L, Wing EJ, and Dowling JN. Hot Water Systems as Sources of *Legionella pneumophila* in Hospital and Non-hospital plumbing fixtures, *Appl and Environ Microbiol* 43: 1104–1110, 1982.

2 Risk Communication

2.1 Management Reporting

To minimise the risks associated with Legionnaires' disease in the hospital, it is essential that there is good communication between:

- Those managing the hospital buildings and particularly the cooling tower or warm water systems
- Water treatment companies
- Infection control teams/practitioners
- Medical staff.

Without good communication, the risks increase significantly. For example, a person with information that a particular cooling tower system has had a high Heterotrophic Colony Count or a positive *Legionella* test may not pass that information onto those responsible for patient care. This could mean that medical staff may not have sufficient suspicion that a person with nosocomial pneumonia is actually suffering from nosocomial Legionnaires' disease and hence not order the appropriate test to confirm Legionnaires' disease. This risk also applies to warm water systems.

Conversely, information that a doctor is treating a patient for confirmed nosocomial Legionnaires' disease may not reach those responsible for operating the cooling tower or warm water system. Such information would alert the responsible person to potential *Legionella* contamination in the cooling tower or warm water system. In the absence of this information, the problem may not be detected for some time and more people may be infected.

Larger hospitals will tend to have a multidisciplinary infection control team that is charged with the task of improving infection

control in the hospital. Such teams are seen as being crucial to the success of an infection control program.

In smaller hospitals, multidisciplinary infection control teams may not exist. The role of infection control practitioners then becomes even more important, to ensure that these issues are brought to the attention of staff in a position to influence decisions and outcomes.

The laboratory results⁴ of environmental surveillance should be notified directly to all of the nominated stakeholders. As soon as a case of nosocomial Legionnaires' disease has been confirmed, that fact must also be communicated to the nominated stakeholders. Adverse results should trigger immediate action by the water treatment contractor, without requiring decisions or confirmation by other parties.

The Victorian WorkCover Authority advises that the elected Health and Safety Representative must be notified of adverse test results. This issue is discussed in more detail in the Communication

⁴ Hospitals are encouraged to consider having the samples taken directly by a NATA accredited laboratory as an independent performance measure to monitor the performance of the water treatment controls.



section of the *Guide to Developing Risk Management Plans for Cooling Tower Systems*.

It is advisable to report regularly to the relevant board of management to allow for adequate oversight of risk management processes. This should occur at least annually. Similarly, it is recommended that there be frequent management reporting of:

- HCC test result trends
- Interventions and actions taken
- Capital improvements including an analysis of the life cycle cost situation where replacement cooling systems are being considered
- Risk-rating trends.

The following charts describe the recommended approach to:

- Reporting of environmental surveillance results (Figure 1)
- Detection of *Legionella* (Figure 2)
- A confirmed case of nosocomial Legionnaires' disease (Figure 3).

It is also important to ensure that any contracts or agreements relating to the maintenance of cooling tower or warm water systems encourage and provide for adequate communication between the parties.

A more detailed publication 'Model Communication Plans for Hospitals—*Legionella* and Legionnaires' Disease' available from the Department deals with this issue in more detail.

2 Risk Communication

Figure 1: Reporting of Environmental Surveillance Results

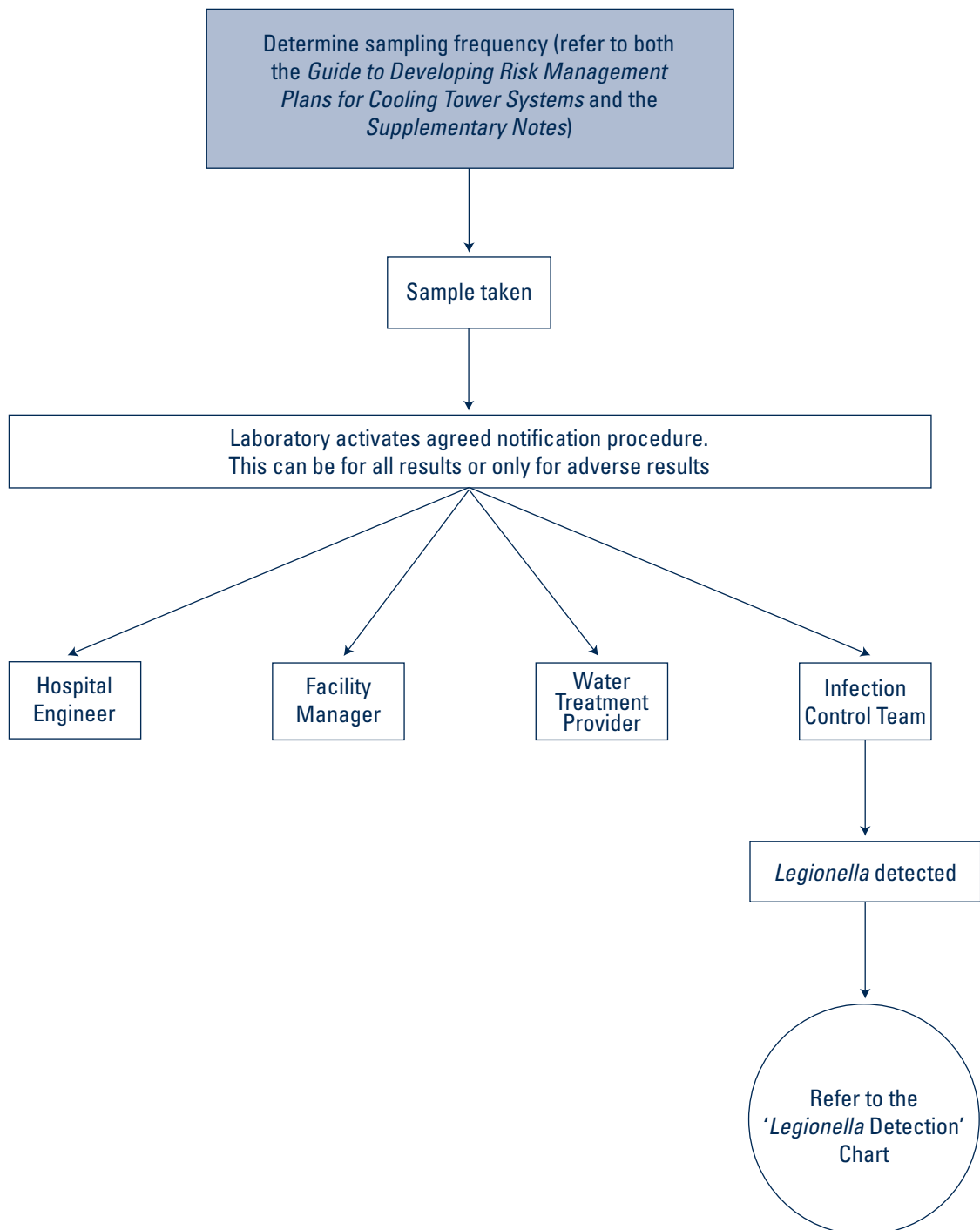
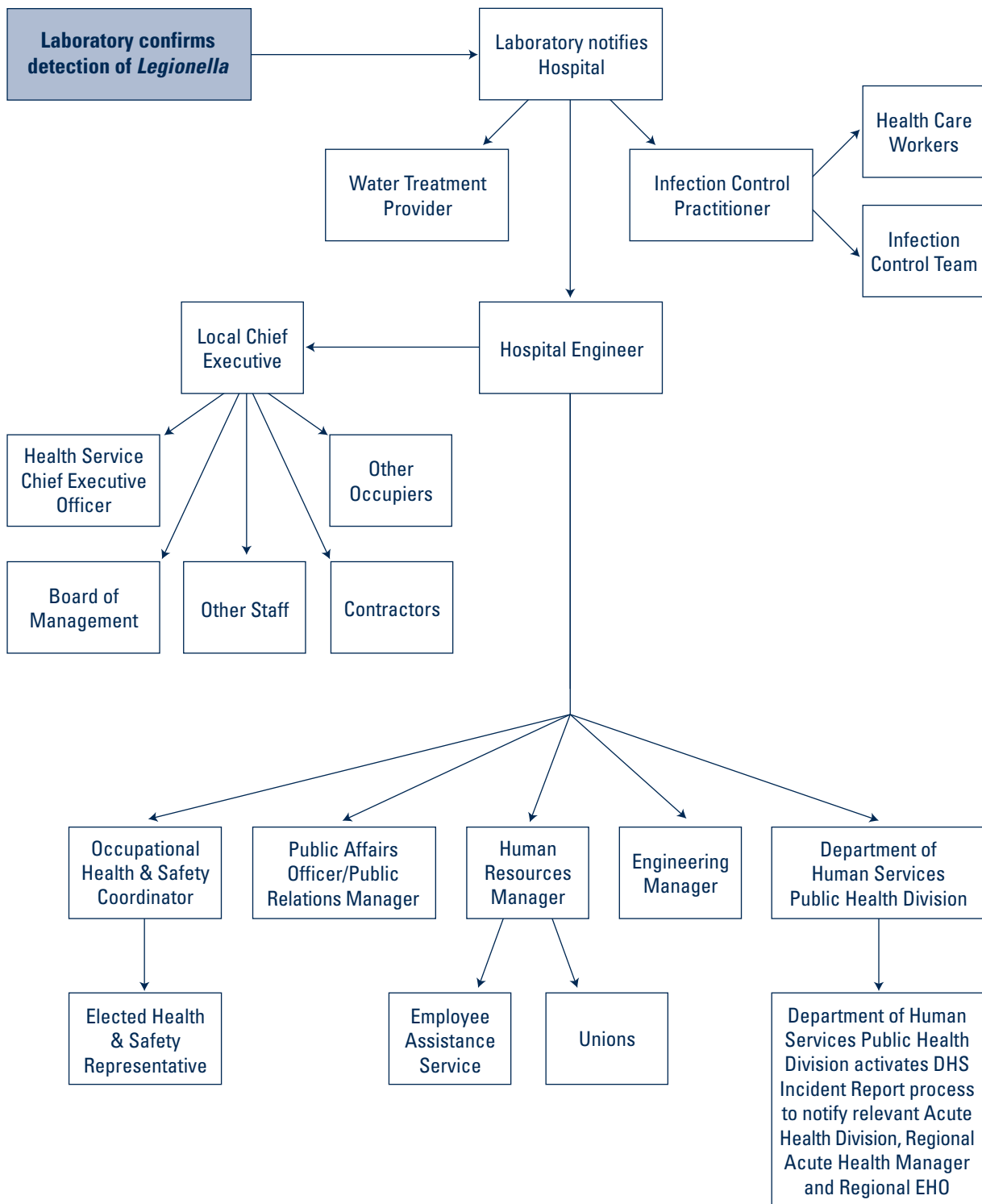
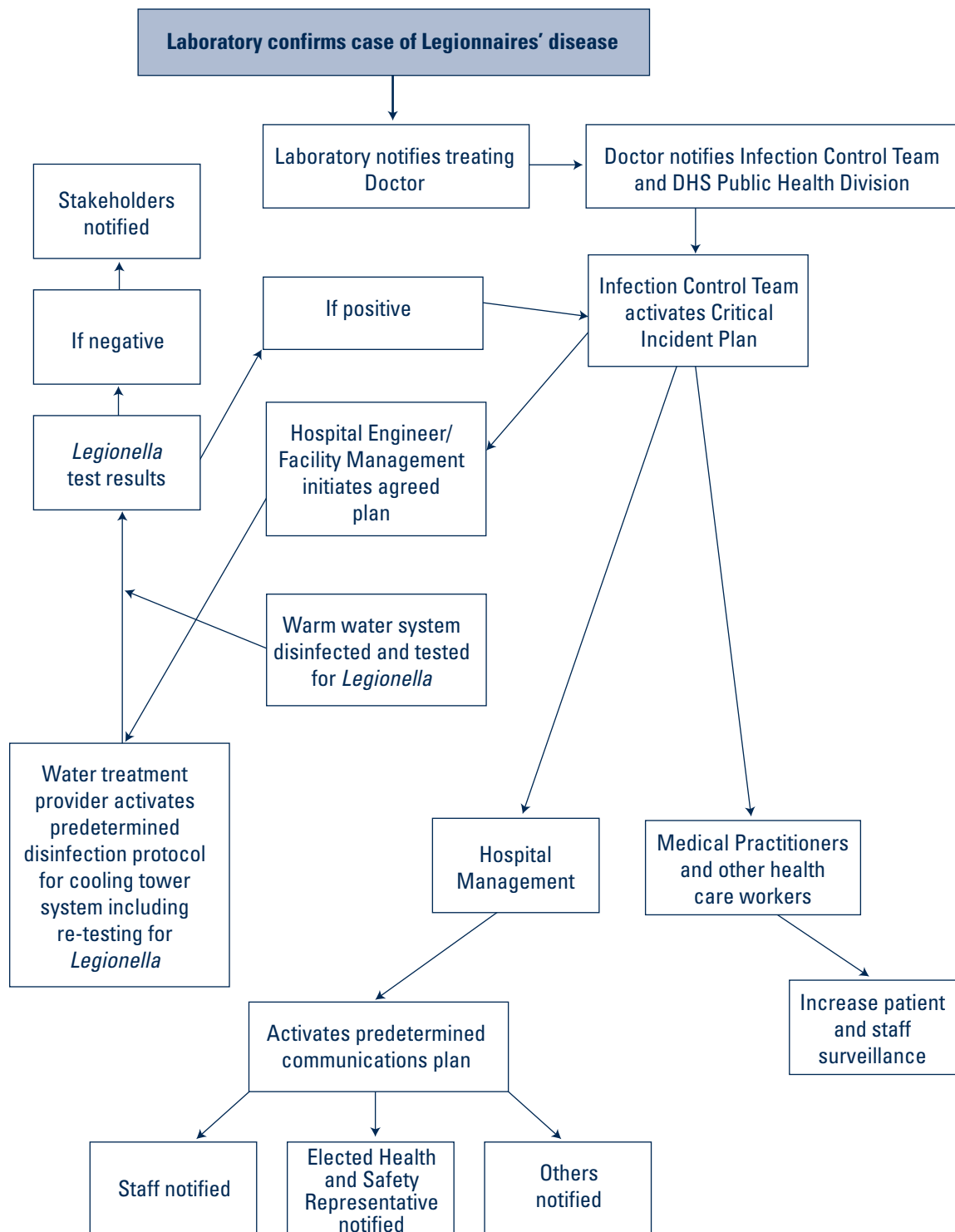


Figure 2: *Legionella* Detection



2 Risk Communication

Figure 3: Confirmed Case of Nosocomial Legionnaires' disease



2.2 Critical Incident Response Plans

Critical incident response plans should be developed to clearly identify the lines of communication, responsibilities of key staff (management, infection control, occupational health and safety, engineering, public relations, patient complaints officer) and the extent of their authority to act upon adverse test results.

The authority to act upon a positive *Legionella* test or a case of nosocomial Legionnaires' disease should include clear protocols that provide for the:

- Water treatment provider to act immediately
- Water treatment provider or testing laboratory to re-sample the cooling tower water at the appropriate time
- Notification of patients
- Notification of staff
- Notification of Health and Safety Representative(s)
- Notification of the Departments' Environmental Health Unit
- Preparation of media releases and statements.

Hospitals are strongly encouraged to prepare for the media and public interest that may follow detection of *Legionella* or a case of nosocomial Legionnaires' disease.

3 Highlighting and Minimising the Risks for Hospitals with Cooling Tower and Warm Water Systems

3.1 System Improvement Plans

As part of a comprehensive review of the risks associated with a particular system (that is a cooling tower or warm water system), a plan must be developed to replace components of the system that are inadequate or fail to meet the relevant Australian Standards. This could include the removal of redundant piping or the upgrading or replacement of an existing system. Decisions on issues such as the replacement of a cooling system may be supported by a life cycle costing of the various options.

The next step is to install replacement components that can reduce the overall system risk, by helping to maintain adequate and consistent control over the system.

The completion of such an improvement plan should be noted in the mandatory review of the cooling tower system risk management plan.

Discussions are currently being held regarding the issue of testing of high risk patients for Legionnaires' disease and recommendations on this issue will be communicated to hospitals.

The *Legionella* infection control critical incident plan should be activated when a case of nosocomial Legionnaires' disease is suspected or confirmed.

3.2 Patient Surveillance

Cases of nosocomial Legionnaires' disease may not be recognised unless *Legionella* infection is considered during the provisional diagnosis.

Multiple cases may be caused by the same source before the problem is recognised and the source treated.

4 Cooling Tower Systems

4.1 Risk Identification

The *Guide to Developing Risk Management Plans for Cooling Tower Systems* describes the critical risks in detail, but there are a number of risks that are either peculiar to hospitals, or more likely to be a significant issue.

The critical risks are:

- Stagnant water
- Nutrient growth
- Poor water quality
- Deficiencies in the cooling tower system
- Location and access.

There are three other additional risk factors that reflect particular risks associated with hospital cooling tower systems. These are:

- Patient mix
- Patient management practices
- Risk communication.

4.1.1 Stagnant Water

Hospitals are often constructed or redeveloped in stages, over an extended time period. As a result, there are often considerable sections of redundant or disused pipework ('dead legs'), still connected in some way to the main pipe network and the cooling tower system. These pipes may contain stagnant water and encourage bacterial growth.

A major component of risk management plans in hospitals should be documentation of a strategy to progressively locate and remove 'dead legs' from cooling tower systems. This would include:

- Removal of easily accessible 'dead legs'.
- Eliminating 'dead legs' by making them active through pipe redesign.

- Commitments to remove 'dead legs' during the redevelopment of a hospital.
- Involvement of infection control staff in construction planning for new hospital areas, to 'design out' dead legs.

A higher level of maintenance and environmental surveillance must be applied until 'dead legs' are removed.

4.1.2 Nutrient Growth

Nutrient growth can be a particular issue with hospitals because of:

- The relatively high frequency of construction associated with many hospital sites. Construction on or nearby the site is likely to generate considerable dust. This dust has the potential to enter the cooling tower system, contribute nutrients that feed bacterial growth and reduce biocide efficiency. It can be addressed by an active program to reduce the generation of dust during construction and by short term measures such as increased system cleaning frequency.
- The location of many hospitals on or close to major roads, contributing to high dust levels in the cooling tower system. This can be addressed by increased system cleaning frequencies and the installation of sidestream filtration to remove suspended solids.

4 Cooling Tower Systems

4.1.3 Poor Water Quality

Hospitals may be at a higher risk of poor water quality in their cooling tower systems because of the potentially higher nutrient loading described in 4.1.2.

This can only be addressed by a comprehensive water treatment program supported by the use of adequate control measures such as the frequent, and preferably, continuous monitoring of key parameters.

4.1.4 Deficiencies in the Cooling Tower System

It is critical to comprehensively review all aspects of the system to identify all problems before starting development of a risk management plan.

It is also important to note the cooling tower systems older than 25 years are more likely to have inherent design or structural problems that may encourage *Legionella* growth. Higher risks should be attributed to towers and systems as they age.

It is essential that cooling tower systems in hospitals have basic components such as timer or feedback controlled dosing pumps, automated bleed-off systems and drift eliminators. These devices are described in more detail in the *Guide to Developing Risk Management Plans for Cooling Tower Systems*.

4.1.5 Location and Access to Cooling Towers

The risk of exposure to *Legionella* and cases of Legionnaires' disease may increase where high risk patients have access to areas where there is a direct air path from a cooling tower.

Many hospitals have balconies or roof top areas that patients may access during convalescence. Such areas can be close to, or in direct line of sight of, another building with a cooling tower. Any drift from the tower could be carried to a patient in such

areas, given the appropriate wind speed and direction. The likelihood of this happening is greater in periods of higher humidity, where aerosols are less likely to evaporate at the cooling tower.

Note that although the tight configuration of most hospital sites means that aerosols from a particular tower could reach many parts of the site, it is reasonable to assume that the towers in direct line of sight from a balcony or rooftop seating area represent a much higher risk than other towers.

Patient management can reduce the overall risks relating to cooling tower systems by considering excluding high risk patients from areas where cooling tower system exhausts are in close proximity. Areas such as balconies or roof tops should be reviewed for likely exposure to cooling tower system drift, with consideration given to excluding those patients at highest risk.

4.1.6 Patient Mix

The risk of Legionnaires' disease increases with the vulnerability of the people who may be exposed to the aerosols from a cooling tower. This may be addressed by strategies such as rigorous water treatment, system improvements and environmental surveillance.

4.1.7 Patient Management Practices

Patient management in the context of cooling tower systems relates to minimising the contact that high risk patients may have with aerosols from nearby cooling towers.

4.1.8 Risk Communication

As discussed earlier, good communication protocols are critical to ensure information relating to *Legionella* and Legionnaires' disease reaches the appropriate people in a timely manner.

4.2 Operational Programs for Hospital Cooling Tower Systems

The potential for high risk patients with the conditions listed earlier (Section 1.7) to become infected if *Legionella* contaminated aerosols are released from a hospital-based cooling tower are significant.

All hospital-based cooling tower systems should be regarded as being high risk, that is Category A as described in the *Guide to Developing Risk Management Plans for Cooling Tower Systems*. This should be the case whatever the system's condition.

The *Guide* recommends that Category A systems are maintained with:

- Weekly inspection
- Fortnightly service
- A minimum of a monthly Heterotrophic Colony Count (HCC) test
- Six-monthly cleaning (more frequently where environmental contamination is a problem).

4.3 Minimising the Risk

Hospitals must take action to minimise the overall risk associated with their cooling tower system. In most cases, the only way this can practically be done is via some form of capital investment to:

- Upgrade the tower
- Remove 'dead legs'
- Improve the level of control of water treatment and quality.

Minimising access to high risk locations as described in Section 4.1.5. should also form part of this strategy.

Ultimately, the risk can only be eliminated if the cooling tower system is removed. In most hospitals, this is possible where the water cooled system can be replaced by an air cooled system.

4.4 Environmental Surveillance

Environmental surveillance is the process of monitoring the cooling tower water for bacterial levels as either:

- An indicator of the level of control of water quality, in the case of HCC
- A performance indicator, in the case of *Legionella* testing.

Bacterial test results should be routinely reported to the key stakeholders described in Section 2.

Where *Legionella* is detected in three consecutive samples of the same cooling tower system, the *Health (Legionella) Regulations 2001* require immediate notification to the Department of Human Services.

4.5 Frequency of *Legionella* Testing

Given the high risk nature of hospital cooling tower system operation, a sampling protocol and frequency for *Legionella* testing is a critical part of managing the risks. The *Guide* recommends that testing for *Legionella* in hospitals be performed at least every month, to provide a performance measure of the system.

4.6 Comparing Risks Associated with Different Cooling Tower Systems

Many hospitals have multiple cooling tower systems on several sites. Decisions need to be made about priorities for upgrade or replacement of individual units.

This should be based on an assessment of the relative risks of each system. One tower may represent a higher risk of generating aerosols containing *Legionella* than another, or where that risk is equal, one may pose a higher risk of infecting a highly susceptible patient.

4 Cooling Tower Systems

These decisions can be made using the qualitative data obtained from the risk management plan process, but it may be useful to have a quantitative tool to rate individual cooling tower systems. Such a tool can also measure the impact of particular actions and monitor the overall risk management process.

A risk-rating tool is provided in Attachment 1. It can be used during the development of a risk management plan and again after any significant intervention or event.

Note that the Hospital Risk-rating tool is purely a guide as to *comparative* risks between two or more cooling tower systems. Regardless of the score obtained, any cooling tower system associated with a hospital must be treated as high risk, with corresponding maintenance programs and environmental surveillance.

5 Warm Water Systems

5.1 A Risk Management Approach to Warm Water Systems

Warm water systems in hospitals must be well managed to reduce the risk of the system becoming a source of Legionnaires' disease.

This is because:

- Inpatients (at relatively high risk of contracting Legionnaires' disease) may be exposed to *Legionella*-contaminated aerosols from showers within the hospital.
- Hospital warm water systems are generally large and complex.

As a result, even though Victorian law does not require the development of a risk management plan to address the risks posed by a warm water system, the Department recommends that hospitals develop risk management plans as a way to review and address the risks of such systems.

The development of risk management plans for warm water systems ought to follow a similar approach to that outlined for cooling tower systems. This would include identifying, evaluating and treating those risks.

5.2 Risk Identification

There are a number of key risks associated with hospital warm water systems:

- Stagnant water
- Growth of *Legionella*
- Risk communication
- Age and complexity
- Patient mix
- Patient management.

5.2.1 Stagnant Water

Water within the system may stagnate because a particular outlet is not used for more than a week. Facilities management can have a direct impact on

the risk of Legionnaires' disease outbreaks. For example, in most hospitals there are areas that may have water outlets such as showers that are not used for significant periods of time. These areas may change from time to time, as wards or patient bathroom areas are disused and re-opened. Showers in such areas are more likely to contain *Legionella* than those in areas where outlets are in regular use.

The *Health (Legionella) Regulations 2001* require that any outlet not in use for 7 days or more must be flushed at full flow. The period of flushing must be sufficient to remove all stagnant water leading to the outlet and should be continued until the temperature at which the system is set is reached at the outlet.

This risk can be addressed by:

- Compliance with the *Health (Legionella) Regulations 2001* by flushing all such outlets once a week.
- A systematic program to locate and eradicate 'dead legs' from the warm water system. This requires confirmation as to whether the existing plans of the system are accurate and knowing the location of areas where water is allowed to stagnate (storage tanks, unused plumbing pipe sections or infrequently used taps or showers).

5 Warm Water Systems

As with cooling tower systems, seize opportunities to remove 'dead legs' during hospital redevelopment.

5.2.2 Growth of *Legionella*

Legionella may enter the system through the cold water supply and contaminate the system.

In the case of warm water systems that circulate warm water and do not use thermostatic mixing valves, the risk of *Legionella* growth must be addressed by disinfection, combined with regular *Legionella* testing as a performance measure.

Disinfection usually involves the use of one or more methods such as monthly heat disinfection, monthly chlorination, continuous low-level chlorination or UV treatment. Combinations of different disinfection methods should be considered as a way of minimising the risks.

Where thermostatic mixing valves are used, the risk of *Legionella* growth must be addressed by the annual valve cleaning and maintenance.

A program to monitor temperatures throughout the system can also assist in understanding of the system and may consequently allow actions to be taken to reduce the risks.

The hospital critical incident plan must deal with the potential for the system to become contaminated with *Legionella* and should describe in detail the procedure to be followed in that event.

5.2.3 Risk Communication

As discussed earlier, good communication protocols are critical to ensure information relating to *Legionella* and Legionnaires' disease reaches the appropriate people in a timely manner.

5.2.4 Age and Complexity

Older pipe networks are more likely to support *Legionella* because of problems such as corrosion. This risk needs to be considered in a risk assessment.

There is also an increased risk associated with a highly complex and lengthy network of pipes and heaters, when compared to simpler, shorter pipe systems.

These factors can only be addressed by:

- Comprehensive reviews of the system including the examination and replacement of key components where appropriate.
- More intensive environmental surveillance or disinfection systems.

5.2.5 Patient Mix

The risk of Legionnaires' disease increases with the increasing vulnerability of the people who may be exposed to the aerosols from a shower. This may be addressed by strategies such as increased *Legionella* testing and rigorous disinfection.

5.2.6 Patient Management

Patient management in the context of warm water systems relates to minimising the contact that high risk patients may have with showers from a contaminated system, until such time as the contamination has been eliminated.

5.3 *Legionella* Testing

5.3.1 Regulatory Compliance

The *Health (Legionella) Regulations 2001* require that in the case of hospitals with warm water systems which provide **overnight accommodation**:

- At least two samples must be tested for *Legionella* every **quarter** for at least 12 months (minimum of 8 samples per year).
- If *Legionella* is not detected in any sample during the previous 12 months, at least two samples may be taken every 6 months for so long as *Legionella* remains undetected in the system (minimum of 4 samples every year).

However, where the method of disinfection in such facilities is by **ultra-violet light**, at least two samples must be tested for *Legionella*:

- At least monthly for 12 months (minimum of 24 samples per year)

- If *Legionella* is not detected in any sample during the previous 12 months, testing may be performed every 3 months, for so long as *Legionella* remains undetected in the system (minimum of 8 samples per year).

Health facilities such as day procedure centres, which do not provide overnight accommodation, are only required to sample for *Legionella* when the method of disinfection is by **ultra-violet light**. In such cases testing is required:

- At least **monthly** for 12 months (minimum of 12 samples per year).
- If *Legionella* is not detected in any sample during the previous 12 months, testing may be performed every 3 months for so long as *Legionella* remains undetected in the system (minimum of 4 samples per year).

Note that these *Legionella* testing requirements do not apply to hot water systems supplying water above 60°C directly to multiple thermostatic mixing valves.

5.3.2 Sampling Protocol

In most warm water systems there are few if any control measures, other than monitoring the temperature of the water during heat disinfection or the level of chlorine in a continuous chlorination system. This contrasts with cooling tower systems, where there are typically a number of control measures that are relatively easily measured. As a result, the importance of *Legionella* testing as a performance measure becomes even more critical.

As stated above, the *Health (Legionella) Regulations 2001* require a minimum frequency of *Legionella* testing. However, the Department recommends that:

- The sampling frequency be increased to gain a more representative measure of the performance of the systems' performance.
- A sampling protocol be developed.

The Department recommends the following basic components be included in such a sampling protocol:

- Samples are taken of the water as it leaves showers and taps.
- Sampling points are varied each time, so as to eventually take samples from all parts of the facility.
- Higher weighting is given, resulting in increased sampling frequency, to high risk sites such as transplant and oncology units.
- A sampling protocol should take into account the age, complexity and number of warm water systems and require additional samples where these factors point to increased risk.
- Additional attention should be given to patient treatment areas with showers that are furthest from the heating or disinfection points.
- Sampling frequency be specified in detail.

In relation to the sampling frequency, the Department recommends that:

- In the case of hospitals with less than 500 beds, a minimum of at least 10 samples is taken over a six-month period, regardless of the method of disinfection.
- In the case of hospitals with more than 500 beds, a minimum of two samples per 100 beds is taken over every six-month period, regardless of the method of disinfection.

5.4 Comparing the Risk Associated with Different Warm Water Systems

Attachment 2 is a risk-rating tool that can be used to assess the risks of one warm water system against another on the same or different sites.

As with cooling tower systems, all warm water systems in a hospital must be regarded as having a high potential for the growth of *Legionella* and for cases of Legionnaires' disease in high risk patients. The risk-rating tool is purely a guide as to the comparative risks between two or more warm water systems. It may assist with the tracking of improvements over time and in deciding how best to spend capital to minimise the risks.

Glossary

Aerosols

Microscopic droplets or particles suspended in the air such as fog, smoke, or fine sprays.

Algae

Multicellular plants occurring in water or moist ground that contain chlorophyll, but lack true stems, roots and leaves.

Anti-corrosive agent

A chemical designed to inhibit or prevent corrosion in a cooling tower system.

AS/NZS 3666

Australian/New Zealand Standard 3666: Air handling and water systems of buildings – Microbial Control. At present, there are three parts to this standard:

- Part 1: Design, installation and commissioning
- Part 2: Operation and maintenance
- Part 3: Performance-based maintenance of cooling water systems.

Audit

An inspection and verification of a Risk Management Plan.

Approved auditor

A person qualified to audit Risk Management Programs for cooling tower systems. Under the *Building (Legionella) Act 2000* definition, this means a person holding a current certificate issued under section 75GB of the Act.

Automated biocide dosing device

An automated device that discharges a measured amount of biocide to the water in a cooling tower system.

Automated bleed-off systems

Automatic discharge of a portion of the recirculating water in a cooling tower system, due to a build up of salts and other matter.

Bacterial testing

Laboratory-based testing to establish the concentration of bacteria in water.

Biocide

A physical or chemical agent that is capable of killing micro-organisms including *Legionella*.

Biodispersant

A chemical compound added to recirculating water within a cooling tower system to penetrate and break down biofilm, which may be present on the wetted surfaces of the cooling tower system.

Biofilm

A surface layer of micro-organisms and other organic matter. It is usually combined with particulate matter, scale and products of corrosion.

CFU/mL

A unit of measurement used in microbiology to gauge the number of micro-organisms present in a water sample. It is measured by the number of colony forming units (CFU) present in a millilitre of the water sample.

Chlorine compatible biodispersant

A biodispersant that does not react with or neutralise the chlorine that may be present in the water of a cooling tower system.

Clean

Means to render free from visible sludge, foam, slime (including algae and fungi), rust, scale, dirt, and any deposit or accumulation of impurities or other foreign material.

Cooling tower

A device for lowering:

- The temperature of recirculated water by bringing the water into contact with fan forced or fan induced atmospheric air.
- The temperature of water, a refrigerant or other fluid in a pipe or other container by bringing recirculated water and fan forced or fan induced atmospheric air into contact with the pipe or container.

This term does not include evaporative coolers.

Cooling tower system

A 'cooling tower system' is defined as:

- A cooling tower or a number of interconnected cooling towers that use the same recirculating water.
- Any machinery that is used to operate the tower or towers.
- Any associated tanks, pipes, valves, pumps or controls.

Dead legs

Lengths of pipe ending at a fitting, through which water flows only when the fitting is opened. These extra areas of the cooling tower contain stagnant water, which can cause a build up of bacteria and sludge in a recirculating system, contaminating the system.

Disinfection

Application of a chemical agent or physical process that destroys pathogenic micro-organisms but not their spores.

Drift eliminator

A grid or grill-like arrangement of physical barriers located before the cooling tower exhaust, designed to minimise the drift emanating from a tower. Efficient eliminators should restrict the drift loss to less than 0.02 per cent of cooling tower recirculating water.

Evaporative condenser

These units are similar in principle and in operation to cooling towers. Water is distributed directly over a bank of pipes, which contain circulating refrigerant or other fluids, but there is no fill as in cooling towers. These systems will have to be registered under the *Building (Legionella) Act 2000* as cooling towers.

Evaporative cooler

Evaporative coolers are also known as evaporative air conditioners, evaporative air coolers, and 'swampies'. They use water to cool outdoor air for use indoors. Evaporative cooling is based on the same principle that the human body uses to cool itself down, with perspiration being evaporated from the skin by circulating air. Warm outside air is drawn into the unit through a series of wetted filter pads. Energy is removed from the air by the water causing a drop in temperature. The energy consumed by the water turns the water into vapour, causing increased humidity in the air. The cool, humidified air is discharged indoors, where it is blown over the body causing additional evaporation or drying of perspiration from the skin and lowering of the body temperature. Doors and windows must be open to force this cooled air through the building.

Fill

The structure located at the top of a cooling tower that is designed to create an extensive wetted surface area through which air passes.

Flushing

The process of draining a cooling tower, cleaning the basin, associated pipework and other parts of the tower.

Heterotrophic colony count (HCC)

An estimate of the number of viable units of bacteria per millilitre of sample water, using a laboratory-based method such as the pour plate, spread plate or membrane filter test (also known as total bacteria count, total plate count or viable bacteria count test).

***Legionella* count**

Refers to the number of *Legionella* colony-forming units (CFU's) found in one millilitre of the water sample. The minimum level of detection is deemed to be 10 CFU/mL as per Australian/New Zealand Standard 3666: Air handling and water systems of buildings – Microbial Control. A count of less than 10 CFU/mL is regarded as not detected.

Nutrient

Any food source providing sustenance to an organism.

pH

A term used to describe the hydrogen-ion activity of a system that provides a measure of the acidity or alkalinity of water, on a scale (range) between 0 and 14. Pure water has a pH of 7, acid solutions have a pH less than 7, and alkaline solutions have a solution greater than 7. For effective use of chlorine as a disinfectant, pH should be maintained in a range of 7.0 – 7.8. Above this, and up to pH 8.5, bromine should be used if the pH cannot be easily adjusted.

Plume

The visible discharge of air and moisture from a cooling tower. This can include condensation and aerosols. Usually most visible on cool mornings as steam emanating from the top of a system.

Recirculating water

Water that is recirculated through the cooling tower system.

Risk management plan (RMP)

A risk management plan is described in the Australian and New Zealand Standard 4360: 1999 Risk Management (AS/NZ 4360) as a working document that:

- Establishes the context of what type of risk is to be managed
- Identifies the risks
- Analyses the risks
- Evaluates the risks
- Sets out measures for controlling or treating the risk
- Monitors and reviews the control measures
- Incorporates easy communication and consultation into its structure.

Scale

A crystalline deposit that can form on surfaces or pipework within the cooling tower system due to a build up of minerals (usually calcium carbonate). The water of the cooling tower system must be alkaline for scale formation to occur.

Scum

A film of impurities that rises to or is formed on the surface of a liquid, or is formed upon the surface of a solid object (such as the structure of a cooling tower).

Sludge

A build up of sediment that can be found in the basin or pipework of a cooling tower system.

Stagnant water

Pockets of motionless water within the cooling tower system that can allow micro-organisms to grow.

Spray drift

Aerosol emissions from cooling towers due to the fan forced or extracted air exiting the cooling tower.



Thermostatic mixing valves

Valves that mix the hot and cold water of the system to provide water at a predetermined temperature. These valves can overcome the necessity for long-term storage of tepid water and should be located close to the point of use.

Warm water system

A piped water system, including any thermostatic mixing valve, designed to supply water at a temperature of between 30°C and 60°C.

Attachment 1

A Risk-rating Tool for Hospital Cooling Tower Systems

Purpose

This risk-rating tool compares the relative risks of different cooling tower systems on the same or different sites. The tool can also be used to measure the impact of particular interventions and improvements either:

- Before works have been undertaken, to decide on which action might have the most impact.
- Over time, as a measure of risk reduction in a particular system.

The risk-rating process can be repeated during the development of a risk management plan and after any significant event such as:

- Completion of strategies outlined in the plan
- Adverse bacterial testing results
- Adverse chemical or water testing results.

Important note:

The risk-rating tool is not intended to compare the risks of cooling tower systems between different organisations. It has been developed to allow an organisation to rate their cooling tower systems and make more informed decisions about the potential risk reduction associated with an upgrade or replacement. It can also be used to compare the risks associated with a particular system over time. It is intended that the risk-rating tool will be upgraded as new information becomes available and feedback is obtained from users.

The tool should be used, as far as possible, by the same person or organisation to avoid different perceptions affecting the comparison.

Hospitals should be aware of the potential for these ratings to be obtained in a Freedom of Information request and, as a result, a note explaining the purpose of the rating tools should be applied to each page.

Critical Risks and Australian Standards

The *Guide to Developing Risk Management Plans for Cooling Tower Systems* describes the five critical risks that are prescribed in the *Building (Legionella Risk Management) Regulations 2001*:

- Stagnant water
- Nutrient growth
- Poor water quality
- Deficiencies in the cooling tower
- Location and access.

These critical risks have been distilled from the risk factors described in Australian Standard AS/NZS 3666.3.

This tool has been based on the risk factors contained in AS/NZS 3666.3. These risk factors are shown on the following table.

Table 1 – Australian Standards AS/NSZ 3666.3

AUSTRALIAN STANDARD AS/NZS 3666.3	
RISK AREA	RISK FACTOR
Opportunity for multiplication	Presence of water (especially if stagnant e.g. dead legs or system not in use)
	Presence of Legionella spp. *
	Legionella spp. Concentration*
	Presence of other heterotrophic bacteria
	Presence of protozoa and algae
	Presence of nutrients
	System size [(surface area available for biofilm development (compared with water volume)]
	Presence of biofilm
	Water quality: <ul style="list-style-type: none"> • Cleanliness* • pH* • presence of corrosion products* • presence of scale and fouling • conductivity/TDS* • control limits out of range* • suspended solids • control of water treatment chemicals, bleed*
	Water temperature*
	Characteristics of make-up water
	Direct sunlight
	Physical condition of system*
	Microbial control program
	Mechanism for dissemination
Aerosol generation	
Mode of operation: <ul style="list-style-type: none"> • intermittent operation • seasonal usage 	
Drift elimination	
Aerosol dispersion	
System location (distance to other cooling water systems, air intakes and passers by)	
*Risk factor identified as a key performance indicator	

Additional Risk Factors

In addition to these risk factors, there are several others that reflect particular risks associated with hospital cooling tower systems. These are:

- Patient mix
- Patient management practices
- Risk communication.

Scoring

The risk-rating process requires an assessment to be made for each risk factor and a score given to each assessment, based on predetermined rules. These rules include a maximum score for each risk factor. Within the risk factor there are one or more observations or possible risk assessments. Each of these observations has a corresponding sub-score. Select the risk assessment that matches the observations of the cooling tower system. For each risk factor, add up the sub-scores. Where this score exceeds the maximum score, only the maximum score is to be included in the overall risk-rating.

These individual scores are then added to arrive at an overall score. The maximum score possible is 326. **The higher the score, the higher the risk.**

Testing Results

The main variables of the risk-rating tool are:

- **Presence of Legionella.** The detection of *Legionella* in a sample of the cooling tower water has a substantial impact on the rating for a lengthy period of time. Detection of *Legionella* at any level attracts a high score.
- **Legionella concentration.** This is the number of organisms detected in a sample. A high concentration in a positive test over the previous year attracts a higher score than a lower concentration.

- **Presence of other heterotrophic bacteria.** This is the result of the Heterotrophic Colony Count test. As for *Legionella*, a high concentration attracts a higher score than a lower score. Any result over the regulatory limit for action of 100,000 CFU/mL in the last year attracts a higher score because it shows that the system is not under effective control.
- **Water quality.** Results that indicate that the system is not under control attract a high score.

Most of the risk-rating tool elements are relatively static and not subject to change, unless there is intervention such as installing new equipment.

It is possible for a system to have a higher rating one year when compared to a previous year, if there is a significant deterioration in these variable elements.

'Dead Legs'

The risk-rating tool makes reference to assessing the length of 'dead legs' in the system. Most hospitals with complex pipe networks are likely to have extensive lengths of such pipes. As a guide, the following information is provided:

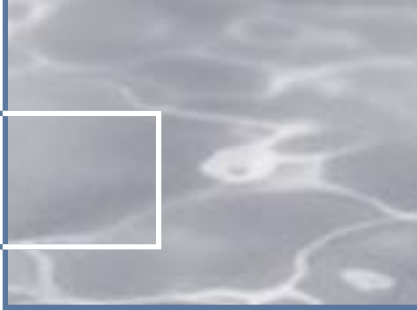
- A 'dead leg' is any length of pipe longer than the diameter of the main pipe extending off the main branch.
- A small length of 'dead legs' can be regarded as 'dead legs' of total length of less than one metre in no more than two locations.
- Extensive lengths of 'dead legs' can be regarded as 'dead legs' of total length of greater than one metre or 'dead legs' in more than two locations.



RISK AREA	RISK FACTOR	RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE
Opportunity for Multiplication	Presence of stagnant water	Key Performance Indicator Water circulates through the system continuously. There are no 'dead legs'.	0	20		
		Recirculating pump with timer not installed	5			
		System sometimes idle for more than a month	6			
		Some small lengths of 'dead legs'	7			
		Extensive lengths of 'dead legs'	10			
	Presence of Legionella	Key Performance Indicator Legionella should not be detected in any sample	0	30		
		Legionella detected in the previous 12 to 24 months	5			
		Legionella detected in the previous 12 months	15			
		Legionella detected in the previous 3 months	25			
		No monthly Legionella testing	30			
	Legionella concentration	Key Performance Indicator Legionella should not be detected in any sample	0	10		
		Legionella detected previously at greater than 1000 Colony Forming Units per millilitre (CFU/mL)	10			
	Presence of other heterotrophic bacteria	Key Performance Indicator No result over 100,000 CFU/mL with monthly testing	0	20		
		At least one result over 100,000 CFU/mL during last 12 to 24 months	2			
		At least one result over 100,000 CFU/mL during last 12 months	5			
		At least one result over 500,000 CFU/mL during last 12 months	10			
		At least one result over 500,000 CFU/mL during last 6 months	15			
		At least one result over 500,000 CFU/mL during last 3 months	20			
	Presence of protozoa and algae	Key Performance Indicator No visible algae or slime present on wetted surfaces such as the tower fill	0	8		
		Cloudy water	3			
Extensive algal growths and highly cloudy water		5				
Slime present on tower fill during inspection		5				
Presence of nutrients	Key Performance Indicator Nutrient levels in the cooling tower system should be minimised through measures such as full protection of wetted surfaces from sunlight	0	5			
	Basin or other wetted surfaces exposed to sunlight	5				

Attachment 1

RISK AREA	RISK FACTOR	RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE	
Opportunity for Multiplication	System size [(surface area available for biofilm development (compared with water volume)]	Key Performance Indicator The smaller the ratio of wetted surface area to water volume, the lesser the risk. As a minimum, a review of the system design and performance must include the aspect of whether a series of interconnected towers is the most appropriate design. For example, would the risk be reduced if they were replaced with a lesser number of larger towers?	0	3			
		System consists of small single tower with short pipe lengths (high wetted surface area to water volume ratio)	3				
		Multiple towers or cells within one system	3				
	Presence of biofilm (in the tower fill)	Key Performance Indicator No slime present on the wetted surfaces such as the tower fill. Accumulation of slime is controlled by continuous low level of biodispersant applied in combination with a corrosion inhibitor	0	10			
		Biodispersant not used on a regular continuous basis	10				
		Tower fill slimy	10				
	Water quality	Cleanliness	Key Performance Indicator No visible algae or slime	0	10		
			Cloudy water	3			
			Extensive algal growths and highly cloudy water	5			
			Tower fill slimy. To test this expose a section and note the presence of a coating on the fill material	5			
			Side-stream filter not used to reduce environmental contaminants (solids)	3			
			System located in area where environmental contamination is likely	5			
		pH control	Key Performance Indicator ph is automatically controlled within target range determined based on requirements of the biocide in use to kill Legionella	0	5		
			No automated pH control fitted	2			
			No pH target range determined	5			
			pH often outside pre-determined target range	5			
			pH rarely outside pre-determined target range	2			
		Presence of corrosion products	Key Performance Indicator Corrosion is controlled within target range of less than 5 milli-inches per year. Best practice is electronic measurement of corrosion.	0	10		
			Visible red-brown colour or sludge in the tower basin indicating products of corrosion	10			
			Corrosion monitored using corrosion coupons (not electronic)	4			
No corrosion monitoring performed			10				
	Presence of scale and fouling	Key Performance Indicator No visible scale or fouling in basin	0	7			
		Visible scale or fouling in basin	7				



RISK AREA	RISK FACTOR		RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE
Opportunity for Multiplication	Water quality	Conductivity/ Total Dissolved Solids (TDS)/ bleed	Key Performance Indicator Conductivity does not exceed a pre-determined level appropriate to the biocide in use. Best practice involves the use of an automated conductivity controller	0	10		
			No automated conductivity control fitted	5			
			Conductivity often outside predetermined target range	5			
			Conductivity rarely outside predetermined target range	3			
			Automated bleed-off device fitted and linked to conductivity meter	0			
			Automated bleed-off device fitted but not linked to conductivity meter	3			
			No automated bleed-off device	8			
		Control limits out of range	Key Performance Indicator Control limits set and monitored at least monthly for all measurable parameters	0	4		
			No control limits set for all measurable parameters	4			
			Control limits often outside pre-determined target range	3			
			Control limits rarely outside pre-determined target range	2			
		Suspended solids	See Water Quality—Cleanliness				
		Control of water treatment chemicals	Key Performance Indicator Where oxidising biocide used, feedback controlled automated dosing device fitted. Where non-oxidising biocide used, system volume calculated and microbiological control is demonstrated	0	20		
			No automated dosing device fitted	20			
			Where oxidising biocide used, feedback controlled automated dosing device is not fitted	10			
			System volume not known or calculated	20			
			Where non-oxidising biocide used, microbiological control has not been demonstrated	10			
		Water temperature	Key Performance Indicator System performance is reviewed and water temperature has been monitored and is as low as possible to meet objectives of system. Water temperature never exceeds 20°C.	0	10		
			Water temperature measured in the basin is > 20°C but < 25°C	2			
			Water temperature measured in the basin is never > 25°C	4			
			Water temperature measured in the basin is > 25°C but < 30°C	6			
	Water temperature measured in the basin is > 30°C		10				
	Characteristics of make-up water	Key Performance Indicator The make-up water meets the conductivity limit in the Australian Drinking Water Guidelines (ADWG).	0	2			
		Non-ADWG quality (conductivity) water used	2				

Attachment 1

RISK AREA	RISK FACTOR	RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE
Opportunity for Multiplication	Physical condition of system	Key Performance Indicator The cooling tower system design and current performance should be reviewed and actions taken to address any observed problems. This should include consideration of the age of the system.	0	16		
		Tower or system structure has sustained physical damage which has not been repaired	6			
		Age of cooling tower > 10 years & < 20 years	6			
		Age of cooling tower > 20 years	10			
		System design/performance not reviewed recently	10			
	Microbial control program	Key Performance Indicator The water is successfully treated with high quality, consistent microbial control. The scoring for this issue is included in the Legionella and HCC risk factors				

RISK AREA	RISK FACTOR	RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE	
Mechanism for Dissemination	Open system	All cooling towers by definition are open systems. The considerations that relate to these are dealt with in the other risk factors					
	Aerosol generation	Key Performance Indicator No noticeable drift leaving tower	0	15			
		Fan generates noticeable drift leaving tower	15				
	Modes of operation: • Intermittent operation • Seasonal usage	Key Performance Indicator In systems with low heat loading, a management process is in place to deal with this e.g. by the draining of the system or the cell or fitting of a recirculating pump	0	3			
		Multiple towers used but individual cells may not always be in use. Water may not recirculate through the towers	3				
	Drift elimination	Key Performance Indicator Efficient drift eliminator fitted which is AS/NZS 3666 compliant	0	20			
		Not present	20				
		Fitted but ineffective or non-compliant with AS/NZS 3666	15				
	Aerosol dispersion	Key Performance Indicator The prevailing winds blow away from the direction of high-risk locations particularly at times of the year when high humidity (say greater than 60%) can be expected	0	10			
		Prevailing winds are in the direction of high-risk locations particularly at times of the year when high humidity (say greater than 60%) can be expected	10				
	System location (distance to other cooling water systems, air intakes and passers by)	Key Performance Indicator Tower outlets located greater than 20m from fresh air outlets	0	18			
		Outlet of tower located within 10m of fresh air inlet	15				
		Outlet of tower located within 20m of other cooling tower system	10				
		Outlet of tower located within 20m of pedestrian walkway	15				

Attachment 1

RISK AREA	RISK FACTOR	RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE
Other Considerations	Patient mix	Key Performance Indicator Not applicable	0	5		
		Immunosuppressed patients on-site	7			
		Organ transplant unit on-site	6			
		Patients over 50 years of age on-site	2			
	Patient/staff/visitor management	Key Performance Indicator Nosocomial pneumonia surveillance program in place that responds to adverse cooling tower system results by escalating surveillance and patient surveillance. High risk patients are discouraged from accessing high risk locations.	0	30		
		Nosocomial pneumonia surveillance does not respond to adverse cooling tower system results	20			
		Highly vulnerable patients allowed unrestricted access within 20m of outlet of tower	30			
		Highly vulnerable patients allowed unrestricted access within 100m of outlet of tower	25			
		Highly vulnerable patients allowed access to within 100m of outlet of tower, except during suspected outbreaks/following suspected cases	20			
		Staff, visitors or patients permitted to smoke in areas near cooling tower systems	10			
	Risk communication	Key Performance Indicator Laboratory results sent directly to infection control committee/practitioner/medical staff as well as cooling tower system manager and water treatment contractor	0	15		
		Laboratory results sent only to cooling tower system manager who then makes decision to inform others	15			
		Laboratory results not tabled for discussion at the Infection Control Committee	5			

Attachment 2

A Risk-rating Tool for Hospital Warm Water Systems

Purpose

This risk-rating tool compares the relative risks of different warm water systems on the same or different sites. The tool can also be used to measure the impact of particular interventions and improvements either:

- Before works begin, to decide which action might have the most impact.
- Over time, as a measure of risk reduction in a particular system on a site.

The risk-rating process can be repeated during the development of a risk management plan and after any significant event such as:

- The completion of strategies outlined in the plan
- Adverse *Legionella* testing results
- Adverse chemical or water testing results.

Important note:

The risk-rating tool is **not** intended to compare the risks of warm water systems of different organisations. It has been developed to allow an organisation to rate their warm water systems and make more informed decisions about the potential risk reduction associated with an upgrade or replacement. It can also be used to compare the risks associated with a particular system over time. It is intended that the risk-rating tool will be upgraded as new information becomes available and feedback is obtained from users.

The tool should be used, as far as possible, by the same person or organisation to avoid different perceptions affecting the comparison.

Hospitals should be aware of the potential for these ratings to be obtained in a Freedom of Information request. A note explaining the purpose of the rating tools should therefore be applied to each page.

Risk Factors

The following risk factors reflect the particular risks associated with hospital warm water systems:

- Stagnant water
- Growth of *Legionella*
- Age and complexity of system
- Patient mix
- Patient management
- Risk communication.

Scoring

The risk-rating process requires an assessment to be made for each risk factor and a score given to each assessment, based on predetermined rules. These rules include a maximum score for each risk factor. Within the risk factor there are one or more observations or possible risk assessments. Select the risk assessment that matches the observations of the warm water system. Each of these observations has a corresponding sub-score. For each risk factor add up the sub-scores that have been obtained to find the score for the risk factor being rated. Where this score exceeds the maximum score, only the maximum score is to be included in the overall risk-rating.

These individual scores are then added to arrive at an overall score. The maximum score is 150. **The higher the score, the higher the risk.**

'Dead legs'

The risk-rating tool makes reference to assessing the lengths of 'dead legs' in the system. Most hospitals with complex pipe networks are likely to have extensive lengths of such pipes. As a guide, the following information is provided:

- A 'dead leg' is as any length of pipe longer than the diameter of the main pipe extending off the main branch.
- A small length of 'dead legs' can be regarded as 'dead legs' of total length of less than 1 m in no more than two locations.
- Extensive lengths of 'dead legs' can be regarded as 'dead legs' of total length of greater than 1 m or 'dead legs' in more than two locations.

Attachment 2

RISK FACTOR	RISK ASSESSMENT	SCORE	MAXIMUM SCORE	COMMENTS	YOUR SCORE
Stagnant water	Key Performance Indicator Water circulates through the system continuously. There are no 'dead legs'.	0	25		
	Outlets not used for periods greater than a week	10			
	Some small lengths of 'dead legs'	7			
	Extensive lengths of 'dead legs'	10			
Growth of Legionella	Key Performance Indicator Legionella should not be detected in any sample. Where hot water system installed supplying thermostatic mixing valves and valves are cleaned and maintained annually. All outlets not used for more than a week are flushed at full flow.	0	60		
	Legionella detected in the previous 12 to 24 months	20			
	Legionella detected in the previous 12 months	25			
	Legionella detected in the previous 3 months	35			
	No monthly Legionella testing	40			
	Only one method of disinfection used in a system that circulates warm water (as opposed to hot water system supplying thermostatic mixing valves)	20			
	Where chlorination used, no automated dosing device fitted	20			
	Where chlorination used, feedback controlled automated dosing device is not fitted	10			
Age and complexity of system	Key Performance Indicator The warm water system design and current performance should be reviewed and actions taken to address any observed problems. This should include consideration of the age of the system. The simpler and smaller the warm water system, the lesser the likely risk. As a minimum, a review of the system design and performance must include the aspect of whether the existing design is the most appropriate from an infection control perspective.	0	15		
	System design/performance not reviewed recently	15			
	System design unknown	15			
Patient mix	Key Performance Indicator Not applicable	0	15		
	Immunosuppressed patients on-site	7			
	Organ transplant unit on-site	6			
	Patients over 50 years of age	2			
Patient management	Key Performance Indicator A program is in place for surveillance of cases of nosocomial pneumonia and testing for Legionnaires' disease. Such a program should respond to the detection of Legionella in warm water systems by escalating patient surveillance.	0	20		
	Nosocomial pneumonia/Legionnaires' disease surveillance does not respond to detection of Legionella in warm water systems	20			
Risk communication	Key Performance Indicator Laboratory results sent directly to infection control committee/practitioner/medical staff as well as warm water system maintenance manager and water treatment contractor	0	15		
	Results sent only to warm water system maintenance manager, who then makes the decision to inform others	15			
	Laboratory results not tabled for discussion at the Infection Control Committee	5			