

Public Health and Wellbeing Regulations Sunset Review regulatory impact statement

Chapter 4: Cooling tower systems

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The following chapter is an extract of the regulatory impact statement for the proposed Public Health and Wellbeing Regulations (2019).

Information on infringements, consultation, implementation, evaluation and the exposure draft regulations are contained in the full regulatory impact statement available on the [Engage Victoria website](https://engage.vic.gov.au) <<https://engage.vic.gov.au>>.

This extract was prepared to assist stakeholders who access the report by accessing a specific category on the Engage website.

Introduction (and invitation to comment)

Overview

The Public Health and Wellbeing Regulations 2009 (the current regulations) were made under the *Public Health and Wellbeing Act 2008* (the Act) and are due to sunset on 15 December 2019. New regulations are needed to replace them.

The remaking process provides an opportunity to revisit whether regulations are still needed and, if so, whether there are ways to improve them.

Public health regulations provide a framework for businesses, councils and individuals to protect the health and wellbeing of Victorians. Understanding how these regulations, and any proposed changes, will impact on Victorian business and the Victorian community is critical to the effective operation of the regulatory framework.

The current regulations include several regulatory areas, and the subject matter varies widely. In some ways these regulatory areas are distinct in their nature; however, their overall objective gives effect to the Public Health and Wellbeing Act.

To the extent that the regulatory areas are different, the department consulted key stakeholders to ensure any issues were understood and the impact of proposed solutions would be acceptable. This preliminary consultation has informed the proposed regulations and a summary is provided in the 'Consultation' chapter.

Purpose and objective

Victorians enjoy one of the highest standards of health and wellbeing in the developed world. This could not be achieved without laws and regulations that protect and promote public health and wellbeing.

The Act

The current regulations were made under the Public Health and Wellbeing Act. The purpose of the Act is to provide a legislative framework that promotes and protects public health and wellbeing in Victoria.

The state has a significant role in promoting and protecting the public health and wellbeing of Victorians.

Public health and wellbeing includes the absence of disease, illness, injury, disability or premature death and the collective state of public health and wellbeing. Public health interventions are one of the ways in which the public health and wellbeing can be improved and inequalities reduced.

The regulations

As set out in the Public Health and Wellbeing Act, the aim of the regulations is to achieve the highest attainable standard of public health and to prevent disease and illness while minimising costs for regulated industries.

Public health regulations provide a framework for businesses, councils and individuals in the practical application of the Act.

The regulatory impact statement

The purpose of this regulatory impact statement is to provide information and analysis to review how these regulations, and any proposed changes, will affect Victorian business and the Victorian community and contribute to the effective operation of the regulatory framework for public health.

The current regulations are due to expire on 15 December 2019. New regulations are needed to replace them.

Preparation of the new regulations

Before new regulations are made, the *Subordinate Legislation Act 1994* requires completion of the following four steps shown in Figure 1.

Figure 1: The four steps of making new regulations



Preliminary consultation

The department undertook preliminary consultation with key stakeholders to inform development of the proposed regulations. The proposed regulations address a range of matters for giving effect to the Act and therefore different stakeholders were engaged on different matters.

A summary of the preliminary consultation that has occurred is provided in the ‘Consultation’ chapter of this regulatory impact statement.

Public consultation: regulatory impact statement, evaluation and implementation

This regulatory impact statement has been prepared to meet the requirements of the Subordinate Legislation Act, enabling public consultation on the proposed regulations. The regulatory impact statement presents the range of matters addressed in the proposed regulations in separate chapters. Each chapter includes the regulatory objective for the matters addressed in the chapter, an assessment of the costs and benefits of the proposed regulations and possible alternatives.

In most cases the regulatory impact statement considered and analysed three regulatory options: to remove all regulation, to remake the current regulations without change, or to strengthen the requirements set out in the current regulations. The extent of the analysis of the regulatory options varies but is consistent with the need for regulatory change. In most cases the recommended option for each regulatory area is to strengthen the current regulations.

Each of the regulatory areas included within the regulatory impact statement has a specific implementation plan that will support awareness and understanding of any changes, preparedness and compliance. Information about implementing the proposed regulations can be found in the ‘Implementation’ chapter.

The proposed regulations will operate for up to 10 years. Evaluation has a key role in ensuring the intended improvements of the proposed regulations (appropriately effective and proportionate) are borne out and align with government objectives on an ongoing basis. Each of the regulatory areas included within the regulatory impact statement has a specific evaluation plan. Information about the evaluation, including public consultation, can be found at the end of the regulatory impact statement.

The proposed regulations are included as an attachment to this document.

Consideration of submissions

Public comments and submissions will be considered before the new regulations are made.

Final decision

The decision to make or not to make the proposed regulations will be informed by the public comments and submissions received. Notice of the decision will be published as soon as practicable after the decision has been made.

Small business impact and competition assessment

Small businesses may disproportionately experience the impacts from regulatory requirements for a range of reasons, including relatively limited resources to interpret compliance requirements or to keep pace with regulatory changes, and the cumulative effect of different requirements.

Most of the proposed regulations propose simplified and streamlined regulatory definitions and requirements compared with the current regulations, particularly where stakeholder feedback has raised issues about ambiguity of the intention of regulations. Any regulatory proposal needs to be scrutinised carefully to assess whether it is having an adverse impact on the ability of firms or individuals to enter and participate in the market. In line with the *Victorian guide to regulation*, new legislation (both primary and subordinate) needs to demonstrate that it will not restrict competition, unless benefits of the restriction outweigh the costs and the objectives of the legislation can only be achieved by restricting competition.

In instances where restrictions on competition have been identified, the benefits of the restriction outweigh the costs and the objectives of the legislation can only be achieved by restricting competition. For example, the registration of a premises by local government for the purposes of infection control standards creates an additional cost for starting a health and beauty service business. However, this cost is offset by the reduced risk of disease in the community and the reduced risk of an infectious disease outbreak.

Structure of the regulatory impact statement and the proposed regulations

This regulatory impact statement and the proposed regulations have grouped the regulations according to either how the regulations are administered or the regulation's purpose in the Act. These are broadly grouped into:

- regulations administered by councils
- regulations administered by the department
- regulations related to managing and controlling infectious diseases, micro-organisms and medical conditions
- other regulations.

Regulations administered by councils

- Vector-borne infectious disease control
- Registered premises – infection control
- Aquatic facilities

Regulations administered by the Secretary to the Department of Health and Human Services

- Cooling tower systems
- Legionella risks in certain premises (water delivery systems)
- Pest control

Management and control of infectious diseases, micro-organisms and medical conditions

- Notifications of infectious diseases, micro-organisms and medical conditions
- Closed court orders for prescribed diseases
- Immunisation and exclusions – schools and childcare
- Escort agencies providing information to sex workers and clients

Other regulatory provisions

- Prescribed senior officers (Chief Health Officer delegations)
- Tissue donations
- Consultative councils.

What isn't included in this regulatory impact statement

The Public Health and Wellbeing Act

The Public Health and Wellbeing Act is the legislation under which these regulations are made. The matters that can be set out in the regulations are confined to what is required under the Act. The requirements under the Act are not the subject of this review, only the details set out in the regulations. During the process of the review and consultation it is likely that potential improvements to the Act may be identified, but that is not the focus of this regulatory impact statement.

Public Health and Wellbeing Regulations relating to prescribed accommodation

Regulations relating to prescribed accommodation will not be considered within this regulatory impact statement (rr. 13 to 27). Separate new regulations relating to prescribed accommodation will be made in 2020. In the interim, the operation of the prescribed accommodation regulations will be extended in their current form for 12 months to allow further time for review and consultation.

The extension of the prescribed accommodation regulations provides an opportunity to separate regulations relating to prescribed accommodation from the other regulations made under the *Public Health and Wellbeing Act 2008*. It is intended that the extended prescribed accommodation provisions will be contained in the renamed 'Public Health and Wellbeing (Prescribed Accommodation) Regulations 2009' and will operate separately from the proposed Public Health and Wellbeing Regulations 2019.

Public Health and Wellbeing Regulations relating to HIV testing

The Public Health and Wellbeing Act prescribes special requirements for HIV testing and these requirements are included in the 2009 regulations. The need to review and modernise these requirements is an issue that a range of sector stakeholders have been raising for some years. Overwhelmingly, the sector has supported a repeal of relevant sections of the Act relating to pre and post HIV testing. The Victorian Parliament recently passed the Public Health and Wellbeing Bill 2019 to repeal the HIV testing specific provisions (ss. 131 and 132) on the basis that they stigmatise people with HIV and are outdated. As a result, the prescribed regulations will not need to be made.

Invitation to comment

In accordance with the *Victorian guide to regulation*, the Victorian Government seeks to ensure that proposed regulations are well-targeted, effective and appropriate, and impose the lowest possible burden on Victorian businesses and the community.

The regulatory impact statement process involves assessing regulatory proposals and allows members of the community to comment on proposed regulations before they are finalised. Such public input provides valuable information and perspectives and improves the overall quality of regulations.

The Public Health and Wellbeing Regulations 2019 (the proposed regulations) will replace the Public Health and Wellbeing Regulations 2009 (the current regulations). A copy of the proposed regulations is published with this regulatory impact statement.

Public comment is invited on the regulatory impact statement and the proposed regulations.

The consultation period is 60 days. Please note that all comments and submissions received will be treated as public documents.

Submission deadline

Comments and submissions should be received by the Department of Health and Human Services no later than 5.00 pm, Monday 30 September 2019.

How to make a submission

Preferred method

The [Engage Victoria website](https://engage.vic.gov.au) <https://engage.vic.gov.au> is the preferred method for receiving submissions. The website includes specific questions for each regulatory area and allows for additional feedback to be provided.

Email

If you are unable to use the preferred method above, submissions can be received by [emailing the department](mailto:phwa.enquiries@dhhs.vic.gov.au) <phwa.enquiries@dhhs.vic.gov.au>.

Post

If you are unable to use the preferred method above, submissions can be received by post marked 'Submission to the Review of the Public Health and Wellbeing Regulations 2009' and addressed to:

Chief Health Officer
Regulation, Health Protection & Emergency Management
Department of Health and Human Services
GPO Box 4057
Melbourne VIC 3001

Where can I obtain copies of this regulatory impact statement and the proposed regulations?

Copies of this regulatory impact statement and the proposed regulations can be obtained from the [Engage Victoria website](https://engage.vic.gov.au) <https://engage.vic.gov.au>.

How can I be updated on the progress of the review?

The [Engage Victoria website](https://engage.vic.gov.au) <https://engage.vic.gov.au> enables you to register to receive updates on the progress of the review of the current regulations.

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This extract was prepared to assist stakeholders who access the report by accessing a specific category on the Engage website. This is not intended to limit the scope of submissions; the department welcomes submissions from all interested parties.

Chapter 4: Cooling tower systems

Problem analysis

Victoria regulates cooling tower systems to manage the risk of legionellosis. All cooling tower systems must be registered with the department under the Act. Cooling towers are a common source of legionellosis – a serious and sometimes fatal disease in humans. Over the past 10 years there has been an increase in reported cases of legionellosis beyond what would be expected relative to population growth.

Hazard

Cooling towers systems are frequently associated with outbreaks of legionellosis (also known as legionnaires' disease) for two reasons:

- they provide water temperatures that favour the proliferation of *Legionella pneumophila* bacteria
- the cooling process causes water to 'aerosolise' (form very small droplets), enabling the Legionella bacteria to enter the human respiratory system, resulting most commonly in pneumonia.

While most people exposed to Legionella bacteria do not get sick, for some, exposure to Legionella bacteria may result in illness or death. Twenty-six people died from legionellosis in Victoria between 2009 and 2018.

Exposure

People living and working near cooling tower systems cannot avoid being exposed to aerosolised water emitted from cooling towers that may contain the Legionella bacteria. Cooling tower systems are used for air-conditioning purposes in office buildings, shopping centres and other premises, and in factories and other industrial sites that require cooling. As at 1 January 2019, there are 2,859 registered cooling tower systems on 1,702 sites throughout Victoria.

Vulnerability

In most cases, people who become ill from exposure to Legionella bacteria are those who are already at increased risk of illness such as the elderly, smokers and people with weak immune systems or underlying chronic illnesses. In Victoria, an estimated 93 per cent of people with legionellosis end up in hospital.

Exposure to Legionella bacteria in places with high concentrations of at-risk people (for example, hospitals and aged care facilities) has significantly higher infection and fatality rates.

See the appendix for a [history of cooling tower regulation in Victoria](#).

Objective of the regulations

The objective of the regulations is to reduce the risk of Legionella bacteria in cooling tower systems and consequently the risks to human health from legionellosis.

The regulations contribute to minimising the impact of legionellosis on Victorians by reducing illness in the community and reducing service disruptions that impact on the community and businesses.

Requirements of the regulations

The regulations relate to s. 236 of the *Public Health and Wellbeing Act 2008*, which allows for certain matters in respect of cooling tower systems to be prescribed. The Act also establishes a mandatory framework for regulating cooling tower systems that requires:

- registration of cooling tower systems
- development of risk management plans
- auditing of those risk management plans.

The regulations require cooling tower system operators to maintain and test the systems to manage public health risks. The regulations also require specific remediation measures when *Legionella* bacteria are found in cooling tower systems.

Options

- Option 1: Retain the current regulations without changes
- Option 2: Amend some aspects of the current regulations
- Option 3: Remove or reduce the current regulations

The options under consideration are constrained by the requirements in the Act. The Act requires cooling tower systems to be registered for the purposes of controlling legionellosis.

Option 1: Retain the current regulations without changes

All cooling tower systems must be registered with the department under the Act, and are required to comply with the current regulations setting out the following obligations from operators of cooling tower systems:

1. Cooling tower systems are maintained and tested as described in the regulations, unless it is shut down or is otherwise not in use.
2. The water in the cooling tower system is continuously treated with one or more biocides to effectively control the growth of micro-organisms, including *Legionella*. It must also be treated with a bio-dispersant, and other chemicals to minimise fouling, formation of scale and corrosion.
3. A chlorine-compatible bio-dispersant is added to the recirculating water of the system and the system is disinfected, cleaned and re-disinfected:
 - (a) immediately before initial start-up following commissioning or any shut-down period of more than a month
 - (b) at least every six months.
4. The system is inspected at least monthly to ensure it is operating without defects.
5. The water in the system is tested by a laboratory for heterotrophic colony count (HCC) at least monthly and for *Legionella* every three months.
6. Maintenance and testing records are kept for 12 months and can be produced for an authorised officer from the department on request.
7. The regulations require that action is taken in response to an HCC result of more than 200,000 colony forming units per millilitre (CFU/mL) or to the detection of *Legionella* in a sample taken from the cooling tower system.

Option 2: Amend some aspects of the current regulations

Proposed amendments to strengthen regulation

1. Include an additional requirement of the cooling tower system owner to notify the Secretary when testing returns a result above the threshold in the Australian Standards (in addition to the existing requirement to notify the Secretary when three consecutive tests show Legionella of any level)

This would increase the surveillance capacity of the department. It would also provide a greater response framework upon detection. It is likely that, upon notification, the department would advise the operator to take the precautionary step to disinfect the cooling tower system. It is not expected that there will be many such notifications, but the increased awareness of these outlying events could subsequently reduce the incidence of legionellosis.

2. Ensure the integrity of the monitoring system by introducing offences relating to tampering with or falsifying water samples or laboratory reports for test samples from cooling tower systems

While the department has no hard evidence that there has been tampering of water samples or falsifying laboratory reports, there have been anecdotal reports that the practice may occur.

Since the detection of Legionella currently in the proposed regulations triggers a mandatory series of responses by the responsible person, it has been suggested to the department that this creates an incentive to tamper with a sample to not trigger the mandatory responses.

By creating a clear offence provision, there will be deterrent to this possible practice. Given there is no hard evidence, it could be expected that there would be a small increase in the number of detections of Legionella bacteria detected in cooling tower systems that would not be reported otherwise.

It is difficult to estimate what impact such a measure may have but as a minimum it is expected that this measure would provide greater confidence in the monitoring and response system.

3. Improve clarity of meaning and consistency of use regarding terminology used throughout the regulations

Improved clarity and consistency could be achieved by:

- using consistent terminology when referring to 'samples' that clarify that testing is required of recirculated water in cooling towers
- referring, where relevant, to 'cooling tower systems' rather than 'cooling towers' to ensure that testing and regulatory requirements are applied in reference to the entire system rather than a part of the system.

Consistent application of terminology will remove uncertainty and confusion from potentially ambiguous elements of the current regulations. This could improve stakeholder understanding and application of the regulations, contributing to improved outcomes relating to Legionella bacteria in cooling towers.

4. Clarifying disinfection requirements to explicitly require cleaning of the interior of the cooling towers in the system

The proposed regulations tighten the current regulations reference to cleaning of the system. It proposes a requirement to clean the interior of the cooling tower system as part of the mandatory disinfection process. This clarification of regulatory expectations should make a modest improvement in the quality of the disinfection process.

5. Introduce infringement penalties for certain offences

To address the gap between existing measures to achieve compliance such as education, notices and prosecution, it is intended that certain offences be enforced by way of an infringement notice, also known as infringement offences). This approach provides a proportionate and graduated response and a practical means of addressing noncompliance (including moderate levels of public health risk). For example, where lower level approaches have not been effective, and prosecution is not a proportionate response. Please see chapter 13 for a list of proposed infringement offences.

As is currently the case, education, routine monitoring and assisted compliance (making sure businesses are aware of, and understand, the requirements) will form the primary means of achieving compliance with the regulations.

Option 3: Remove or reduce the current regulations

Removing or reducing requirements in the regulations would result in confusion and uncertainty for cooling tower system operators and almost certainly lead to a further increase in legionellosis from cooling towers systems.

No regulation, supported by information and awareness campaigns by the department, is a potential option. The regulations could be removed in favour of relying on reputational effects and post-infection legal action by impacted individuals to act as controls on the risk of legionellosis from cooling tower systems. However, these controls are relatively weak, and their effect is significantly delayed.

A lack of regulation would not be sufficiently replaced by market forces and would increase the risk of *Legionella* bacteria in cooling tower systems, impede the ability for the department to detect *Legionella* bacteria, and impede remedial action following a detection.

Lack of prevention

The absence of regulations means that any action taken to protect people from *Legionella* bacteria in cooling tower systems can only occur following illness, rather than preventing illness, as is currently the case. Building operators would have existing liabilities under general consumer protections; however, this recourse would only be possible after an outbreak of legionellosis.

The lack of regulations may contribute to a perception that the risk of *Legionella* within cooling tower systems is not serious. This would likely lead to reduced preventative action taken by the person responsible for the cooling tower systems to manage the risk of *Legionella* bacteria. Cooling tower systems can be expensive to maintain, and adequate maintenance incurs a cost that may not be a prioritised by the building operator with competing fiscal demands.

Reduced or removed preventative action would lead to increased outbreaks of legionellosis.

Impeded ability to detect *Legionella* bacteria

Without regulation, the department would no longer have the specific power to require a water sample to be taken from the cooling tower systems if it is suspected or implicated as the source of infection of legionellosis.

Impeded or ineffective remedial action following detection

In the absence of regulations there would be no requirement for remedial action to prevent further infection if *Legionella* bacteria was detected in a sample taken from a cooling tower system. The department would continue to provide best practice guidelines to owner/operators of cooling tower systems to provide guidance about appropriate measures to control the risk of *Legionella* bacteria.

In the absence of regulations, thorough disinfection of the cooling tower systems may not be undertaken or may not be undertaken within the 24-hour period currently specified which puts those exposed to the system at greater risk of exposure to *Legionella* bacteria.

Public expectation

The final consideration is whether the removal of *Legionella* regulation would meet public expectations that government manages this public health risk. Outbreaks of *Legionella* have been associated with significant media attention and public demands for intervention and action by government. In responding to potential outbreaks, the department considers there is a heightened reaction (relative to the number of people identified as contracting legionellosis) to the real or potential health impacts of an outbreak of legionnaires' disease. Academic literature theorises that this is because the risk cannot be assessed by the public and the hazard is invisible. It is likely that

shifting the regulations to focus solely on the most vulnerable populations or the highest risk cooling towers would not be sufficient to address the expectations of the public in the event of an outbreak.

Impact analysis

In the absence of regulations, the department expects that a majority of cooling tower operators would continue to provide a majority of the maintenance and testing required by the regulations. In a survey of providers of cooling tower maintenance and servicing the respondents advised that a majority of cooling tower operators engaged providers to undertake more stringent services (servicing programs A, B or C) compared with the minimum requirements of the regulations (servicing program D). These four programs are outlined in the current regulations and are discussed in more detail in the appendix. However, if the regulations were removed, it would be expected that some of the operators currently undertaking servicing program D, would choose to undertake less servicing and maintenance, choosing to allocate resources to other costs associated with building operation and maintenance. As a consequence, the department expects that the likelihood of Legionella bacteria being present in cooling tower systems and the risk of an outbreak of legionellosis due to cooling tower systems would increase in the absence of regulations.

The section below reviews the regulatory options described above and identifies the benefits from preventing burden of disease and the costs to stakeholders to maintain and enforce each of the options for regulating cooling towers.

Burden of disease of the status quo

The department has estimated the total potential burden of disease from legionellosis (from Legionella pneumophila) below. The department is unable to accurately estimate the proportion attributable to cooling tower systems versus other sources; however, cooling tower systems are the most widely known source of legionellosis.¹

This disease burden for a theoretical 10 years is an estimate of the current burden in Victoria and is associated with the disease burden from option 1, the status quo. It has been estimated based on the 10-year average of the current burden in Victoria. The department expects that the total disease burden would marginally decrease in option 2 and increase in option 3 (the removal of regulations) – this is further discussed for each option in the impact analysis.

The total potential burden is as follows:

Total net present value of potential burden of disease from legionellosis (from *Legionella pneumophila*) in Victoria: \$90,599,902 over 10 years (2019 to 2029, in 2019 dollars)

Details on how burden of disease has been calculated can be found in the [appendix](#).

Each of the options outlined below contributes to the expected likelihood of Legionella bacteria being present in cooling tower systems and the chance of this being aerosolised and infecting the population with legionellosis. There are expected to be economic costs associated with outbreaks of legionellosis due to cooling tower systems. While the benefits of avoiding outbreaks cannot be accurately quantified, a further discussion is contained in the [appendix](#).

Option 1: Retain the regulations without changes

Remaking the regulations without change would not address the unexplained increase in legionellosis.

While the department considers the current regulatory system to be effective in preventing and responding to Legionella in cooling tower systems, there has been an increase in reported cases beyond what would be expected

¹ *Ten questions concerning the aerosolization and transmission of Legionella in the built environment*, Building and Environment 123 (2017) pp. 684–695

relative to population growth over the past 10 years. A continuation of the existing regulations, unchanged, would most likely see this trend continue.

This increase has come about in spite of a 32 per cent decrease in the number of cooling towers in Victoria over the past 10 years (see appendix for more information) and a 38 per cent decrease in detection of Legionella bacteria in the remaining cooling towers over the same time (see the appendix for more information on [the number of cooling towers](#)).

Fewer cooling towers and less Legionella in cooling towers should result in fewer cases of legionellosis; however, this has not been the case. Victorian notifications relative to population size has more than doubled, with an increase from 0.88 per 100,000 people in 2009 to 1.88 per 100,000 people in 2018. For more information see '[Notification rate of legionellosis](#)' in the appendix.

It is important to note that legionellosis is still not a common disease and remains comparatively less prevalent in the nine years since 2009 (1.32 per 100,000 population) compared with the 2000–2009 period (1.98 per 100,000 population) and below the Australia-wide five-year average (1.6 per 100,000 population, 2013–2017). For more information see '[Comparison with other jurisdictions](#)' in the appendix.

Contributing factors to the increase in reported cases in Victoria most likely include:

- improved reporting of cases by medical practitioners and laboratories resulting from improved awareness
- demographic and population behaviour changes including:
 - an ageing population contributing to a larger number of more vulnerable Victorians in the community
 - increased density of the urban population resulting in more people living in and around areas with cooling towers
 - increased travel between countries resulting in Legionella acquired overseas being notified in Victoria
- increased Legionella in the environment separate from cooling tower systems.

For a full explanation of these contributing factors see '[Contributing factors to increased legionellosis](#)' in the appendix.

In addition, there has been an unexplained worldwide increase in legionellosis. Similar to the trend in Victoria, the Centers for Disease Control in the United States has observed an increase in the rate of reported legionellosis of nearly five and a half times between 2000 and 2017 (contrasted with the threefold increase in Victoria).² In this report it was noted that 'it is unclear whether this increase represents test artefact (due to increased awareness and testing), increased susceptibility of the population, increased Legionella in the environment, or some combination of factors'.³ This is further supported by increased reporting of legionellosis in other developed countries. A 2015 study of Legionella in Europe found there was an increase across the region between 2011 and 2015. In 2015 there was a notification rate of 1.4 per 100,000 population, which was the highest rate ever recorded.⁴

This increase in the number of cases has been seen in many parts of the world, but there is no clear evidence yet to explain this increase. The experience globally, without clear explanation for the reason, makes it difficult for regulators to target potential reforms.

The benefits and costs of option 1, relative to a base case having no regulations, are described qualitatively in Table 4.1.

² [National Center for Immunization and Respiratory Diseases, Division of Bacterial Diseases](https://www.cdc.gov/) <https://www.cdc.gov/>

³ Ibid.

⁴ *Legionnaires' disease – annual epidemiological report for 2015*, 15 Nov 2017, Publication series: Annual epidemiological report on communicable diseases in Europe, Time period covered: 2015. [European Centre for Disease Prevention and Control](https://ecdc.europa.eu/en/publications-data/legionnaires-disease-annual-epidemiological-report-2015) <https://ecdc.europa.eu/en/publications-data/legionnaires-disease-annual-epidemiological-report-2015>

Table 4.1: Cost-benefit analysis of option 1

Current regulations	Benefit	Cost ⁵
<p>The system is maintained and tested as described in the regulations, unless it is shut down or is otherwise not in use.</p>	<p>Reduced likelihood of Legionella bacteria being present in the system.</p> <p>Stagnant water due to the lack of water circulation in parts of the system is likely to result in solids in the system settling out as sludge. This may encourage the formation of biofilm. Lack of circulation will also almost certainly mean that any biocides or other chemicals being added will not reach all parts of the system.</p>	<p>Resource cost (either time or cost to outsource) to conduct maintenance. Specific cost depends on a range of site-specific variables.</p> <p>Servicing must be performed by personnel with a much higher degree of knowledge than is required for an inspection. Typically, a service would include:</p> <ul style="list-style-type: none"> • a check of the water quality, including parameters such as pH, conductivity and biocide levels • refilling of chemical dosing tanks • removal of empty tanks • a check of all dosing and control equipment, including timers, pumps and tubing (this should involve a calibration check on the pumps and resetting, if necessary, against desired parameters) • inspection of the wetted components and general integrity of the system • corrosion checks.
<p>The water in the cooling tower system is continuously treated with one or more biocides to effectively control the growth of micro-organisms, including Legionella. It must also be treated with a bio-dispersant, and other chemicals to minimise fouling, formation of scale and corrosion.</p>	<p>Reduced likelihood of environmental contamination that provides nutrients that can encourage more rapid bacterial growth of Legionella bacteria. The introduction of high levels of solids will also reduce the effect of biocides. The site should be inspected to identify potential nutrient sources.</p>	<p>Resource cost (either time or cost to outsource) to conduct treatment. Specific cost depends on a range of site-specific variables.</p> <p>Treatment of the cooling tower system for control of corrosion, scale formation and fouling, and to minimise microbiological growth (ensuring that it remains at safe levels).</p>
<p>A chlorine-compatible bio-dispersant is added to the recirculating water of the system and the system is disinfected, cleaned and re-disinfected:</p> <ul style="list-style-type: none"> • immediately before initial start-up following commissioning or any shut-down period of more than a month • at least every six months. 	<p>Reduced likelihood of Legionella bacteria being present in the system.</p>	<p>Resource cost (either time or cost to outsource) to conduct treatment, as well as the relevant chemicals.</p> <p>The chemical program must incorporate use of:</p> <ul style="list-style-type: none"> • a corrosion and scale inhibitor • at least one biocide (preferably two, used in rotation) • a bio-dispersant to help remove any biofilm in the system.

⁵ Details on how cost for industry to implement the regulations has been calculated can be found in Appendix: [cost for industry](#)

Current regulations	Benefit	Cost ⁵
The system is inspected at least monthly to ensure it is operating without defects.	Ensure that a cooling tower system is operating without defects, reducing the likelihood of Legionella bacteria being present in the system. Allows rectification of issues that may cause increased risk of Legionella bacteria being present in the system.	Resource cost (either time or cost to outsource) to conduct inspections. Inspection means simple monitoring of key components such as: <ul style="list-style-type: none"> • an observation of water clarity • a check that the chemical dosing devices are operating. It is expected that a nontechnical person with minimal training can do the inspections. Inspections should be frequent. Where problems are noted, they need to be reported to the responsible person, who can then authorise remedial works.
The water in the system is tested by a laboratory for heterotrophic colony count (HCC) at least monthly and for Legionella every three months.	This monitoring process ensures the cooling tower system is operating without defects with a test from a laboratory. Allows identification and rectification of issues that may cause increased risk of Legionella bacteria being present in the system and for these to be remedied and reduce the likelihood of Legionella bacteria being present in the system.	Testing for Legionella requires samples to be: <ul style="list-style-type: none"> • taken in containers as described in AS2031 • collected as described in AS/NZS 3666.3 • stored and transported as described in AS/NZS 3896 (Waters – Examination for <i>Legionella</i> spp. including <i>Legionella pneumophila</i>). This standard requires that the samples be transported to the testing laboratory as soon as possible and then analysed in accordance with AS/NZS 3896. The testing is much more sophisticated for Legionella than for HCC, and results can take up to 10 days.
Maintenance and testing records are kept for 12 months and can be produced for an authorised officer from the department on request.	Provides an identifiable audit trail associated with the history of actions taken to reduce Legionella bacteria in the cooling tower system. Helps the department to identify outbreak sources when required.	Cost to store records on site; however, in some circumstances, they may be stored off site – for example, a property manager may hold the records on behalf of a building owner.
The regulations require that action is taken in response to an HCC result of more than 200,000 colony forming units per millilitre (CFU/mL) or to the detection of Legionella in a sample taken from the cooling tower system.	Provides minimum obligations in response in the event of an HCC above a threshold. Subsequent actions are likely to reduce the presence of Legionella bacteria in the cooling tower system.	Cost associated with responding to the result. Specific response depending on site variables but is likely to include water treatment with chemicals and further monitoring and sampling.

Based on the number of cooling tower systems in Victoria (December 2018) the cost to undertake the minimum requirements of the regulations relating to maintenance equates to **\$10,386,747 over one year** or **\$99,486,525 over the 10 years** of the regulations (in 2018 dollars).

Option 2: Amend the regulations

An increase in legionellosis warrants a modest strengthening of regulations to build on prevention efforts.

The current regulations provide the department with the authority to undertake action when Legionella is detected. In 2017 the department ordered that cooling tower systems on 90 sites be disinfected in response to seven

separate outbreaks of legionellosis. The number of cooling tower systems required to be disinfected in 2017 was unusually high. A large proportion of the disinfections related to a specific outbreak of legionellosis associated with the Melbourne central business district. The outbreak occurred in the lead up to a holiday period where high volumes of people were expected to travel to the Melbourne CBD. As such, these disinfections were undertaken without prior sampling to avoid delays and mitigate the risk of a major outbreak as soon as possible. Given that a single cooling tower system has previously been linked to 127 cases in Victoria (Melbourne Aquarium in 2000), preventive measures are favoured over responsive measures. The 2017 response provides an excellent example of how the current regulations facilitate preventative measures. It is important that preventative efforts continue to be supported by regulations to address the rise in legionellosis cases.

While the potential contributing factors outlined above (changes to reporting behaviour, changes to population composition, density and behaviour) cannot be addressed by this particular regulation, the increase in legionellosis cases does warrant a thorough re-examination of the existing regulations with a view to identifying potential improvements.

Refinements to the regulations and strengthening of some requirements specified within the regulations has the potential to assist the department, cooling tower owners and other stakeholders to better understand and meet their obligations. This in turn has the potential to impact on the trend of increasing incidence of legionellosis. While these refinements to the regulations will not directly address the likely causal factors behind the increase, these could help stabilise the rates of increase of legionellosis cases, avoiding further increases.

Consultation with cooling tower owners undertaken by the department in mid-2018 identified several requirements of the regulations that could benefit from clarification or strengthening. These are considered to be very modest changes to the status quo but, would contribute to reducing the risk of legionellosis from cooling towers, and provide a framework for action if Legionella bacteria is detected.

The benefits and costs for option 2, relative to the status quo, are described qualitatively in Table 4.2.

Table 4.2: Cost-benefit analysis of option 2 – amend the regulations

Proposed amendment	Benefit	Cost
Include an additional requirement of the cooling tower owner to notify the Secretary when testing returns a result above the threshold in the Australian Standards (in addition to the existing requirement to notify the Secretary when three consecutive tests show Legionella of any level).	This would increase the surveillance capacity of the department. It would provide a greater response framework upon detection. It is expected that a higher number of directions to disinfect would occur than under the existing regulation, subsequently reducing the prevalence of Legionella bacteria in cooling tower systems.	It is likely that, upon notification, the department would advise the operator to take the precautionary step to disinfect the cooling tower system.
Ensure the integrity of the monitoring system by introducing offences relating to tampering with or falsifying water samples or laboratory reports for test samples from cooling tower systems.	It is expected that this measure would provide greater confidence in the monitoring and response system and would be expected to contribute to a reduction in the impact of legionellosis outbreaks.	Because this creates a disincentive to tamper or falsify, it would be expected that there would be an increase in the number of notifications of Legionella bacteria detected in cooling tower systems that would not be reported otherwise.
Improve clarity of meaning and consistency of use regarding terminology used throughout the regulations. Using consistent terminology when referring to 'samples' that clarify	Consistent application of terminology will remove uncertainty and confusion from potentially ambiguous elements of the current regulations. This could improve stakeholder	Due to the current ambiguity, there may be instances where cooling tower system operators do not take specific actions. Removing this ambiguity may increase the burden on some

Proposed amendment	Benefit	Cost
<p>that testing is required of recirculated water in cooling towers. Referring, where relevant, to 'cooling tower systems' rather than 'cooling towers' to ensure that testing and regulatory requirements are applied in reference to the entire system rather than a part of the system.</p>	<p>understanding and application of the regulations, contributing to improved outcomes relating to Legionella bacteria in cooling towers.</p>	<p>operators in line with expected obligations for operating cooling tower systems.</p>
<p>Clarifying disinfection requirements to explicitly require cleaning of the interior of the cooling towers in the system.</p> <p>The proposed regulations tighten the current regulations reference to cleaning of the system. It proposes the requirement to clean the interior of the cooling towers as part of the mandatory disinfection process.</p>	<p>Improved consistency and therefore a uniform standard across industry which should result in cleaner towers and therefore a potential modest reduction in detection of Legionella and legionellosis cases.</p>	<p>This is a modest clarification and so we expect the impact to be negligible.</p>
<p>Introduce infringement penalties for certain offences</p>	<p>Address the gap between existing measures to achieve compliance.</p> <p>Provides proportionate response and a practical means of addressing noncompliance (including public health risk)</p>	<p>Cooling tower operators who receive an infringement notice will incur the cost burden.</p> <p>It is expected that:</p> <ul style="list-style-type: none"> • these compliance measures can be used where there are compelling grounds, such as where lower level approaches have not been effective or moderate levels of risk • compliance will continue to be primarily achieved through education, compliance monitoring and assisted compliance. <p>The department expects that the quantum of infringements issued to be relatively low.</p>

The overall cost of option 2 would be similar to option 1, the status quo. However, due to the increased regulatory burden associated with these changes, it is estimated that cooling tower operators on aggregate would have costs increase with a range of 1–3 per cent of the total burden.

This would be a cost increase of between \$103,867 and \$311,602 per year spread across all cooling tower system operators in Victoria. Based on the current 2,859 registered sites in Victoria this would be an average increase in costs of between \$36.33 and \$109 per cooling tower in operation per year.

As such the cost to undertake the minimum requirements of option 2 regulations relating to maintenance equates to between \$10,490,614 and \$10,698,348 across one year.

Proposed approach

Break-even analysis to assess options for regulation

The department has used break-even analysis (BEA) to assess each option for cooling tower regulations and determine the preferred option. BEA is a useful technique when the key benefits of options can be identified (for example, reduced burden of disease) and a unit of benefit can be valued (for example, using the value of a statistical life and cost of a hospitalisation⁶), but it is very difficult to quantify how many units of benefit each option will generate (for example, how many deaths or hospitalisations would be avoided). The steps of a BEA are:

1. identifying, quantifying and valuing the costs of each option
2. estimating the value of a unit of benefit
3. discussing whether each option would achieve enough benefit to 'break even'.

BEA can only be used to assess whether an option breaks even. It cannot be used to compare options.

The department has estimated the cost of option 1 as \$99.5 million (present value) from 2019 until the regulations sunset in 2029. The department has estimated that option 2 is costlier and that the present value costs than option 1, with present value costs of \$1–3 million higher for the 10 years from 2019. Both options have small unquantified costs that are not considered as part of this analysis.

These costs are relative to the base case of no regulations. Workings for these cost estimates are in the appendix.

The purpose (benefits) of cooling tower regulations is to minimise the burden of legionellosis. The department has estimated the burden of legionellosis from cooling tower systems to be \$124.8 million over 10 years. This estimate represents 27 deaths, 729 hospitalisations and 51 cases where hospitalisation was not required. More than 90 per cent of the estimated burden is from deaths even though there are far more hospitalisations than deaths. This is because the burden of a death is much greater than the burden of a hospitalisation. In the department's view, the burden of disease would be much higher than \$124.8 million under the base case of no regulations. Further details on the calculations for these benefits estimates are in the appendix.

Using the above estimates:

- Option 1 would break even if there was a reduction in the burden of disease equivalent to at least 22 deaths, relative to the base case.
- Option 2 would break even if there was a reduction in the burden of disease equivalent to at least 23 deaths, relative to the base case.⁷

The department is confident that both options 1 and 2 would break even (Table 4.3).

The burden of disease would likely be much higher under the base case of no regulations (option 3). The department expects this approach would potentially:

- negatively impact on the Victorian population by increasing the likelihood of legionellosis in the community
- negatively impact on the Victorian economy by increasing the likelihood of an outbreak of legionellosis in a population centre, causing closure of facilities and potentially affecting reputation of collocated businesses
- positively impact on the operations of cooling tower system operators in the short term because there would be more flexibility to reduce servicing and maintenance standards.

Table 4.3 Break-even analysis of options for the regulation of cooling tower systems

⁶ For further details on this concept, refer to the [Best Practice Regulation Guidance Note: Value of statistical life](https://www.pmc.gov.au/sites/default/files/publications/Value_of_Statistical_Life_guidance_note.pdf) <https://www.pmc.gov.au/sites/default/files/publications/Value_of_Statistical_Life_guidance_note.pdf>, Office of Best Practice Regulation, Commonwealth

⁷ Both of these break-even analysis estimates are based on a proportionate reduction in deaths, hospitalisations and cases not requiring hospitalisation.

Option	Quantifiable costs over 10 years	Break even analysis – benefits	Comments
1. Retain the current regulations without changes	\$99,486,525	21.5 deaths	Likely to reduce by at least 21 deaths
2. Amend the regulations	\$100,481,390– \$102,471,121	21.7–22.2 deaths	Likely to reduce by at least 22 deaths
3. Base case – remove or reduce regulations	\$0	0	–

Both options 1 and 2 (maintaining the current regulations and amending the regulations) would be expected to positively impact on the health outcomes of the Victorian population by reducing the likelihood of legionellosis in the community due to poorly operating cooling tower systems and the associated impacts of an outbreak of legionellosis.

The department prefers option 2 to option 1 because, by reducing ambiguity, option 2 is expected to be marginally better at improving health outcomes. Both would have a positive impact by reducing the economic impacts of an outbreak of legionellosis and the stigmatisation of certain exposure sites. However, both would have an impact on the operations of cooling tower system operators, who, in the absence of regulations, may choose a less rigorous servicing and maintenance program. Option 2 is expected to marginally increase costs for cooling system tower operators relative to option 1.

Based on the above the preferred option is option 2: amend the regulations.

This option is expected to benefit the people of Victoria by contributing to the prevention and management of legionellosis from cooling towers through increased surveillance capacity, improved clarity of requirements and greater confidence in the compliance and monitoring system. The cost to industry for the additional requirements is considered to be marginally higher and offset by the benefits to industry of clearer regulation, improved health outcomes and reduced likelihood of outbreaks causing negative economic impacts in Victoria.

Appendix

History of regulation

A cooling tower system is a device to lower temperatures, that rejects heat to the atmosphere through the cooling of circulating water. The majority of cooling tower systems are small-scale units used to remove heat from air conditioning systems.

Case notifications of legionellosis slowly increased between 1979 and 2000 in Victoria (with legionellosis first being identified in the 1970s in the United States). This gradual increase is thought to be substantially explained by the rapidly increasing use of cooling towers in air-conditioning systems in large buildings. A major outbreak of *Legionella* occurred at the Melbourne Aquarium in April 2000, the cause of which was subsequently traced to the cooling tower systems associated with that building's air conditioning.

In response to the outbreak the Victorian Government strengthened the regulatory framework to improve testing and maintenance standards for cooling tower systems, with the aim of reducing the impact of *Legionella* on the community. A comprehensive register of cooling tower systems was established, and developing and implementing risk management plans and annual audits became a requirement on those responsible for cooling towers. In addition, the Department of Health and Human Services was given inspection powers and developed an enhanced technical advisory and outbreak investigation service.

These response actions were implemented by the Building Commission (through the *Building Act 1993*), the Plumbing Industry commission (the Plumbing Regulations 1998) and the Department of Health and Human Services (Health (Legionella) Regulations 2001).

The implementation of the *Public Health and Wellbeing Act 2008* and the Public Health and Wellbeing Regulations 2009 consolidated all these controls into one regulatory tool but retained the original intent of the *Legionella* reforms.

Comparison with other jurisdictions

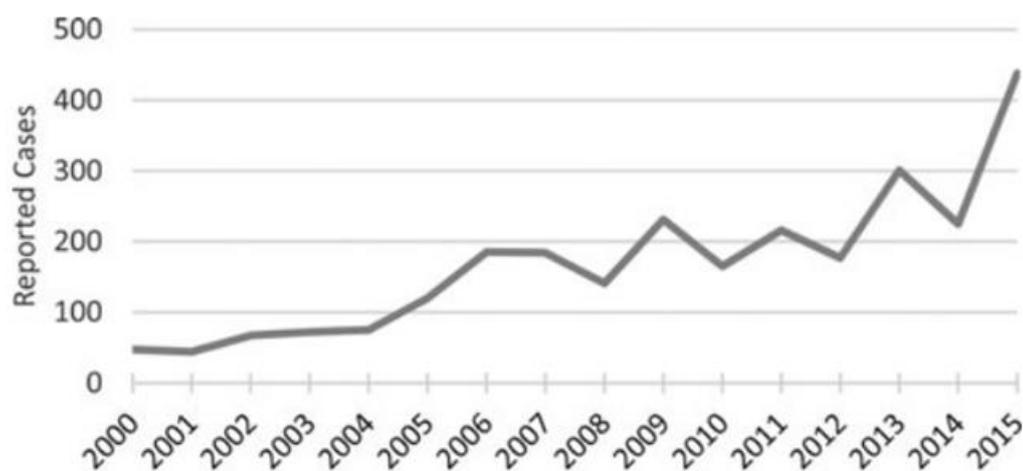
New York City

In 2015 New York City experienced a similarly large-scale outbreak to the Melbourne Aquarium outbreak of 2000. In 2015 the Bureau of Communicable Disease of the New York City Department of Health and Mental Hygiene detected an abnormal number and distribution of legionellosis cases. This cluster of cases grew into the largest outbreak of legionellosis in the history of New York City (there were two major outbreaks in 2015). These outbreaks were preceded by reported cases in New York City rising from 47 in 2000 to 438 in 2015 (Figure 4.1).

In response to rising cases of legionellosis, New York State recently introduced a similar regulatory framework to the framework used in Victoria.

The experience of New York City before regulation may illustrate the impacts Victoria could encounter if regulations were to be removed – specifically an increase in the number of legionellosis cases and the likelihood of an outbreak.

Figure 4.1: Reported cases of legionellosis in New York City, 2000–2015



Source: *The Bureau of Communicable Disease of the New York City Department of Health and Mental Hygiene*⁸

In reviewing the response to the outbreak and increase in legionellosis in New York State, it was noted that ‘while systems were already in place for obtaining and managing clinical data on Legionnaire’s disease diagnoses, there was no analogous system for managing data obtained from environmental sampling activities’.⁹ In other words, *Legionella* could be detected because of cases being reported to health authorities by medical practitioners, but not as a result of bacteria detected in cooling tower systems themselves.

As such, regulations stipulating cooling tower registration, certification, maintenance, inspection and testing requirements was put in place. From these measures, the New York City Department of Health and Mental Hygiene expects that the registration database will allow them to intervene in the operation of cooling towers or building maintenance plans to more effectively prevent disease spread.

This is a contemporary example of another jurisdiction encountering issues with managing legionellosis, which considered the most appropriate response was to introduce registration and prescriptive registration of cooling tower systems like the regulation used in Victoria.

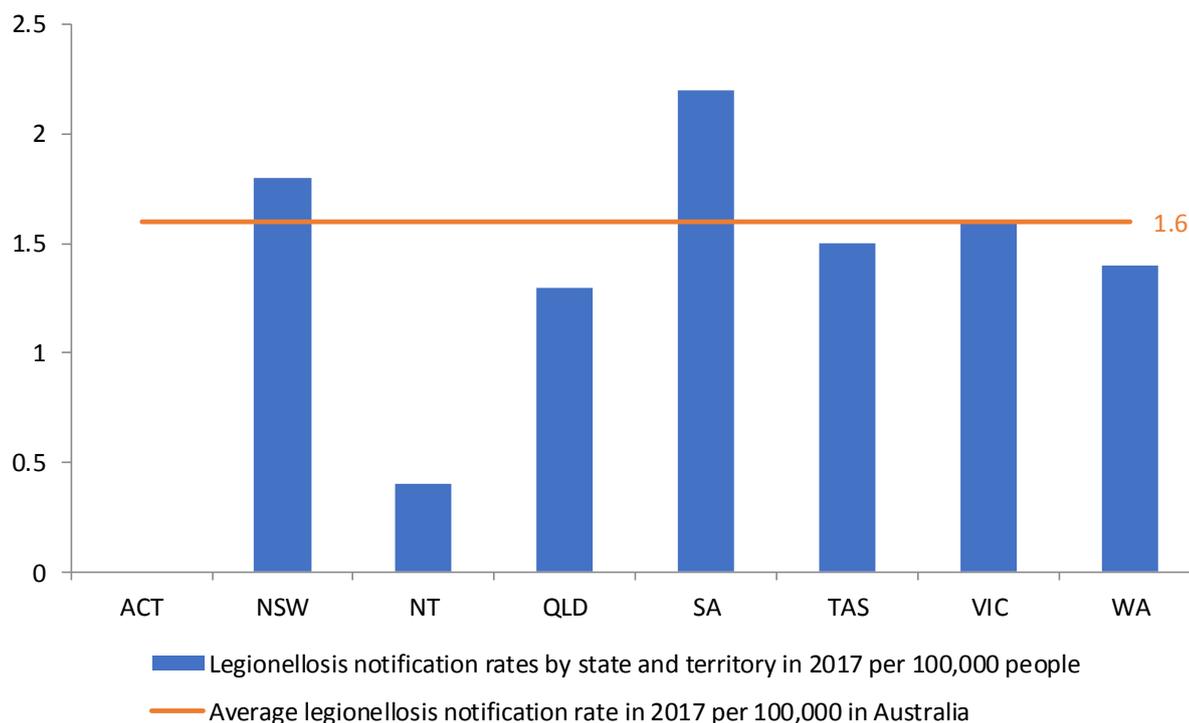
Other Australian state and territories

Figure 4.2 shows the rates for legionellosis for all types of *Legionella* (including *Legionella pneumophila*) for all states and territories in Australia.

⁸ Chamberlain AT, Lehnert JD, Berkelman RL 2017, The 2015 New York City Legionnaires’ disease outbreak: a case study on a history-making outbreak. *Journal of Public Health Management and Practice*, vol. 23, no. 4, pp. 410–416.

⁹ Ibid.

Figure 4.2: Legionellosis notifications per 100,000 population by state, territory and five-year average for Australia, 2017



Source: National Notifiable Diseases Surveillance System, Department of Health, Australian Government

New South Wales has comparable population density with Victoria but has a more devolved regulatory regime, with registration of cooling tower systems being a local government function. This approach provides greater flexibility in compliance but is expected to have less statewide consistency compared with Victoria.

As such, the legionellosis case notification rate of 1.8 per 100,000 for New South Wales can be used as benchmark for comparison with the Victorian regulatory approach.

Based on the experience of New York City before introducing cooling tower regulations in 2016, a base case in Victoria would, in the absence of regulations, expect to see a higher rate of legionellosis cases and an increased likelihood of a major outbreak. As such, a comparison rate per 100,000 could be even higher than the experience in New South Wales. Given the complexities of comparing overseas jurisdictions, specifically quantifying how much higher the rate per 100,000, would have significant variability and will not be expressed in a quantitative sense. However, it is expected that estimates of the burden of disease would likely be higher than the difference between Victoria's rate and the 1.8 per 100,000 used as comparison.

Fewer cooling towers

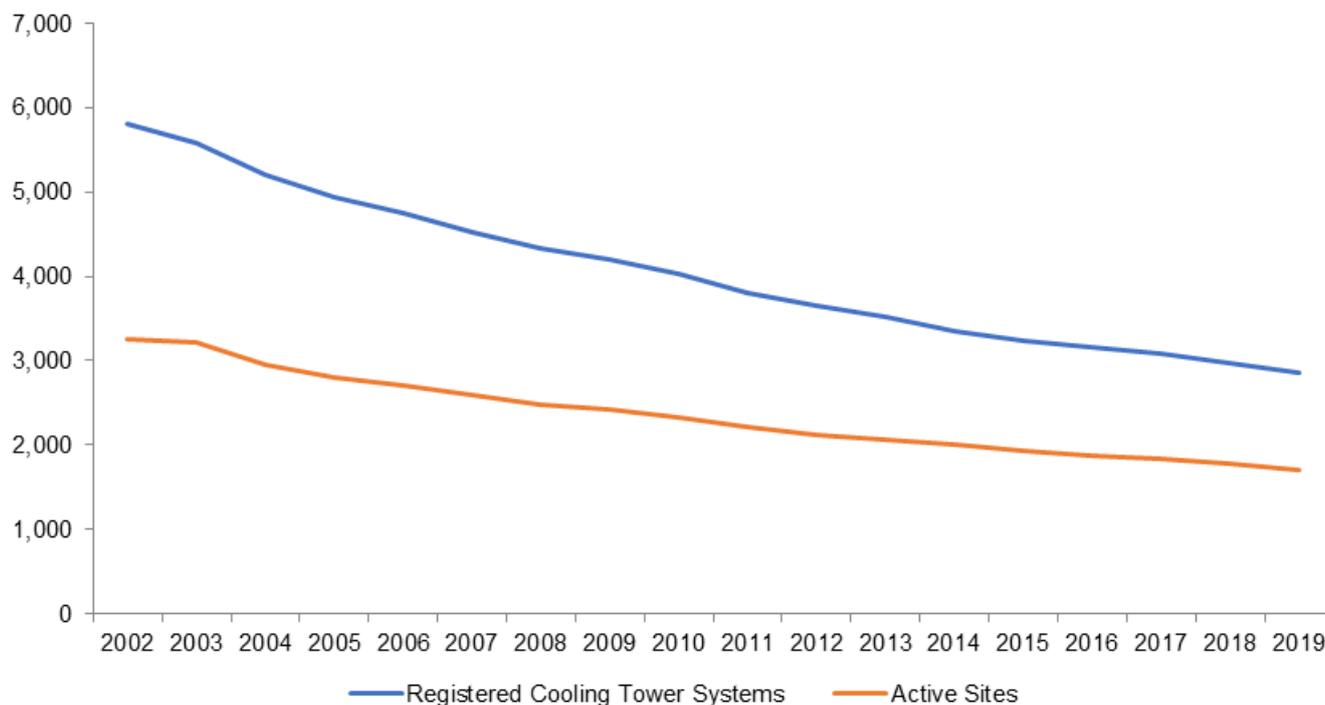
There are 2,859 registered cooling tower systems on 1,702 sites throughout Victoria (as at 1 January 2019). Most cooling tower systems are located within Melbourne and regional cities; however, systems are also found in rural and remote areas, including dairy farms.

Over the past 10 years, cooling tower system registrations have declined, from 4,192 in 2009 to 2,859 at the beginning of 2019 (Figure 4.3). This may be due to closures of factories and large industrial sites and a shift towards air-based air-conditioning systems that do not pose the risk of legionellosis. However, cooling towers still represent a relatively energy efficient approach and are therefore likely to continue to be used for the foreseeable future.

Since 2002 many operators have chosen to decommission cooling tower systems and install alternative systems. Residential developers appear to prefer to install air-based cooling systems over cooling towers, such as split-systems in individual apartments. This preference may reflect improvements in performance of alternative systems

rather than risks posed by cooling tower systems. It is expected that the technology improvements offered by alternative systems for temperature control is the main driver of the decrease in cooling tower systems; however, the department does not have a complete picture of the heating, air-conditioning and ventilation industry operations. The costs associated with complying with the regulations are expected to have also contributed to the decline in the number of cooling towers by imposing requirements above what industry may have undertaken in the absence of regulations; however, these are substantially lower than other cost considerations for operators.

Figure 4.3: Number of registered cooling systems and active sites as at 1 January, Victoria, 2002–2019

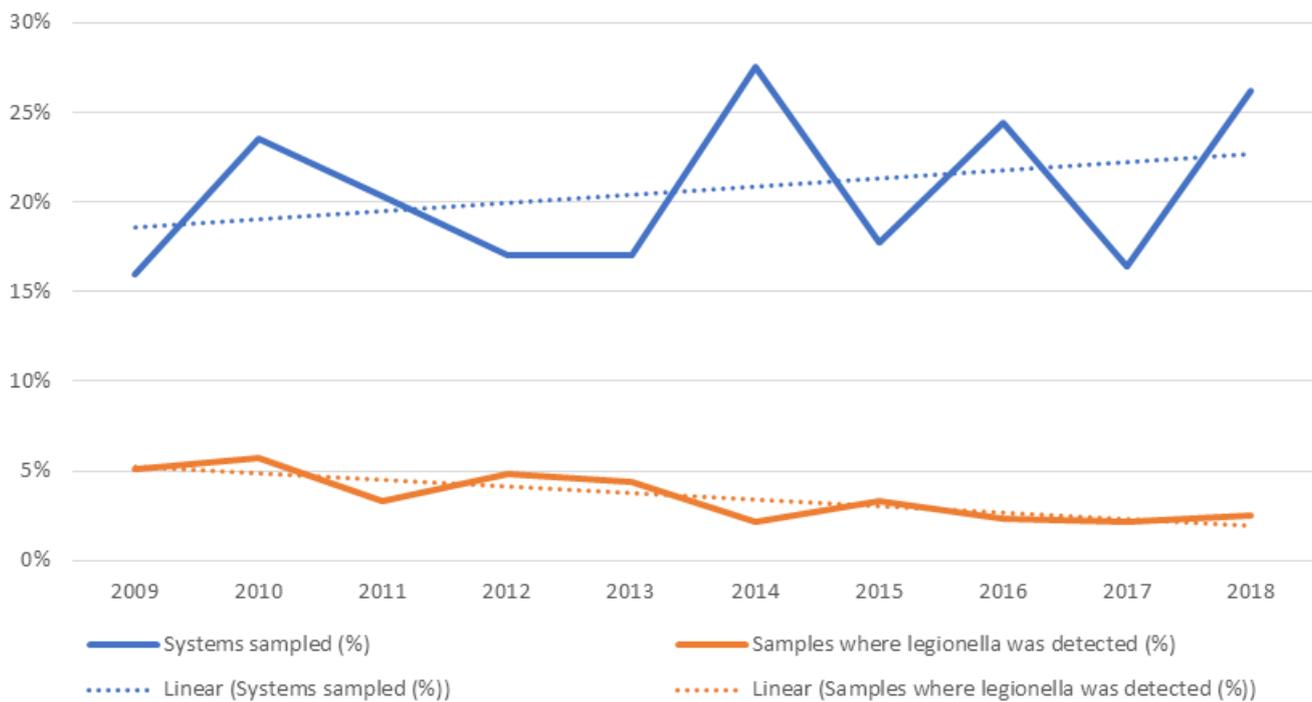


Source: The Department of Health and Human Services, Victorian Government

Fewer Legionella detections

The department undertakes inspections of sites where cooling tower systems are located. During these inspections samples of the water in the cooling tower systems are taken as part of compliance monitoring work. Since 2010, there has been a sustained decline in the detection of Legionella bacteria in these water samples (Figure 4.4). The number of annual detections declined by approximately 38 per cent over the past 10 years, from 45 to 27. This decrease in the number of detections has declined even when the number of cooling tower systems registered has fallen – meaning that even while the percentage of systems sampled has increased and the total number of samples taken has also increased, detections of Legionella has fallen. This demonstrates that the existing cooling tower systems continue to address the risk of Legionella bacteria occurring in these systems and the increase in cases of legionellosis in Victoria could be attributable to other sources of Legionella bacteria.

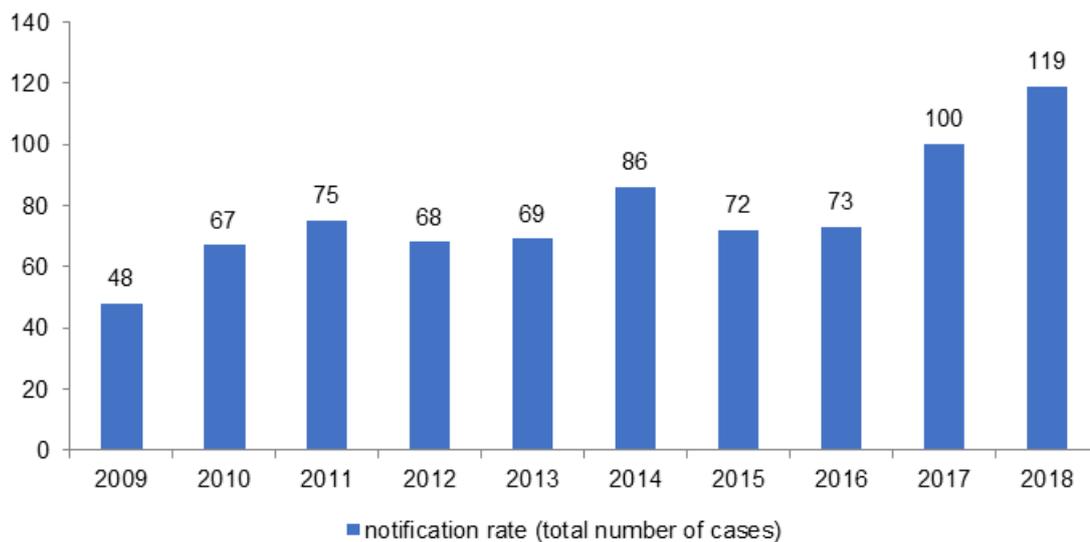
Figure 4.4: Total cooling tower samples compared with Legionella-positive samples, Victoria, 2009–2018



Notification rate of legionellosis

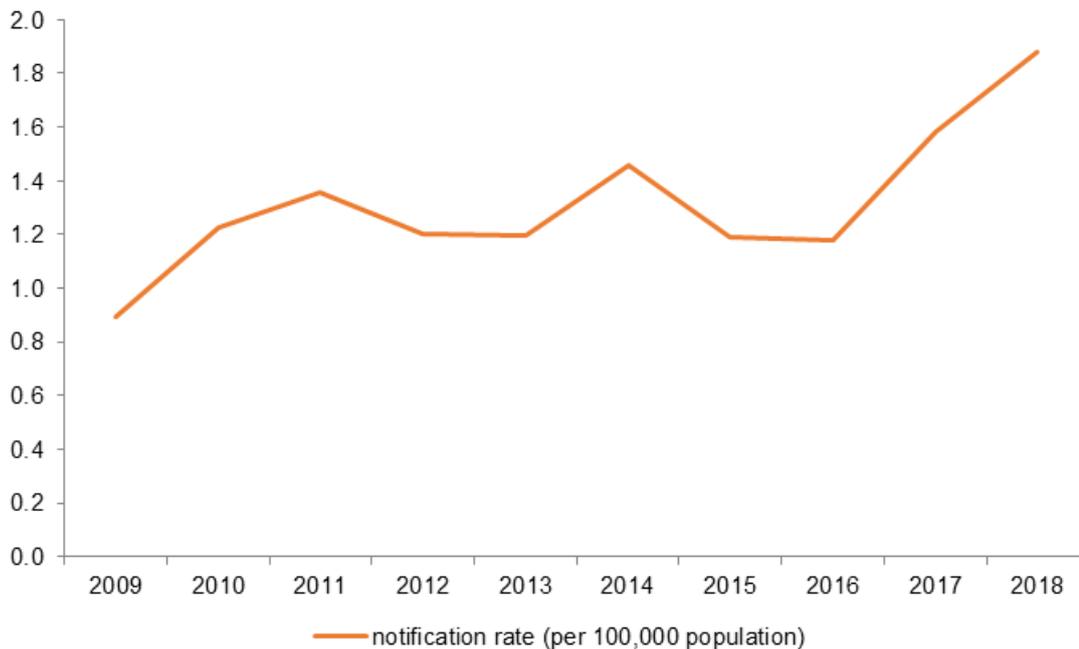
Under the Public Health and Wellbeing Regulations, laboratories and medical practitioners must immediately notify the Department of Health and Human Services of a legionellosis diagnosis (noting that these notifications do not identify a source). Figure 4.5 shows that the incidence of legionellosis in Victoria has been increasing gradually over the past 10 years. This increase is occurring in both the total notification rate and the rate per 100,000 population (Figure 4.6).

Figure 4.5: Notified cases of legionellosis in Victoria, 2009–2018



Source: The Department of Health and Human Services, Victorian Government

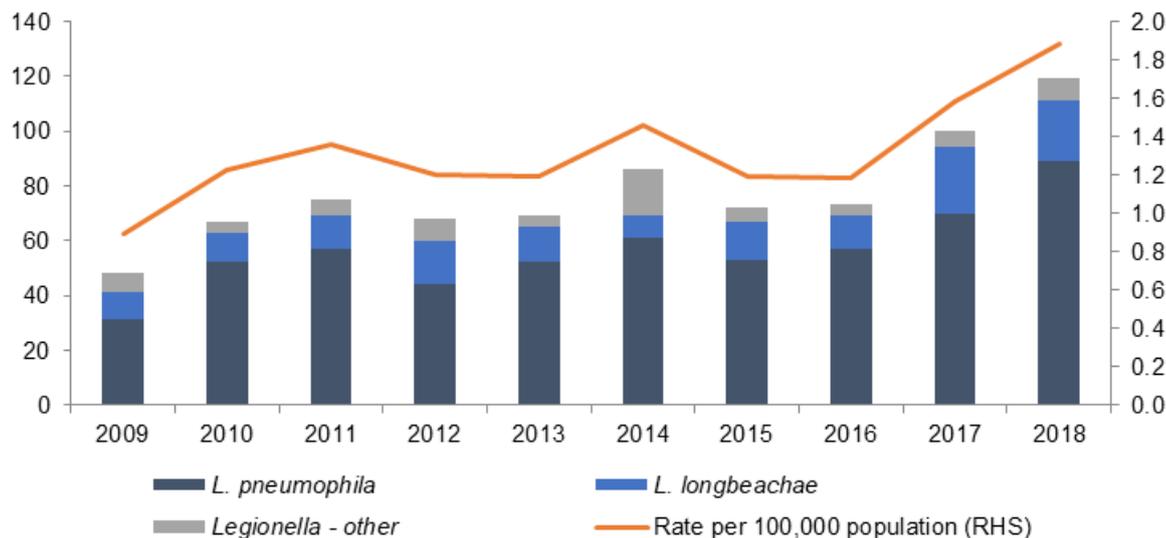
Figure 4.6: Number of notified cases of legionellosis per 100,000 population, Victoria, 2009–2018



Source: The Department of Health and Human Services, Victorian Government

Notifications relative to population size has more than doubled, with an increase from 0.88 per 100,000 people in 2009 to 1.88 per 100,000 people in 2018. The notified cases graph in Figure 4.7 includes all types of Legionella bacteria, which can come from a variety of sources, including hot springs, sea water, woodchips, mulch and soil.

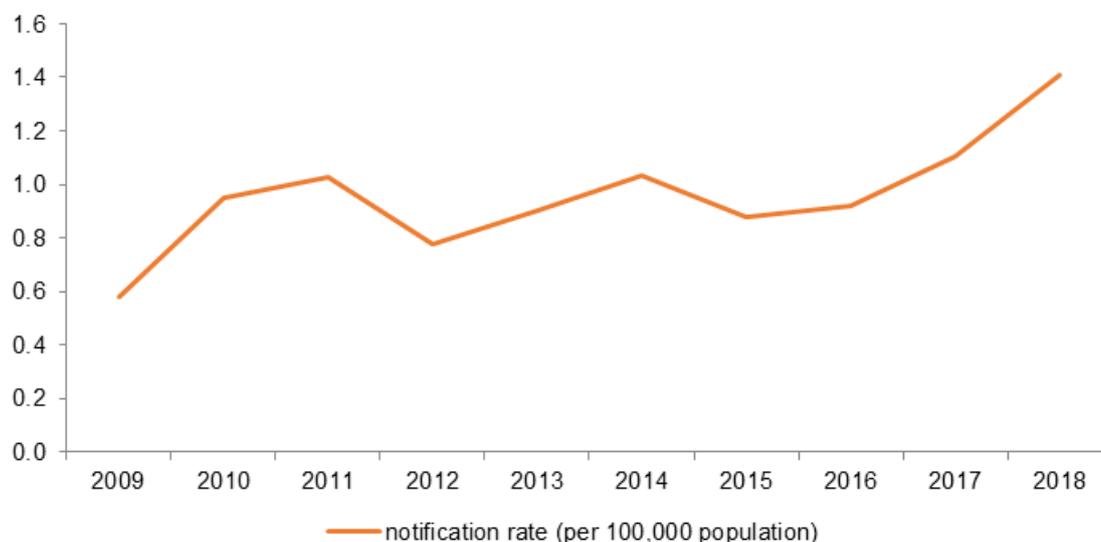
Figure 4.7: Notifications of Legionella by type, Victoria, 2009–2018



Source: The Department of Health and Human Services, Victorian Government

Exposure via cooling towers generally involves a specific type of Legionella bacteria: *Legionella pneumophila*. By reviewing the incidence of legionellosis from *Legionella pneumophila* (Figure 4.8), a sense of the number of cases from cooling towers and warm water delivery systems (see Chapter 5: Legionella risks in certain premises (water delivery systems)) can be gained.

Figure 4.8: Legionellosis due to *Legionella pneumophila* notified cases per 100,000 population, Victoria, 2009–2018



Source: The Department of Health and Human Services, Victorian Government

Figure 4.8 indicates that the type of *Legionella pneumophila*, the most commonly source found in cooling towers, is also steadily increasing, from 0.58 per 100,000 to 1.41 per 100,000 – an almost trebling of cases. This graph shows that, while other types of Legionella bacteria are also on the rise, the majority of cases remain *Legionella pneumophila* – the likeliest source of which is cooling towers, water delivery systems or other environmental sources. Sources within water delivery systems are described in Chapter 5: Legionella risks in certain premises (water delivery systems).

Contributing factors to increased legionellosis

Improved reporting of legionellosis in Victoria

In 2000 a major outbreak of legionellosis at the Melbourne Aquarium significantly raised public and medical community awareness of legionellosis, with 125 reported cases linked to the aquarium. As a likely result of the increased awareness of the disease in the years following this major outbreak, reporting of cases by medical practitioners and laboratories improved (along with a range of regulatory changes and substantial improvements in the department’s follow-up of reported outbreaks). The department believes that, while there continues to be an element of underreporting of legionellosis, the extent of this underreporting has declined in Victoria following this major event. In other words, reports of disease are not fully indicative of occurrence of disease, therefore the current increase may be, in part, the result of increased reporting rather than significantly more cases.

There is recognition across the literature on Legionella that notifiable disease datasets, such as Victoria’s notification conditions and micro-organisms regulations, only provide an indication of the most severe cases of the disease. A proportion of community-acquired pneumonia cases are likely to be due to undiagnosed legionellosis, and the community-acquired pneumonia screening performed by most hospitals does not include Legionella (although this has started to change in very recent years). Studies quote the proportion of community-acquired pneumonia due to Legionella range from one to 15 per cent of all cases. In Australia, it is estimated that there is a rate of community-acquired pneumonia of 245 per 100,000 population,¹⁰ meaning undiagnosed legionellosis, from any source, could represent an additional burden of disease between 2.5 to 36.8 cases per 100,000 population.

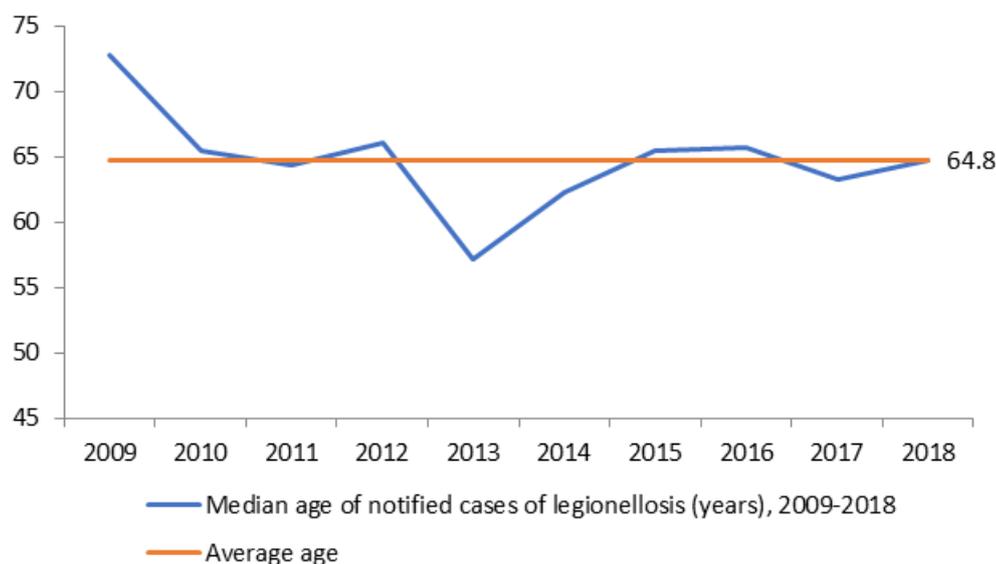
¹⁰ Department of Health 2017, Community-acquired syndromes causing morbidity and mortality in Australia, *Communicable Diseases Intelligence*, vol. 41, no. 1, Commonwealth of Australia

Change in Victorian demographics

Ageing population

Legionellosis is more prevalent in older people (aged over 50) and the elderly (over 85), with more than 70 per cent of infections in Victoria occurring in patients over 50 years of age (Figure 4.9).

Figure 4.9: Legionellosis notifications by median age, Victoria, 2009–2018



Victoria is continuing to experience an increase in the average age of its population. In 1971, eight per cent of Victoria's population was over the age of 65 years.¹¹ On the basis of Victorian Government projections,¹² the population over the age of 65 years was estimated to be 14 per cent in 2011. In 2051 the proportion of the population over the age of 65 years is projected to increase to 21.5 per cent. A higher proportion of susceptible people could result in an increase in cases of legionellosis. Regulation of cooling towers cannot prevent an increase in the number of people who are vulnerable to *Legionella* because of age.

Population density

Victoria has the highest population density of all Australian states (measured by people per square kilometre). In June 2009 Victoria's population density was 23.9 people per square kilometre. By June 2017 Victoria's population density had increased to 28 people per square kilometre. This is very high compared with Australia's population density of 3.2 people per square kilometre. Population density has particularly increased in urban areas, coinciding with the location of cooling towers (for example, at large shopping centres). More people are living and working in and around cooling towers, therefore people are more likely to be exposed to possible infection by *Legionella* bacteria.

Legionella in return travellers (proportion of total cases)

According to the Australian Bureau of Statistics, Australians are travelling overseas for holidays more than ever, with a 100 per cent increase in the number of short-term resident departures (short trips overseas) in 2016 compared with 2006. Of the 9.8 million Australians who travelled overseas in 2016, 25.5 per cent were from Victoria, with the most popular destinations being New Zealand and Indonesia.

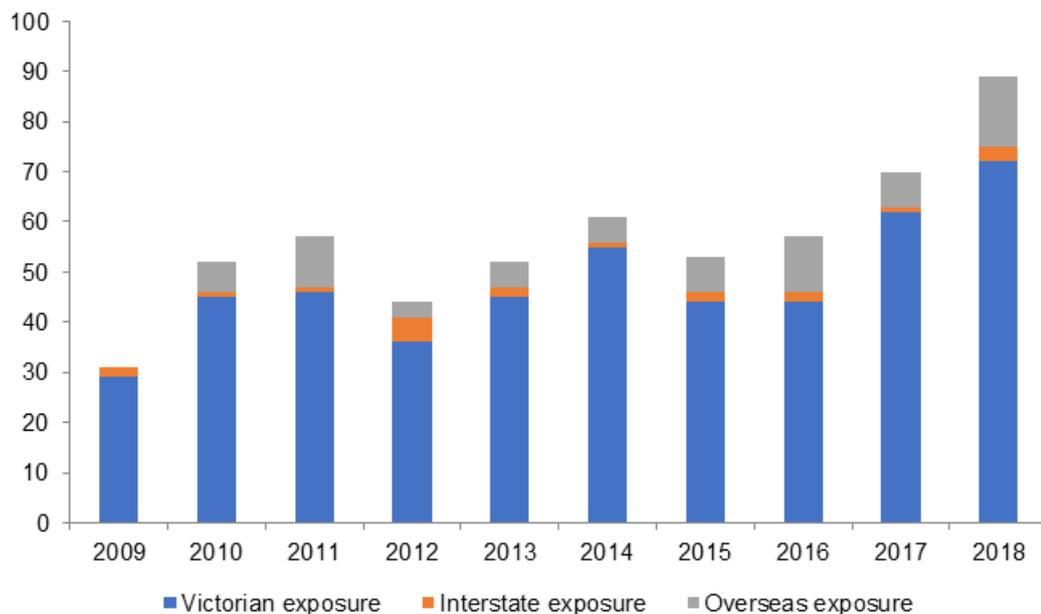
The proportion of *Legionella pneumophila* that can be traced to an overseas source has also increased in the past 10 years. It is worth noting that the source overseas is suspected to be in the built environment in these countries – there is no recorded human-to-human transmission of legionellosis. In 2018, 16 per cent of notifications (14 cases)

¹¹ Department of Infrastructure, Victoria, 2000

¹² Department of Environment, Land, Water and Planning, Victoria, 2016

of legionellosis from *Legionella pneumophila* were acquired overseas (Figure 4.10). Of these 14 cases in 2018, four were acquired in Indonesia and four were acquired in Thailand. The 10-year average between 2009 and 2018 was 11 per cent of total notifications, yet the 10-year average between 1999 and 2008 was one per cent of notifications of legionellosis.

Figure 4.10: Exposure sources of *Legionella pneumophila*, Victoria, 2009–2018

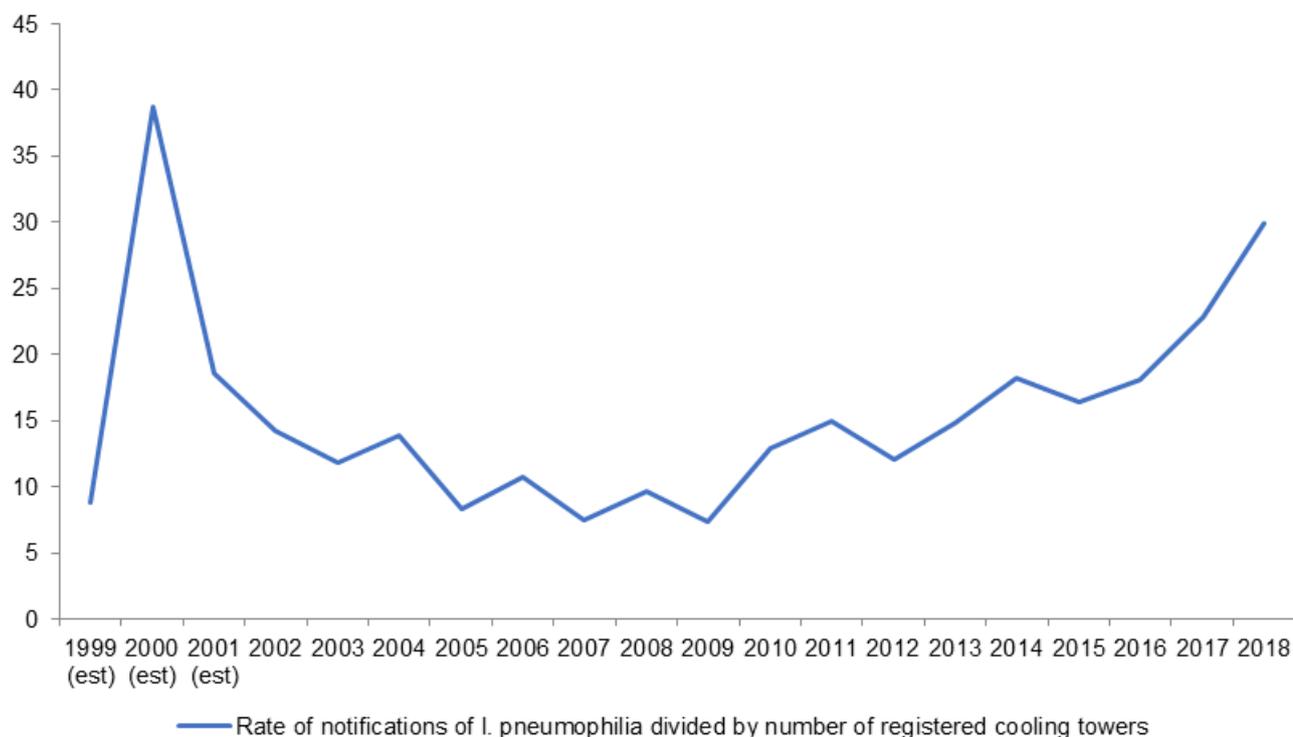


More travel by Victorians has resulted in more legionellosis acquired from *Legionella* bacteria from sources overseas. Legionellosis acquired outside of Victoria cannot be influenced by the Victorian regulations related to *Legionella* control yet partially contribute to the increase in the case notification rate per 100,000 population in Victoria between 2009 and 2018.

Reduced detection of *Legionella* in cooling tower systems

Sampling of cooling tower systems indicates that there has been a decrease in the detection of *Legionella* in the existing stock of cooling towers (Figure 4.11). This indicates that the source of community-acquired legionellosis is from another source.

Figure 4.11: Rate of notifications of *Legionella pneumophila* divided by the number of registered cooling towers, Victoria, 2002–2018 (1999–2001 estimated number of cooling towers)



Burden of disease

The impact of legionellosis can be valued by its component costs:

- hospital and medical costs
- the loss of economic output due to absences from work (including carer’s leave)
- the economic impact of a death.

Each regulatory option differs in possible number of cases and subsequent statewide burden of the disease; however, the expected burden of a single case would remain the same regardless of the option.

Key data from the department’s notification system relating to legionellosis is outlined in Table 4.4. This data is used to inform the costs associated with a single case of legionellosis.

Table 4.4: Cases of hospitalised legionellosis over the past 10 years

Type	10-year average (2009–2018)
Cases of legionellosis (all types)	77.7
Proportion of cases hospitalised (%)	93.4
Cases of legionellosis attributable to <i>Legionella pneumophila</i> (%)	73.5

Hospital and medical costs

Over the past 10 years, most notified cases of legionellosis were hospitalised (all types, including *Legionella pneumophila*). The median length of stay at a hospital was five days. The cost for a hospital stay for respiratory system disorders with ventilator support is estimated at \$9,500 per hospitalisation.¹³

¹³ Depending on the specific hospital, year and number of days treated, using the Victorian Weighted Inlier Equivalent Separation casemix funding model.

Post-hospitalisation medical costs incurred are estimated at \$811, comprising the estimated costs of prescription medicines received and general practitioner visits following release from hospital. This calculation is derived by updating the estimate from the previous regulatory impact statement for inflation (\$657 in 2008). It is assumed that cases that do not require hospitalisation would incur similar post-hospitalisation medical costs.

Loss of output due to absences and carer's leave

The average loss of output due to absence from work assumes that each case of legionellosis required five days' absence while hospitalised and an additional three weeks (21 days) absence from work while recovering post-hospitalisation (this post-hospitalisation estimate from the previous regulatory impact statement has been assumed to be comparable). This is a total of 26 days absence from work per case of legionellosis.

Table 4.5 shows average annual earnings in Victoria and the comparable daily rate.

Table 4.5: Average annual earnings in Victoria

Type	May 2018
Average weekly earnings in Victoria	\$1,171.90
Yearly earning as a daily rate	\$167.41

These are aggregate figures and do not reflect an individual's circumstances such as work profile of people that are diagnosed with legionellosis (full-time, part-time, casual, unemployed or retired).

Burden of disease from legionellosis – hospitalisation and non-hospitalisation

The costs described above are listed in Table 4.6 for cases requiring hospitalisation (Table 4.6a) and non-hospitalisation (6b).

Table 4.6a: Impact of legionellosis requiring hospitalisation

Risk	Impact	Quantity	Per unit cost	Total
Legionellosis requiring hospitalisation	Absence from work (days)	26	\$167.41	\$4,352.66
	Public hospital admissions – respiratory system disorders with ventilator support	1	\$9,500.00	\$9,500.00
	Post-hospitalisation medical costs	1	\$811.00	\$811.00
	Total			\$14,663.66

Table 4.6b: Impact of legionellosis not requiring hospitalisation

Risk	Impact	Quantity	Per unit cost	Total
Legionellosis <i>not</i> requiring hospitalisation	Absence from work (days)	26	\$167.41	\$4,352.66
	Post-hospitalisation medical costs	1	\$811.00	\$811.00
	Total			\$5,163.66

Mortalities due to legionellosis

Over the past 10 years there have been an average of three deaths per year from legionellosis, a 10-year average mortality rate of 3.4 per cent per notifiable case. In line with guidance from the Office of the Commissioner for Better Regulation, a Value of a Statistical Life figure of \$4.5 million has been adopted per death.

Burden of disease of legionellosis in Victoria over the theoretical 10 years

The department estimates the potential burden of disease as follows:

Total net present value of potential burden of disease from *Legionella pneumophila* in Victoria: \$90,599,902 over 10 years (in 2019 dollars)¹⁴

Avoided disease burden

In the absence of the regulations it would be expected that less rigorous requirements would give rise to greater exposure rates to *Legionella pneumophila* and a greater number of cases of legionellosis in Victoria.

Based on the comparison with other Australian state and territories above, the notification rate of notification rate of 1.8 per 100,000 for New South Wales (five-year average to 2017) may be an appropriate benchmark for comparison with the Victorian regulatory approach.

Legionellosis cases in Victoria using benchmark comparison notification rates per 100,000 population

The potential difference in the avoided disease burden will use the estimated average rate of 1.8 per 100,000 for New South Wales compared with the 1.6 per 100,000 in Victoria (five-year average to 2017), using actual population figures in Victoria across the past 10 years of the regulation (Table 4.7).

Table 4.7: Potential avoided disease burden over 10 years from legionellosis, 2019 to 2029.

Measure	Over 10 years
Victorian population (combined 2009–2018)	59,189,833
Victorian benchmark (per 100,000)	1.6
Expected notified cases	947
New South Wales benchmark (per 100,000)	1.8
Expected notified cases	1,065
Difference	118

In this estimate, it is expected that if Victoria had a more devolved regulatory regime similar to the structure in New South Wales, it could be expected to have an additional 118 notified cases of legionellosis over the past 10 years.

Using the estimates for disease burden and mortalities above, this would equate to additional estimated costs for medical treatment, lost output from work and the losses attributed to the Value of a Statistical Life. The additional burden is shown in Table 4.8.

¹⁴ Additional details are outlined in the technical appendix relating to the estimated disease burden.

Table 4.8: Estimated additional disease burden associated with a more devolved regulatory regime

Measure	Percentage likelihood	Additional costs associated with an extra 118 cases	Cost per case	Additional burden
Hospitalisation for legionellosis	93.4%	110	\$14,664	\$1,616,111.30
Non-hospitalisation for legionellosis	6.6%	8	\$5,164	\$40,214.58
Mortality (in additional medical treatment)	3.4%	4	\$4,500,000	\$18,054,000.00
Total				\$19,710,325.88

The potential additional burden of disease and mortality of an increased rate of legionellosis from 1.6 to 1.8 per 100,000 is estimated at **\$19,710,326 over 10 years**.

Avoided economic impacts from an outbreak of legionellosis attributed to cooling tower systems

There have been observable reputational impacts for building operators and collocated businesses following outbreaks being linked to specific cooling tower system sites. In the event that the department or the Chief Medical Officer announces that an outbreak has occurred, there is a noticeable change in public behaviour in response.

A recent example occurred in April–May 2018. The department identified an outbreak of legionellosis where the cases had been in the vicinity of Airport West and Gladstone Park shopping centres during the incubation period. Samples were taken from registered cooling tower systems in the vicinity, which were also disinfected by the cooling tower system operators as a precautionary measure.

In the subsequent weeks, the shopping centre operators advised that there was a significant drop in foot traffic to the shopping centres, which was assumed to be linked to the recent outbreak of legionellosis in the area. This occurred even when the shopping centres were not directly identified as causing the outbreak. There would be merit in monitoring public reaction to impacts of outbreaks, and whether there is observable differences in the length of time that it takes different country cohorts to return to a certain building following an identified outbreak in the area.

To illustrate the potential impact, Victoria has three of the five largest shopping centres in Australia (by annual turnover) with Chadstone, Westgate Fountain Gate and Highpoint Shopping Centre moving an annual turnover of \$3.98 billion in 2017.¹⁵ An outbreak in a specific high turnover area could have high impacts to the businesses in that area, and this would be amplified if the outbreak was ahead of normally high retail spending such as in December.

The potential economic impact provides a negative incentive to building operators to reduce the risk of Legionella in their cooling tower systems; however, because this is an extreme risk with a low likelihood, it is expected that cooling tower system operators may undervalue the risk that it would occur to their specific building until after the event has occurred. This undervaluation of this risk is most likely amplified because the impacts are likely to fall on people living and working near cooling towers and not just the building operator.

In the absence of the regulations, the department would continue to respond and make announcements relating to outbreaks of Legionella. However, as the regulations are expected to reduce the incidence of Legionella in cooling tower systems, it is expected that the number of outbreaks (and the severity) will also reduce. As such it is expected that the regulations contribute to economic activity by reducing the number of outbreaks and by providing a level of confidence for the public that, in the event of an outbreak, that the impact is minimised.

¹⁵ Shopping Centre News 2018, [Big Guns 2018](https://www.shoppingcentrenews.com.au/category/the-guns/big-guns/) <https://www.shoppingcentrenews.com.au/category/the-guns/big-guns/>

Costs for industry to implement the regulations

There are quantifiable costs that can be attributed to regulating cooling tower systems. These relate to the requirements relating to risk management plan audits, maintenance and sampling of cooling towers, and actions in response in the event of detection.

The department surveyed cooling tower water treatment providers for breakdowns of costs. The survey has aggregate information for providers that service more than 1,300 cooling tower systems across Victoria, which is around 45 per cent of the total market.

Maintenance of cooling tower systems

Maintenance and cleaning service providers for cooling tower systems were surveyed for the cost of implementing a maintenance regime that is compliant with the regulations.

Guidelines relating to cooling tower systems (*A guide to developing risk management plans for cooling tower systems*) recommend operational programs. Maintenance and cleaning service providers generally offer services based on the frequency and scope listed in Table 4.9. Program D, the lowest requirements, align with the requirements in the regulations.

Table 4.9: Recommended operational programs for cooling tower systems

Program A	Program B	Program C	Program D
Weekly inspection	Monthly inspection (2 weeks after service)	Monthly inspection (2 weeks after service)	Monthly service
Fortnightly service	Monthly service	Monthly service	
HCC and Legionella tested at a minimum of once each month	HCC and Legionella tested monthly	HCC tested monthly Legionella tested every 2 months	HCC tested monthly Legionella tested every 3 months
Six-monthly cleaning, or more frequently where environmental contamination (for example, dust, soil, building works) is a problem.			

HCC = heterotrophic colony count

Source: *A guide to developing risk management plans for cooling tower systems*, Department of Health and Human Services, Victoria

Based on the survey results, the average annual costs to undertake the operational programs as per the recommended operational requirements are shown in Table 4.10.

Table 4.10: Surveyed costs of operational programs for cooling tower systems

Costs	Program A	Program B	Program C	Program D
Average	\$7,017	\$4,947	\$4,000	\$3,633
Minimum	\$4,800	\$3,900	\$3,500	\$2,900
Maximum	\$10,000	\$6,000	\$4,500	\$4,500

Note that these values are averages; the site-specific costs depend on a range of other parameters.

Based on the 2,859 cooling tower systems in Victoria at the beginning of 2019, the cost to undertake the minimum requirements of the regulations relating to maintenance equates to **\$10,386,747 over one year** or **\$99,486,525 over the 10 years** of the regulations (in 2018 dollars).

However, a number of operators of cooling tower systems (more than 90 per cent) choose to undertake a maintenance program that is higher than the regulatory minimum, which may indicate that many operators value the benefit of higher levels of inspections, servicing, testing and cleaning than the regulatory minimum.

Annual audit and review of the risk management plan

The annual audit must be conducted by a person independent of those operating and servicing the cooling tower, and they must be certified by the department. Developing and reviewing risk management plans can be undertaken by anyone and is often the water treatment company supplying other services.

The cost to undertake the annual audit and review are generally separated from the cost to undertake the recommended operational programs above; however, these costs are associated with the requirements in the Act.

Routine service

The current regulations require cooling tower systems to be serviced at least once each month to check that the system is operating without defects. The regulations give no details about what should be checked during a service.

There is no requirement for observed deficiencies in the cooling tower system noted on the service report to be addressed; however, if a high heterotrophic colony count (HCC) result or Legionella detection occurs, the deficiency would have to be addressed within 24 hours of notification.

The cost to undertake a routine service is included in the cost to undertake the recommended operational programs above.

Heterotrophic colony count sampling

The regulations currently require the responsible person to ensure that at least once each month a sample of the recirculating water of the cooling tower system is taken and is delivered to a laboratory for testing for HCC.

The costs to undertake this testing are included in the cost to undertake the recommended operational programs above.

Legionella sampling

The responsible person must ensure that at least once every three months a sample of the recirculating water of the cooling tower system is taken and delivered to a National Association of Testing Authorities accredited laboratory for testing and reporting for Legionella.

There is no requirement to notify the department of the detection of Legionella in a cooling tower system except in the case that Legionella is detected in three consecutive samples taken from the same cooling tower system. In this circumstance the responsible person must notify the department immediately by phone and within three days in writing.

The costs to undertake this testing are included in the cost to undertake the recommended operational programs above.

Record-keeping requirements

The responsible person must ensure that testing records are kept up to date and are available upon the request of the department.

The costs to undertake this testing are assumed to be included in the cost to undertake the recommended operational programs above.

Cooling tower system public register

Registration is a requirement under the Act and is not included in considering options for the regulations. These are included below for reference only and are not included in the cost totals.

The Act sets out legal obligations on landowners to register cooling tower systems. A cooling tower system is considered to be in operation from when it is first commissioned until it has been decommissioned or removed and the department has been notified that it has been decommissioned or removed. The Act requires the cooling tower system to be registered at all times when it is in operation.

Obtaining registration involves obtaining and completing the relevant form and submitting it with the required fee and a copy of the risk management plan in respect of the cooling tower system or, in the case of a renewal, evidence that an audit and review has been conducted.

The department must keep a register containing the details of the location of each registered cooling tower system. This register must be available for inspection by any person wishing to inspect the register during the department's normal business hours.

Disinfection, testing for Legionella and follow-up samples

The following are surveyed costs relating to once-off actions in cooling tower systems.

Based on industry information, cooling tower system operators make arrangements with service providers to undertake these actions as part of outsourced annual contracts for maintenance and cleaning services. However, there have been situations where the department has requested that actions be undertaken to proactively manage potential outbreaks. It is not known whether the operator would have undertaken these actions in the absence of direction by the department.

These actions may incur additional costs on the operator, depending on the contractual arrangements the operator has made with the third-party service provider. An estimate of the costs for a specific action are listed in Table 4.11 (informed by a survey of service providers).

Table 4.11: Surveyed costs relating to service and maintenance for cooling tower systems

Costs	Disinfection	Chemical dosing in response to a high HCC	Follow-up sample
Average	\$198	\$175	\$158
Minimum	\$120	\$100	\$99
Maximum	\$325	\$275	\$225

Costs for government to enforce the regulations

The cost to the department to administer the regulations relating to Legionella is shown in Table 4.12.

Table 4.12: Staffing related to cooling tower systems regulations

Staffing profile	Salary
Management	\$23,617
Field work	\$240,228
Administration/registration	\$62,494
Subtotal	\$326,339
On-costs	\$101,250
Total	\$427,589

This cost reflects a very small centralised team of environmental health officers supported by a share of a centralised licensing and registration team.

The total cost of administering the regulations is estimated at \$571,093 over one year. There are 2,859 cooling tower systems registered, and the per-system administration costs are estimated at \$200 per cooling tower system.

Regulatory administration and compliance by the department involves processing registration (both initial and renewal applications) and cancellations, providing information to operators, responding to complaints and conducting inspections and undertaking investigations.

In the absence of the cooling tower system registration requirements in the Act, it is expected that the department would continue, in a more limited capacity, to maintain oversight of risks relating to Legionella associated with cooling tower systems and water delivery systems.

Fees revenue

While not included in the costs associated with the regulations, there is a cost to industry to register cooling towers for a period of one, two or three years.

The current fees are as follows:

- one-year registration = \$108.40 per cooling tower
- two-year registration = \$202.30 per cooling tower
- three-year registration = \$296.20 per cooling tower.

A majority of cooling tower operators (75 per cent) choose to register and renew for a period of one year; with 22 per cent choosing a two-year term. This preference for shorter terms is probably attributable to the tendency for property managers to prefer annual fees rather than longer, multi-year fees. The fee revenues received for the previous three years is shown in Table 4.13.

Table 4.13: Fee revenue for cooling tower system registration, 2015–16 to 2017–18

Year	2015–16	2016–17	2017–18	Average
Fee revenue for cooling tower system registration	\$428,972.68	\$446,139.30	\$462,582.75	\$445,898

Based on trends in cooling tower system registration, the department expects the number registrations to gradually decline over the next 10 years, with an associated decrease in fee revenue. However, given the ongoing presence of legionellosis cases and the potential for outbreaks in Victoria, the department expects to continue to maintain the same level of staffing profile in the regulatory administration and compliance relating to legionellosis.

It is proposed to set fees at the level needed for full cost recovery. This means that fees can be retained at existing levels. It is not proposed to discount the longer registration periods as is the case with the current regulations given the observed industry demand for shorter registration periods.

This will translate in the regulations to 7.5 fee units for registration of a tower for a one-year period; 15 fee units for registration of a tower for a two-year period and 22.5 fee units for registration of a tower for a three-year period (based on the value of a fee unit for the 2019–20 year of \$14.81¹⁶).

¹⁶ [Department of Treasury and Finance](https://www.dtf.vic.gov.au/financial-management-government/indexation-fees-and-penalties) <https://www.dtf.vic.gov.au/financial-management-government/indexation-fees-and-penalties>

Technical appendix

Table 4.14: Burden of disease of legionellosis – theoretical example in Victorian context

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Number of cases of legionellosis in Victoria	78	78	78	78	78	78	78	78	78	78	780
Deaths from legionellosis (3.4% of cases – 10-year average)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	27
Value of a Statistical Life figure	\$4,500,000	\$4,635,000	\$4,774,050	\$4,917,272	\$5,064,790	\$5,216,733	\$5,373,235	\$5,534,432	\$5,700,465	\$5,871,479	
Lost economic output due to deaths (deaths multiplied by Value of a Statistical Life)	\$11,934,000	\$12,292,020	\$12,660,781	\$13,040,604	\$13,431,822	\$13,834,777	\$14,249,820	\$14,677,315	\$15,117,634	\$15,571,163	\$136,809,936
Legionellosis requiring hospitalisation (93.4 per cent of cases)	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	72.9	729
Burden of disease from hospitalisation cost	\$14,664	\$15,104	\$15,557	\$16,023	\$16,504	\$16,999	\$17,509	\$18,034	\$18,575	\$19,133	
<i>Burden per year</i>	<i>\$1,068,277</i>	<i>\$1,100,325</i>	<i>\$1,133,335</i>	<i>\$1,167,335</i>	<i>\$1,202,355</i>	<i>\$1,238,426</i>	<i>\$1,275,579</i>	<i>\$1,313,846</i>	<i>\$1,353,261</i>	<i>\$1,393,859</i>	
Legionellosis not requiring hospitalisation (6.6 per cent of cases)	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	51
Burden of disease from non-hospitalisation cost	\$5,164	\$5,319	\$5,478	\$5,642	\$5,812	\$5,986	\$6,166	\$6,351	\$6,541	\$6,737	\$59,196
<i>Total burden per year</i>	<i>\$26,583</i>	<i>\$27,380</i>	<i>\$28,201</i>	<i>\$29,047</i>	<i>\$29,919</i>	<i>\$30,816</i>	<i>\$31,741</i>	<i>\$32,693</i>	<i>\$33,674</i>	<i>\$34,684</i>	
Total burden of disease from legionellosis	\$13,028,859	\$13,419,725	\$13,822,317	\$14,236,987	\$14,664,096	\$15,104,019	\$15,557,140	\$16,023,854	\$16,504,569	\$16,999,706	\$12,551,337

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Net present value	\$13,028,859	\$12,903,582	\$12,779,509	\$12,656,629	\$12,534,931	\$12,414,403	\$12,295,033	\$12,176,812	\$12,059,727	\$11,943,768	\$124,793,254
Percentage attributable to <i>Legionella pneumophila</i> (73.5% of cases – 10-year average)	\$9,458,952	\$9,368,001	\$9,277,924	\$9,188,713	\$9,100,360	\$9,012,856	\$8,926,194	\$8,840,365	\$8,755,362	\$8,671,176	\$90,599,902

Table 4.15: Estimated cost to undertake the minimum requirements of the regulations relating to maintenance of cooling tower systems in Victoria

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Cost to undertake the minimum requirements of the regulations	\$10,386,747	\$10,698,349	\$11,019,300	\$11,349,879	\$11,690,375	\$12,041,087	\$12,402,319	\$12,774,389	\$13,157,620	\$13,552,349	\$119,072,414
Net present value	\$10,386,747	\$10,286,874	\$10,187,962	\$10,090,001	\$9,992,982	\$9,896,895	\$9,801,733	\$9,707,486	\$9,614,144	\$9,521,701	\$99,486,525

Table 4.16: Estimated disease burden using other jurisdictional comparison

Measure	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018 (estimated)	Total
Victoria population	5,419,249	5,495,711	5,591,818	5,709,586	5,832,585	5,957,512	6,093,049	6,244,863	6,385,695	6,459,765	59,189,833
Victoria benchmark (per 100,000)	1.6	–	–	–	–	–	–	–	–	–	
Expected notified cases	87	88	89	91	93	95	97	100	102	103	947
New South Wales benchmark (per 100,000)	1.8	–	–	–	–	–	–	–	–	–	
Expected notified cases	98	99	101	103	105	107	110	112	115	116	1,065
Difference	11	11	11	11	12	12	12	12	13	13	118

Accessing the full regulatory impact statement

Information on infringements, consultation, implementation, evaluation and the exposure draft regulations are contained in the full regulatory impact statement available on the [Engage Victoria website](https://engage.vic.gov.au) <https://engage.vic.gov.au>.

This extract was prepared to assist stakeholders who access the report by accessing a specific category on the Engage website. This is not intended to limit the scope of submissions; the department welcomes submissions from all interested parties.

Making a submission to the review

Public comment is invited on the proposed regulations and RIS. Please note that all comments and submissions received will be treated as public documents.

Comments and submissions should be received by the Department of Health and Human Services no later than **5.00 pm, Monday 30 September 2019**.

The Engage Victoria website is the preferred method for receiving submissions. Submissions can also be received by [emailing the department](mailto:phwa.enquiries@dhhs.vic.gov.au) <phwa.enquiries@dhhs.vic.gov.au>, or post, marked 'Submission to the Review of the Public Health and Wellbeing Regulations 2009' and addressed to:

Chief Health Officer
Regulation, Health Protection & Emergency Management
Department of Health and Human Services
GPO Box 4057
Melbourne VIC 3001

Copies of the RIS and proposed regulations can also be obtained from the [Engage Victoria website](https://engage.vic.gov.au) <https://engage.vic.gov.au/>.