Jules Zacher, Esquire

2133 St. James Place, Philadelphia, PA 19103
Phone: 215-988-0160 · Fax: 215-988-0169

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I. BACKGROUND

The purpose of this paper is to highlight the need for federal legislation to address the cause of Legionnaires' disease: *Legionella* bacteria. There are currently no federal regulations governing the control and mitigation of *Legionella* bacteria. Control efforts are left to state and local regulations, which are inadequate to address the problem.

Legionnaires' disease is primarily a respiratory disease. It was discovered after a *Legionella* outbreak in 1976 among people who went to a Philadelphia convention of the American Legion. Those who were affected suffered a deadly form of pneumonia that we now know as Legionnaires' disease. In the United States, the rate of reported cases of Legionnaires' disease has grown by nearly nine times since 2000.[1] According to the Centers for Disease Control and Prevention (CDC), it is unclear whether this increase is due to an increase in awareness and testing, increased susceptibility among our population, the increase in *Legionella* bacteria in our environment, or some combination of factors. The National Academy of Sciences, Engineering, and Medicine estimates that between 52,000 to 70,000 Americans suffer from Legionnaires' disease each year, between 3 and 33 percent of whom die as a result.[2] According

[1] https://www.cdc.gov/legionella/about/history.html.
[2] https://www.nationalacademies.org/news/2019/08/stronger-policies-needed-to-protect-the-public-from-legionnaires-disease.

to the CDC, in 2018, there were nearly 10,000 cases of Legionnaires' disease, the most ever recorded in a single year since the disease was first identified in 1976, a number the CDC considers "likely underdiagnosed."[3]

Legionnaires' disease can be contracted from a variety of sources: the municipal water supply; large, commercial potable water systems; large, commercial heating, ventilation, and air conditioning (HVAC) units; water features; spas; pools; and even potting soil.

Legionnaires' disease is caused by the bacteria genus *Legionella*. It is a naturally occurring bacterium typically found in freshwater environments, like lakes and streams. Freshwater *Legionella* is generally harmless because it is naturally found in low doses. But when *Legionella* gets into municipal or commercial potable water systems it can pose a great health risk. Infection occurs in three steps. First, *Legionella* bacteria grow or propagate until the concentration is high enough to cause illness (i.e., growth to an infectious dose). Second, contaminated water aerosolizes (i.e., breaks into small droplets light enough to travel through the air). And third, a susceptible (i.e., at-risk) individual inhales the contaminated, aerosolized water droplets or aspirates water into the lungs while drinking contaminated water.[4]

A variety of internal and external factors can lead to *Legionella* growth. The causes of *Legionella* growth that we have seen the most of are changes in temperature, inadequate levels of disinfectant in the water, and water stagnation. All water systems (municipal and commercial) contain disinfectant, usually chlorine or bromine. These disinfectants easily prevent *Legionella* growth by killing the bacteria, but if left at inadequate levels for too long they will be

[3] https://www.cdc.gov/legionella/fastfacts.html.
[4] https://www.cdc.gov/legionella/wmp/overview/growth-and-spread.html.

ineffective. *Legionella* grows best within a temperature range of 77 to 108 Degrees Fahrenheit. To keep water outside the range for *Legionella* growth, it is important to keep cold water cold and hot water hot. The goldilocks temperature is not right in these circumstances. Lastly, water stagnation can be a source of *Legionella* growth. We typically see these surrounding cooling towers—water that has been allowed to drip and remain standing. Stagnant water forms a biofilm that is a perfect environment for *Legionella* growth.

Common sources of aerosolized water droplets are hot tubs, shower heads, water faucets, and cooling towers. Contaminated water travels through the steam released from hot tubs and pools, and travels off the back of splashing from shower heads and sink faucets. In the case of cooling towers, wind can disperse contaminated droplets that sit below the towers over the lip of the building and down to unknowing pedestrians walking past, as well as travel through the air conditioning system in the building if the towers suck in contaminated droplets.

An individual cannot contract Legionnaires' disease without inhaling contaminated, aerosolized water or aspirating contaminated water while drinking. Even if contaminated droplets enter a person's lung in an infectious dose, not every individual will contract Legionnaires' disease. Certain groups are considered "at-risk," including those 50 years or older, current or former smokers, and people with chronic disease or a weakened immune system. Often, the symptoms associated with Legionnaires' disease—cough, shortness of breath, fever, and aches—are mistaken for other diseases like pneumonia or now, COVID-19. Symptoms typically appear 2 to 10 days after exposure to the bacteria.

This paper outlines legislative and regulatory steps taken to control the spread of *Legionella* bacteria. Part II details how *Legionella* is spread through water systems and describes

common sources of *Legionella* growth. Part III outlines federal and state and local measures taken to curb *Legionella* growth in the U.S. Part IV surveys *Legionella* prevention programs around the world. Finally, Part V recommends federal regulations the U.S. Congress should pass to address the growth of *Legionella*.

II. LEGIONELLA IN WATER SYSTEMS

Several federal laws address the presence of waterborne illnesses; however, none specifically address *Legionella* bacteria. The Safe Drinking Water Act (SDWA) was passed by the U.S. Congress in 1974 to regulate the nation's drinking water. The SDWA has been amended numerous times, first in 1986 and again in 1996. The law requires that the Environmental Protection Agency (EPA) act as the body that protects the integrity of drinking water and its sources, such as lakes, rivers, reservoirs, springs, and groundwater.

In 1989, the EPA issued the Surface Water Treatment Rule (SWTR). This regulation requires public water systems to treat their water to prevent microbial contamination. It requires "public water systems using a surface water supply, or a groundwater supply under the direct influence of surface water, to filter and disinfect the water."[5] Prevention of the growth of *Legionella* bacteria is subsumed in this rule. While this approach has been effective for controlling certain organisms, such as norovirus, it is less effective for the control of *Legionella*. Thus, the "multi-barrier approach at the treatment plant" allows *Legionella* growth within piping systems even after treatment has been performed.[6]

The failure to control growth of *Legionella* in public water systems allows the bacteria to flow into private plumbing systems, which is especially difficult to control in large building

[5] National Academy of Sciences, *Management of Legionella in Water Systems*, 234.
[6] *Id.*

complexes. These complexes may contain several miles of internal plumbing where *Legionella* can thrive. Some of these buildings, such as those with "some type of secondary control for *Legionella* protection, could be regulated as public water supplies under the SDWA.[7] However, due to the lack of federal guidance, whether the buildings are regulates as such largely depends on the intensity of enforcement by state agencies.[8]

Recreational water supplies, specifically hot tubs, are also a common source of Legionnaires' disease outbreaks. The Centers for Disease Control and Prevention (CDC) tracks Legionnaires' disease outbreaks. The CDC's Morbidity and Mortality Weekly Report (MMWR) published a report on outbreaks associated with recreational water from 2015 to 2019.[9] During this period, there were over 208 outbreaks in 36 states that were associated with treated recreational water. Most of the outbreaks (199 out of 208) occurred in public pools, hot tubs, or playgrounds.[10] Among the 208 outbreaks, 71 (34%) were associated with a hotel or a resort, and 107 (51%) began in the months of June through August.[11] These outbreaks caused 3,646 cases of illness, of which 286 required hospitalization and 13 resulted in death.[12]

III. GOVERNMENTAL ACTION IN THE UNITED STATES

Some federal efforts have been made to regulate *Legionella* growth by the Department of Veterans Affairs and the Centers for Medicare & Medicaid Services (CMS). The Veterans Health Administration (VHA) issued a directive in 2014 covering VHA-owned buildings in which patients, residents, or visitors stay overnight.[13] This directive covers 170 medical centers

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[7] *Id.* at 236.
[8] *Id.*
[9] *See* https://www.cdc.gov/mmwr/volumes/70/wr/mm7020a1.htm.
[10] *Id.*
[11] *Id.*
[12] *Id.*
[13] *See* Department of Veterans Affairs Directive 1061. Available at https://www.va.gov/vhapublications/publications.cfm?pub=1&order=asc&orderby=pub_Number.

that provide acute care, 134 community living centers, and 48 domiciles.[14] This policy targets the building's water systems, particularly hot-water systems.[15] In 2021, the directive was updated to include "outdoor non-potable, aerosol-generating water systems" such as cooling towers and irrigation systems.[16] Among other things, the directive requires Legionnaires' disease prevention plans and routine testing for the covered entities.

CMS regulations extend to entities which receive Medicare or Medicaid funds. This includes hospitals, critical access hospitals, and long-term care facilities. More than 15,000 nursing homes and 4,784 hospitals are registered with Medicare in the United States. 42 CFR §482.42 requires hospitals to "provide a sanitary environment to avoid sources and transmission of infections and communicable diseases." The regulation requires programs "for the prevention, control, and investigation of infections and communicable diseases." 42 CFR §483.80 requires similar disease control and prevention programs for skilled nursing facilities. Additionally, critical access hospitals must have systems "for identifying, reporting, investigating, and controlling infections and communicable diseases of patients and personnel" under 42 CFR §485.635(a)(3)(vi). Finally, CMS issued a 2017 directive requiring Medicare-certified healthcare facilities to have water management policies and procedures to reduce the risk of the growth and spread of *Legionella* in building water systems.[17]

In 2005, Garland, Texas, was the first city to issue a regulation requiring the registration and monitoring of cooling towers for *Legionella*. The regulation originally focused on multi-family housing units and was later amended to include hotels and other places where visitors pay

[14] NAS at 236.
[15] *Id*.
[16] VHA Directive 1601.
[17] NAS at 239.

to stay. A key provision of the regulation was the requirement that testing be performed by a service provider that was not associated with the organization responsible for maintenance of the facility.

Ten years later in 2015, New York City passed similar legislation following a large outbreak of Legionnaires' disease. New York City and New York state regulations require cooling tower owners to take the following actions:

1. Register existing and new cooling towers with the city and state.
2. Sample each cooling tower for Legionella every 90 days.3 Notify the city within 24 hours if Legionella culture results are greater than 106 CFU/L; the state every 90 days while the cooling tower is in operation; and the local health department within 24 hours for any result greater than 106 CFU/L.
3. Perform daily chemical treatment of system water.
4. Monitor temperature, pH, conductivity, and biocides at least three times per week. Microbial monitoring (heterotrophic plate counts) must be performed weekly, wetted surfaces are visually inspected weekly, and chemical treatment equipment is also checked.
5. Inspect the cooling towers every 90 days and obtain annual certification, by a qualified person.
6. Develop and follow maintenance program in plan in like with ASHRAE 188 standard.
7. There are various other requirements for drift eliminators, materials, cleaning, and documentation.
8. If an owner does not register, have a maintenance program and plan, obtain certification, disinfect, perform, or obtain culture sampling and analysis, or inspect

cooling tower within the required time and manner, New York State or the local health department may determine that the situation constitutes a nuisance and may take action, as authorized by law. New York State or the local health department may also take any other action authorized by law, including imposing any and all applicable civil and criminal penalties.[18]

In 2022, Pennsylvania state Senators Wayne Fontana and Joe Pittman introduced a bill to combat the rise in Legionnaires' disease cases in the state. Senate Bill 1125 would help to raise awareness while establishing prevention and mitigation strategies by directing both public drinking water providers and certain building owners to conduct assessments and monitor their water systems. It would further codify the seven-step standard, ASHRAE-188, which is backed by the Centers for Disease Control and Prevention (CDC), as well as many other federal administrative agencies.[19]

In response to a 2019 legionnaires' disease outbreak in Moncton where fifteen people were hospitalized, the New Brunswick government introduced legislation to reduce the risk of legionnaires' disease in cooling towers. This bill was introduced by Health Minister Dorothy Shephard and would require a registry and associated maintenance and testing of cooling towers. The registry is meant to help quickly locate the towers for testing in the event of future outbreaks. Public Health officials have said that regular testing and maintenance can reduce the risk of bacteria; however, to that point there was nothing requiring such work in New Brunswick.[20]

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[18] *Id.* at 240-41.
[19] https://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?syear=2021&sind=0&body=S&type=B&bn=1125.
[20] https://www.cbc.ca/news/canada/new-brunswick/cooling-tower-registry-legionnaires-disease-law-1.6401495

Building owners would be required to adopt water management plans and implement mitigation measures such as flushing water systems, temperature management for hot and cold systems, and routine monitoring of water systems. The bill would further require routine testing of water systems for Legionella pneumophila bacteria.[21]

In March 2021, as a result of the lack of access to clean water in public schools and state agencies, Senator Scott Wiener (D-San Francisco) introduced Bill 1144, the Safe and Efficient Water Act. In recent years, school drinking water has been at unacceptable levels. Of the reporting school districts in California, 53% reported contaminants in their drinking water. SB 1144 will require public schools and state agencies to conduct water quality tests for lead, radon, Legionella, and other contaminants. It will also require testing for water efficiency to ensure the use of water meets the current standard. Finally, it will require agencies or schools with any covered buildings and cooling tower systems to create a Legionella management program that will include routine culture sampling. Any deviation from the legal limits of contaminants or current standards for water efficiency will require the agency to replace the water fixture.[22]

IV. LEGIONELLA PREVENTION PROGRAMS AROUND THE WORLD

A. England

The control of *Legionella* in England is governed by the 1974 Health and Safety at Work Act (HWSA). The law applies to anyone that is in control of a premises, including business owners, employers, and landlords. The Control of Substances Hazardous to Health Regulations of 2002 (COSHH) further provide a framework of actions designed to assess, prevent, or control

[21] *Id.*
[22] https://sd11.senate.ca.gov/news/20220316-senator-wiener-introduces-legislation-ensure-public-schools-and-state-agencies-have

the risk posed by bacteria like *Legionella*. Under these guidelines, premises owners are responsible for risk assessment. Owners must conduct risks assessment themselves or hire another party who can. They must identify whether their water systems are likely to create a risk of *Legionella* exposure. Under the guidelines, risk assessment should include: "(a) management responsibilities, including the name of the competent person and a description of your system; (b) competence and training of key personnel; (c) any identified potential risk sources; (d) any means of preventing the risk or controls in place to control risks; (e) monitoring, inspection and maintenance procedures; (f) records of the monitoring results and inspection and checks carried out; (g) arrangements to review the risk assessment regularly, particularly when there is reason to suspect it is no longer valid."[23]

If there is a risk, the guidelines suggest owners: "(a) ensure that the release of water spray is properly controlled; (b) avoid water temperatures and conditions that favour the growth of legionella and other micro-organisms; (c) ensure water cannot stagnate anywhere in the system by keeping pipe lengths as short as possible or removing redundant pipework; (d) avoid materials that encourage the growth of legionella (The Water Fittings & Materials Directory references fittings, materials, and appliances approved for use on the UK Water Supply System by the Water Regulations Advisory Scheme); (e) keep the system and the water in it clean; (f) treat water to either control the growth of legionella (and other microorganisms) or limit their ability to grow; (g) monitor any control measures applied; (h) keep records of these and other actions taken, such as maintenance or repair work."[24]

[23] https://www.hse.gov.uk/legionnaires/what-you-must-do.htm.
[24] *Id.*

The guidelines also require the maintenance of records. Records must detail: "(a) [the] person or persons responsible for conducting the risk assessment, managing, and implementing the written scheme; (b) significant findings of the risk assessment; (c) written control scheme and details of its implementation; (d) details of the state of operation of the system, i.e., in use/not in use; (e) results of any monitoring inspection, test or check carried out, and the dates."[25]

Additional duties apply to owners of cooling towers or evaporative condensers under the Notification of Cooling Towers and Evaporative Condensers Regulations of 1992 (NCTEC). These owners must notify the local authority or environmental health department in writing and include details about where the applicable cooling or evaporative condensers are located. Owners must also detail when such devices are no longer in use. Although less common, other systems that do not rely solely on the principle of evaporation (e.g., dry/wet coolers or condensers) may not require notification under the NCTEC. Nevertheless, it is important for owners to assess the system against the notification requirements of NCTED (e.g., where such systems spray water directly onto the surface of the heat exchanger).

Finally, under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR), owners must report any cases of *Legionnaires'* disease among employees who have worked on cooling towers or hot and cold water systems likely to be contaminated with *legionella*. There are also specific guidelines for high-risk areas such as spas, hot and cold water systems, and evaporative cooling systems.

B. The Netherlands

The Drinking Water Act applies to "priority premises" such as hospitals and other healthcare facilities with overnight stays. Hotels and other accommodations, truck stops with

[25] *Id.*

showers, harbors, marinas with showers, asylum centers, and prisons are also covered. These facilities must create risk management plans, including water stagnation, tepid temperature, formation of aerosols, and the presence of high-risk individuals. These plans must be periodically updated and generally created by certified consultant to conform to technical guidelines (e.g., about how, when, and where to sample). Control methods include temperature control, flushing, UV light treatment, and filtration.

The Hygiene and Safety Act applies to swimming and bathing facilities where aerosols are dispersed, but not hot tubs. The Act requires a risk management plan and monitoring. Additionally, the Environmental Protection Act applies to wet cooling towers. This Act requires a risk assessment and management plan that provides for treatment monitoring. Cooling towers built after 2010 must be registered. Finally, the Safety At Work Act is designed to protect workers and requires risk assessment and management plans.

C. Germany

The Protection Against Infection Act requires a *Legionella* risk management plan for every large building that has more than 400 liters of hot water or more than three liters of hot water between the water heater and the last tap at the end of the pipe. The Act also targets *Legionella* that may stem from the disposal of wastewater. Wastewater treatment plans must be monitored for *Legionella* by culture methods.

The German Emissions Control Act covers every open cooling tower. This Act requires a management plan, monitoring, and concentration thresholds above which actions must be taken. Regulations like U.S. plumbing and building codes address measures to reduce *Legionella* growth in buildings. Germany is able to achieve high compliance with the regulations through punishment for non-compliance. Additionally, Germany utilizes educational measures to curb

Legionella growth. Information regarding the bacteria is available on every public health department website, building owners are required to inform occupants if levels are high, and guidelines are given for the homes of immunosuppressed people.

D. France

France utilizes mandatory minimum temperatures and monitoring at defined points within hot-water systems. This includes outlets serving vulnerable persons. Environmental monitoring is required for public buildings with collective warm-water systems. Examples include hotels, nursing homes, senior residences, campsites, and tourist accommodations. Monitoring is also required for some specific types of equipment, such as cooling towers, atomizers used in public places, and thermal equipment.

Unlike other European countries, France's regulations are mainly based on environmental monitoring. Less emphasis is placed on water management plans. Regional health and environmental agencies enforce these regulations.

E. Australia

Like the United States, regulations vary by state or territory in Australia. Most jurisdictions require cooling towers to be registered. Regulations also require dosing with biocide, fitting of drift eliminators, monthly servicing, and cleaning twice a year. All these requirements are documented in a risk management plan. Some jurisdictions specifically require monitoring of *Legionella* bacteria.

V. PROPOSED FEDERAL LEGISLATION

The National Academy of Sciences (NAS) recommends several federal measures to curb the spread of *Legionella* in the U.S. The recommendations are as follows: (1) requiring a minimum disinfectant residual throughout public water systems and concomitant monitoring for

Legionella; (2) Congress should require a temperature of 60º Celsius (140º Fahrenheit) at hot water heaters and 55º Celsius (131º Fahrenheit) to distal points; (3) require water management plans for all public buildings; and (4) register and monitor cooling towers. Additionally, our firm recommends the following: (1) comprehensive federal regulations mandating how to best prevent and monitor for *Legionella*; and (2) model federal regulations on New York's law for cooling towers.

VI. CONCLUSION

Legionnaires' disease is a preventable disease. It is not contagious and can only be contracted when Legionella bacteria grow to an infection level that then gets inhaled by its victim. So not only are chances of contracting the disease low, but the bacteria which cause it are fragile. With adequate testing, monitoring, and prevention plans, *Legionella* bacteria can be eliminated *before* victims contract Legionnaires' disease. The U.S. Congress must step in and pass comprehensive federal legislation mandating how to best prevent and monitor for *Legionella*.