Environmental Science, Policy & Research Institute

SB 1125 (2021-22 Legislative Session)
Testimony Presented to The Senate Environmental Resources & Energy Committee
by
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Good morning, Chairman Yaw, Chairwoman Comitta and the esteemed members of the Senate Environmental Resources & Energy Committee. Thank you for introducing SB 1125 – Legionnaires' Disease Risk Management in Public Water Systems. And thank you for the opportunity to provide written testimony in connection with the proposed legislation.

My name is Dr. Jennifer Clancy. I am a microbiologist with 45 years of experience in drinking water quality and treatment and I have worked in both the private and public sector. I was a founder and am currently the Chief Scientist of the Environmental Science, Policy & Research Institute (ESPRI), a non-profit based in Narberth, Pennsylvania (www.esprinstitute.org). ESPRI's mission is to improve public health by promoting best practices for building water systems. Building water systems include multifamily residences, hospitals, office buildings, convention centers, museums, schools, hotels, and other buildings with a significant level of public access. ESPRI's focus on building water fills a critical gap not addressed by institutions focused on best practices for drinking water, wastewater, and storm water. ESPRI promotes building water system best practices through collaboration with building water owners and managers, building occupants who use the water, drinking water utilities that supply the water, and water regulatory authorities. My CV is attached.

I have been working with *Legionella* for over 40 years. I was one of the early researchers on *L. pneumophila* and Legionnaires' disease in 1980 at the U. of Vermont Department of Medicine, shortly after the Burlington, VT outbreak linked to a cooling tower at the hospital. The NSF-funded project developed an animal model of Legionnaires' disease using guinea pigs. The work involved isolation of *L. pneumophila* from human lung tissue at autopsy, *L. pneumophila* culture, animal infectivity in guinea pigs, and animal autopsy and organ culture to determine the model of infection. I have investigated several Legionnaires' disease outbreaks and sporadic cases in hotels, apartment buildings, office buildings, and hospitals. I have been working actively through ESPRI since 2016 on: 1) development of criteria for building water management planning for *L. pneumophila* control to protect public health from water exposure leading to Legionnaires' disease; 2) conducting training for those developing and implementing building water management plans, and 3) developing communications materials for building owners and operators and water utilities to educate customers on managing *L. pneumophila* in building water systems.

The intent of Senate Bill 1125 is an important step forward in managing Legionnaires' disease, currently recognized by the US Centers for Disease Control and Prevention (CDC) as the number one waterborne disease in the US. Legionnaires' disease cases risen 800% since 2000. I support the bill a**s written** and provide the comments below to demonstrate the science and practice that underly the bill's objectives.

1. **Legionnaires' disease occurs from exposure to water in buildings** and water systems associated with buildings (e.g., cooling towers, decorative fountains, etc.). It is well-recognized that Legionnaires' disease is transmitted by aerosols and the route of infection is inhalation of water mists that contain *Legionella pneumophila* bacteria. Disease transmission occurs when conditions are ripe for *L. pneumophila* to colonize (attach to) components in a building water system and amplify (grow). As water is used the bacteria enter the water stream and susceptible individuals can be exposed to the *L. pneumophila*, resulting in disease. Building water systems are recognized as amplifiers of *L. pneumophila* bacteria and may serve as sources for outbreaks and sporadic cases. Modern buildings with extensive water distribution and air conditioning systems which operate hot water systems at temperatures below 60°C are ideal breeding grounds for *L. pneumophila*. For control of legionellae, good building water quality management practices are required. These include identification of hazards; characterization and mitigation of risks that can cause harm; regular inspection, maintenance, and cleaning of the water system to prevent the amplification of *L. pneumophila* leading to exposure resulting in human disease.

   L. pneumophila amplification occurs in biofilms, which are found on any surface exposed to microorganisms and water. Biofilms may consist of many species of bacteria, as well as fungi, algae, protozoa, debris, and corrosion products. As biofilm forms it develops a physical matrix that adheres it to the surface and allows it to exist as an ecosystem that develops its own characteristics, e.g., resistance to disinfectants. Biofilms that we encounter regularly include films or slimes on shower fixtures. Biofilms also form on natural surfaces. Slime on rocks in streams and tooth plaque are examples. By their nature biofilms cannot be eliminated, but can be controlled by physical removal, e.g., with teeth, daily toothbrushing and flossing with periodic dental care manages biofilms to prevent tooth decay ad gum disease.

   Control of *L. pneumophila* and other biofilm waterborne pathogens including *Pseudomonas aeruginosa* and nontuberculous mycobacteria to reduce exposure and prevent disease is through water management planning and implementation of those plans.

2. ***L. pneumophila* can enter building plumbing** in the drinking water supply, from backflow and negative pressure events, and through poorly managed plumbing repairs. Many organizations are working to address *L. pneumophila* occurrence and control in public water systems, including the American Water Works Association (AWWA), the Water Research Foundation (WRF), the Association of State Drinking Water Administrators (ASDWA), and the US Environmental Protection Agency (EPA). These professional organizations and the federal government agency tasked with development and implementation regulations to protect health recognize that there is a shared responsibility from source to tap to protect consumers from Legionnaires' disease.

   There are a limited number of studies on the occurrence and levels of *L. pneumophila* in public drinking water systems. To address this data gap, in 2022 the WRF funded the largest study to date to gather data on *L. pneumophila* occurrence in US drinking water systems. I am a principal investigator on this study. Our focus is on *L. pneumophila* occurrence in public water system distribution systems. Testing drinking water for this pathogen is the only way we can understand how the public water supply may contribute to Legionnaires' disease and to look at measures to mitigate this pathogen. We completed the first sampling and testing round this summer with over 3,200 data points from over 50 water systems in the US that include ground and surface water sources, small to very large systems, and disinfected and non-disinfected systems. A second round of testing will be conducted in 2023. These data will be used to inform the revision to the USEPA's Microbial and

Disinfectant Byproducts Rule revisions, with a focus on *L. pneumophila* management to protect public health. Additionally, the USEPA plans to fund $8 million of research beginning in 2023 to conduct similar studies to inform the rulemaking process.

SB 1125 requires the Commonwealth's public water supplies to manage *L. pneumophila* in their water systems through water safety planning. This is not a new concept as the World Health Organization produced guidance on this topic in 2009 (https://www.who.int/publications/i/item/9789241562638). We expect that the data developed by my team and the upcoming USEPA research will use a water safety planning approach as the basis for *L. pneumophila* control in public water supplies. This will address the front end of the source to tap continuum.

3. **Water management planning** is key to control of *L. pneumophila* in building water systems and reduction of risk from Legionnaires' disease. Water quality can degrade rapidly when it enters a building for many reasons. The building by its nature is a unique ecosystem, vastly different from the pipes and tanks and conditions in the public water supply. Microorganisms that are part of the natural flora, such as *L. pneumophila*, may be present in low and intermittent levels, and can colonize and become established in biofilms in the building. Unless there is a program to actively manage water quality in the building, amplification of these bacteria and dissemination through aerosols can occur and lead to infection in susceptible hosts. Legionnaires' disease occurs when building water quality is not actively managed through water management planning.

   The standard used in the US for development of building water management plans is "ANSI/ASHRAE 188 - Legionellosis: Risk Management for Building Water Systems" (ANSI/ASHRAE, 2018). By its definition, the standard recognizes that building water systems (and not drinking water distribution systems) are the source of *Legionella* exposure and Legionnaires' disease. ASHRAE 188 provides guidance on how to identify and control hazards to minimize risks through managing both chemical and physical conditions in a building water system to minimize *Legionella* growth. SB 1125 references ANSI/ASHRAE 188 as a standard for development and implementation of a building water management plan. ASHRAE developed a second document, ASHRAE Guideline 12-2020 Managing the Risk of Legionellosis Associated with Building Water Systems, that provides additional information on the scientific considerations and practices for the prevention of legionellosis and can be used for implementing ANSI/ASHRAE 188.

   In 2016, due to the occurrence of Legionnaires' disease in health care facilities, the CDC issued guidance on how to development and implement water management plans to control *Legionella* – "Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings: A Practical Guide to Implementing Industry Standards". Referred to as the CDC Toolkit, it uses ANSI/ASHRAE 188 and ASHRAE Guideline 12 to guide hospitals and health care facilities in developing and implementing water management plans for *Legionella* control.

   In 2017 the Centers of Medicare and Medicaid Services (CSM) published the "Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease (LD)" (CMS, 2017). This document states that "CMS expects Medicare certified healthcare facilities to have water management policies and procedures to reduce the risk of growth and spread of *Legionella* and other opportunistic pathogens in building water systems"….. Healthcare facilities are expected to comply with CMS requirements to protect the health and safety of its patients. Those facilities unable to demonstrate measures to minimize the risk of LD are at risk of citation for non-compliance with the CMS Conditions of Participation. Accrediting organizations will be surveying

healthcare facilities deemed to participate in Medicare for compliance with the requirements listed in this memorandum, as well, and will cite non- compliance accordingly." The CMS requirements reference ANSI/ASHRAE 188 and the CDC toolkit.

There is another guidance document that I use in my work concerning development and implementation of water management plans, which is the European Technical Guidelines for the Prevention, Control, and Investigation of Infections Caused by *Legionella* species (2021). The EU Guideline is consistent with ASHRAE 188, but I prefer this document because it provides a how-to roadmap and more detail on each step of the process. It is more user-friendly for those who will eventually implement the plan in their facilities. ESPRI recently completed a guidance document for the US Navy Bureau of Medicine for development of water management plans and relied on the EU Guideline. Unlike US standards and guidances, the EU document provides action levels and actions to take when certain levels of *L. pneumophila* are observed. The EU and other European countries mandate testing for control of *L. pneumophila* in building water systems. An issue with current US guidances is the omission of *L. pneumophila* testing and action levels. Without this type of guidance building owners and operators do not have clear direction on water quality goals.

As part of our WRF study on *L. pneumophila* occurrence in drinking water systems, we developed guidance for water systems on how to respond to *L. pneumophila* detections. The framework is based on the EU and CDC guidance for buildings, suing the rationale that the public water supplier should be providing water that meets the guideline developed for buildings. We held two workshops to present this framework to the water community and it received positive feedback from regulators and water suppliers. This framework will be published in a peer-reviewed paper in early 2023 but can be made available now.

4. ***Legionella pneumophila* testing** is necessary to understand the occurrence and abundance of levels that may occur in drinking water and in building water systems. Measuring the levels of *L. pneumophila* in drinking water and building plumbing systems allows the operator to know the level of contamination present and whether the remediation and control measures implemented are effective. Water Management Plan validation is required in ANSI/ASHRAE 188 but *Legionella* testing is not mandated in the standard or those documents that rely on that standard. However, industry best practice shows that the only way to fully understand building water quality in terms of *L. pneumophila* occurrence is to sample the water and test for *L. pneumophila*. Nearly 98% of Legionnaires' disease cases in the US are caused by *L. pneumophila* and this species should be the focus of water Validation testing.

   Buildings should be sampled and tested for *L. pneumophila* when conducting the initial site assessment for development of a water management plan to establish baseline data, and at regular intervals specified in the plan as part of the plan validation. Microbiological testing, by its retrospective nature, is not used as a control measure for water quality. It is used to validate that the control measures in the water management plan are effective.

5. **Increased public communication** on Legionnaires' disease is recognized within the water community as an important aspect in protecting public health. To that end, the AWWA and the WRF have developed communication materials specifically targeted to water utility customers about Legionnaires' disease. I am a co-author of the Water Research Foundation report which is widely utilized by water utilities to provide Legionnaires' disease information that is understandable to the public. As buildings were shut down or experienced low water use due to COVID-19, many

organizations (USEPA, CDC, ESPRI, universities, etc.) stepped forward and provided information on their websites on how to flush stagnant water from buildings to reduce exposure to *L. pneumophila* and other waterborne pathogens that can grow as water stagnates in building plumbing. Senate Bill 1125 can reference these materials that have been developed by water experts specifically as public education materials.

Conclusion

Thank you for the opportunity to provide comments on Senate Bill 1125. I have been a water quality professional for over 35 years, dedicated to protecting and improving public health through my research and practice. I am pleased to see Senate Bill 1125 address Legionnaires' disease as it is a preventable disease through proper water management practices. This bill contains the elements needed to protect public health by:

1. Focusing on water management planning and implementation using the widely accepted consensus documents. The National Academies of Science, Engineering and Medicine (2019) recommended that water management plans be a requirement for all public buildings. Even when drinking water supplies are not the source of *L. pneumophila* contamination of a building, control of *L. pneumophila* amplification and dissemination happens at the building level.
2. Requiring water safety plans for public water suppliers to control *L. pneumophila* is a sensible approach to improve public health. The water community recognizes its shared responsibility on the issue and is moving in that direction.
3. Focusing testing on *L. pneumophila* as it is the primary species responsible for Legionnaires' disease.

An aspect that will assist the Commonwealth in garnering support and preparing the stakeholders to implement the Bill is through communication. There are communications materials already developed by scientists, public health professionals and communication professionals to educate consumers on Legionnaires' disease risks and how hoe to manage them.

If you have any questions, please do not hesitate to contact me.

Sincerely yours,

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Chief Scientist

Dr. Jen Clancy is Chief Scientist and cofounder of the Environmental Science, Policy & Research Institute (ESPRI). She received her B.S. in Microbiology from Cornell University, Master of Science degree in Microbiology and Biochemistry from the University of Vermont, Ph.D. in Microbiology and Immunology from McGill University and Master of Science in Environmental Law from Vermont Law School. She is a Board-Certified Environmental Scientist of the American Academy of Environmental Engineers and Scientists.

Dr. Clancy's research has focused on water quality and treatment issues, including building water quality. In 2012 she was the inaugural recipient of the Water Research Foundation Dr. Pankaj Parekh Research Innovation Award for contributing to the knowledge of UV disinfection of *Cryptosporidium*. She received the prestigious American Water Works Association A.P. Black Research Award for excellence in water supply research in 2014.

Dr. Clancy made important contributions to the drinking water field including 1) development of improved testing methods for the pathogenic protozoa (*Giardia* and *Cryptosporidium*) that are now USEPA standards and that have been adopted by regulatory agencies worldwide; 2) over a decade of laboratory studies of ground water quality, resulting in a broader of understanding of the natural occurrence of microbiota in groundwaters and aquifers. This led EPA to adopt a more flexible approach in assessing groundwater under the influence of surface water and riverbank filtration; 3) the discovery that *Cryptosporidium* oocysts are highly susceptible to UV light. The widely held theory was that *Giardia* cysts and *Cryptosporidium* oocysts were resistant to UV light. Work by Dr. Clancy and her team demonstrated that not only were oocysts susceptible to UV light, but these protozoa are easily killed at low UV doses. This work led to the inclusion of UV as a primary tool for control of this parasite in the Long Term 2 Enhanced Surface Water Treatment Rule and adoption worldwide of UV for primary disinfection of drinking water for *Cryptosporidium* control. She was a founder member of the International UV Association and served as its second International President.

Dr. Clancy's current work focuses on opportunistic premise plumbing pathogens and she provides consulting services to building owners and managers for control of pathogens in building water systems. She has worked with *Legionella pneumophila* for over 40 years. She was one of the early researchers on *L. pneumophila* and Legionnaires' disease in 1980 at the U. of Vermont Department of Medicine. Dr. Clancy currently works with state agencies, building owners and managers, hotels, hospitals and real estate developers on detection and control of *L. pneumophila* in building water systems, cooling towers, and decorative water features. She serves as a consultant and expert witness in both sporadic cases and outbreaks of legionellosis and an expert in building plumbing contamination issues. She oversees on-site investigations, sampling and analysis, remediation, and ongoing assessments of *L. pneumophila* and other contaminants that persist in building plumbing. She is a co-author of a Water Research Foundation publication on research needs for pathogens in premise plumbing. She served on the expert panel of the American Academy of Microbiology and is a co-author of the report on microbiological issues of the built environment.

Dr. Clancy directed the ESPRI applied research laboratory which focused on opportunistic premise plumbing pathogens. She served as co-PI on a $2 million EPA grant titled "Water Conservation and Water Quality: Understanding the Impacts of New Technologies and New Operational Strategies" as part of a Drexel - UC Boulder research team. Control of *L. pneumophila* and other opportunistic pathogens in building plumbing systems was a major focus of this project. She is a co-She now serves as ESPRI Chief Scientist. She is a co-PI on WRF 5156 - Occurrence of *Legionella* spp. in Drinking Water Distribution Systems.

Dr. Clancy has been the principal investigator or co-investigator on 40+ research grants totaling over $20 million from the US Environmental Protection Agency, American Water Works Association, the Water Research Foundation, WERF, and Health Canada.

Selected Peer-Reviewed Publications

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