

Legionella: the next public health emergency?



THE URGENCY FOR RAPID LEGIONELLA DETECTION AND IDENTIFICATION

EXECUTIVE SUMMARY

This whitepaper looks at the urgent requirement for the rapid and accurate detection of Legionella to prevent the potential for widespread outbreaks of Legionnaires' disease. Such outbreaks will put additional pressure on already heavily burdened health care systems. The impact of the COVID-19 pandemic on Legionella trends is considered here. We introduce our technological breakthrough that has been developed to address this worrying potential trend. Bio Lp-1 can rapidly detect and quantify extremely low levels of Legionella in water samples enabling faster, better informed decisions and assessment of actions required.

INTRODUCTION

The COVID-19 pandemic has taken its toll on public health. Government-imposed national lockdowns worldwide have undoubtedly helped to get the rampaging SARS-CoV-2 virus under control, but has this unintentionally created an opportunity for the potentially lethal Legionnaires' disease to thrive? At a time when public health is at its weakest?

Empty buildings and reduced water usage around the world have provided ideal breeding grounds for Legionella. Left unchecked, this could lead to record high cases of Legionnaires' disease costing even more human lives.

It has been referred to as the 'silent killer' lurking behind the COVID-19 lockdowns. Often going unnoticed and even being misdiagnosed, because Legionella infection can be hard to distinguish from other forms of pneumonia. To confound matters, Legionnaires' disease has very similar symptoms to COVID-19. Legionnaires' disease was already on the rise before COVID-19 struck, with around 20,000 cases reported in the USA in 2018¹. In the USA alone, reported cases increased ninefold from 2000 to 2018². The fatality rate is around 10% for healthy persons and 25% for those with underlying conditions³. This is more than 3 times the SARS-CoV-2 infection mortality rates⁴.

The urgency of rapidly detecting this potentially deadly disease before it gets out of control should be on everyone's agenda as we prepare to get back to 'normal' business post COVID-19.

¹CDC, Legionnaires' disease. Annual epidemiological report for 2018

²CDC, Burden of Waterborne Disease, <https://www.cdc.gov/legionella/about/history.html>

³CDC, Legionnaires' disease. Annual epidemiological report for 2018

⁴ Covid mortality rates on 23 April 2021: UK=2.9%, IRL = 2.0%, USA= 1.8%, FR = 1.9%, GER=2.5% & SP=2.2%

(<https://www.worldometers.info/coronavirus/#countries>)



IT MAY NOT BE CONTAGIOUS, BUT IT CAN STILL SPREAD FAR AND WIDE...

Legionnaires' disease is a severe and potentially fatal pneumonia caused by *Legionella* spp. usually found in contaminated natural and artificial water systems. While some cases can be mild to moderate, others result in respiratory and multi-organ failure. *Legionella* is a waterborne pathogen and cases of Legionnaires' disease have been known to be detected more than 3km from the outbreak source⁵.

The water we use travels through vast, complex water systems before reaching our homes, schools, hospitals, offices, buildings, heating systems, air conditioning units, swimming pools, spas, fountains in our parks etc. Wherever *Legionella* is present in water, there is risk for human exposure. As with COVID-19, *Legionella* spreads mainly through contaminated aerosols, albeit usually restricted to water systems. Minimizing *Legionella* growth along the water's journey is a major factor in preventing infection.

MORE PEOPLE NOW AT RISK

At risk groups are similar for COVID-19 and Legionnaires' disease, usually older people, and those with pre-existing health conditions. Hospital patients are particularly susceptible. COVID-19 hospital patients have weakened immune systems and are at a high risk of secondary infections with pathogens such as *Legionella*. Indeed, it has been proven that co-infections with *L. pneumophila* serogroup 1 can occur in patients with COVID-19⁶. As such, untreated *Legionella* and COVID-19 co-infection can be fatal⁷.

Therefore, when we consider the fragility of COVID-19 patients, including those suffering from 'long COVID', and months of vacant buildings due to lockdowns, there is a very real risk of further significant public health problems. Unsurprisingly, the World Health Organisation (WHO) and the United Nations Economic Commission for Europe (UNECE) jointly agree on the importance of including the monitoring of *Legionella* in water systems during future health emergencies, acknowledging a lesson learned from this pandemic.

Meanwhile, *Legionella* outbreaks will continue to pose a major health burden after these long periods of empty buildings, reduced business activity and resulting water stagnation⁸.

RAPID DETECTION AND ACCURATE IDENTIFICATION WILL SAVE LIVES

Timely identification and reporting of *Legionella* is critical in reducing infection rates. Public health officials can then act quickly to identify and stop potential clusters and outbreaks by drawing links between new and previously reported cases. Traditional testing for *Legionella* has been via culture methods, where a time lag of 14 days often is needed before results are able to determine whether *Legionella* is present in water samples. No longer can we afford such a time lag. New methods using real-time PCR provide accurate, reliable, and fast results within 24 hours, often the same day.

BIO LP-1

Bio Lp-1, is a diagnostic breakthrough, being the world's first open platform rapid Nucleic Acid Diagnostic (NAD) kit for simultaneously detecting and identifying multiple species of legionella from water in a single test.

Designed to work on the leading real-time PCR platforms, Bio Lp-1 rapidly detects extremely low levels of *Legionella*, and can differentiate between *Legionella* spp., *L. pneumophila* serogroups 1-16 and *L. pneumophila*-sg1 simultaneously in a single water sample, giving a complete and accurate *Legionella* profile. With this certainty, the exact risk to public health can be quickly determined and acted upon. Particularly beneficial in cases of an outbreak, appropriate remedial actions can be taken, their efficacy monitored to reduce and remove *Legionella* bacteria from a contaminated water system. In less than 5 hours, water quality and safety can be assured. Simple and convenient to use, delivered in a freeze-dried format, the test contains all necessary components to process a water sample directly.

⁵ WHO, 2018

⁶ Verhasselt et al., 2021, Dey & Ashbolt, 2020

⁷ Dey & Ashbolt, 2020

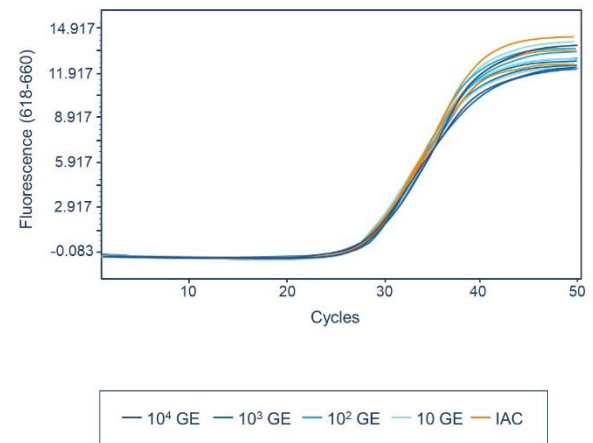
⁸ Dey & Ashbolt, 2021



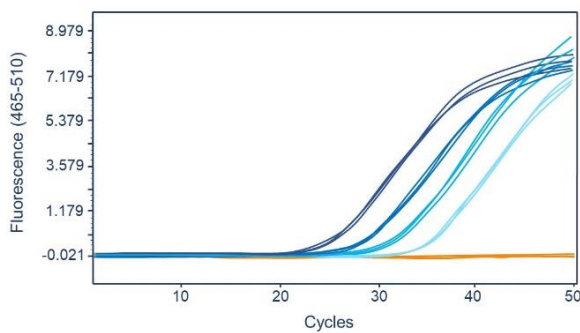
BIO LP-1 REAL-TIME PCR ASSAY

The Bio Lp-1 assay is designed to target specific and unique DNA sequences within the Legionella genome. The PCR products from 4 different reactions can be detected by specific DNA probes labeled with 4 different fluorophores. This allows the simultaneous detection of all the Legionella species associated with infection, all the *L. pneumophila* serogroups (1-16) and specifically identifies *L. pneumophila* sg-1, responsible for ~95% of human infections. An internal amplification control is also included in the master mix as an indicator that the PCR is functioning correctly.

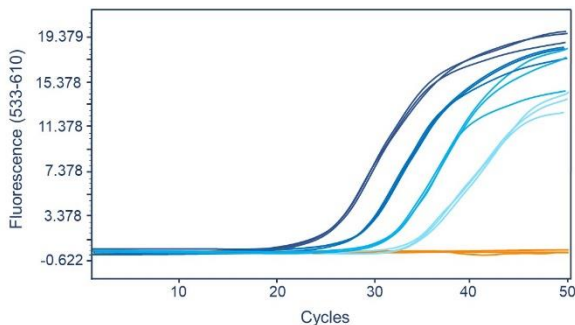
Internal amplification control



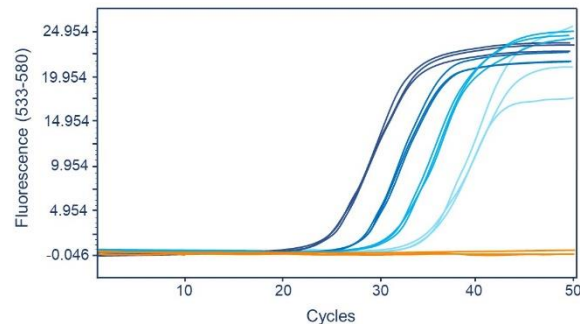
Legionella genus assay



Legionella pneumophila sg1-16



Legionella pneumophila sg1



ABOUT BIOPROBE DIAGNOSTICS

BioProbe Diagnostics, a spinout from the National University of Ireland Galway, develops innovative PCR tests for the detection of microbial pathogens associated with water contamination in environmental and industrial processes. The strong team of scientists, innovators, and business experts, develops and markets these PCR test kits worldwide. Using patented technologies, our goal is to transform the global marketplace with rapid, accurate, cost-effective, and user-friendly PCR test kits. Our first product, Bio Lp-1, a transformative Legionella test kit, received the prestigious EU Fast Track to Innovation Award in 2020. This product will be launched in early 2022 in collaboration with renowned international partners.

**project partners*

myPOLs Biotec GmbH is a European leader in molecular biology reagent manufacturing

Laboratorio Control is a European-based ENAC accredited large environmental testing laboratory

Genaxxon bioscience GmbH is a European leader in the sale of innovative molecular IVD products

Follow BioProbe Diagnostics on [LinkedIn](#) and [Twitter](#) to keep up-to-date with Bio Lp-1 developments.

info@bioprobedx.com



REFERENCES

- Legionella (Legionnaires' Disease and Pontiac Fever) Treatment and Complications. Centers for Disease Control and Prevention (CDC). 26 January 2016. Archived from the original on 29 March 2016. Retrieved 21 March 2016.
- Verhasselt et al. (2021) COVID-19 Co-infection with Legionella pneumophila in 2 Tertiary-Care Hospitals, Germany. Emerging Infectious Diseases, Vol27, No5
- Dey. R. and Ashbolt, N. J. (2021) Legionella Infection during and after the COVID-19 Pandemic, ACS EST Water, Vol1, pp13-14
- Palazzolo, C. et al. (2020) Legionella pneumonia: increased risk after COVID-19 lockdown? Italy, May to June 2020, Eurosurveillance, Vol25, No30
- Legionella Control, <https://legionellacontrol.com/international/us-covid-shutdown-legionnaires-outbreaks/> (accessed on 20 April 2021)
- UNECE, https://unece.org/sites/default/files/2021-04/Item%205%20b_Surveillance_Hyllestad.pdf (accessed on 20 April 2021)
- Alliance to Prevent Legionnaires' Disease, <https://preventlegionnaires.org/pdf-report/apld-virtual-conference-executive-summary/> (accessed on 20 April 2021)
- WHO, <https://www.who.int/news-room/fact-sheets/detail/legionellosis> (accessed on 20 April 2021)
- HSE, <https://www.hse.gov.uk/healthservices/legionella.htm> (accessed on 20 April 2021)
- Centre for Disease Control and Prevention, <https://www.cdc.gov/legionella/clinicians/diagnostic-testing.html#:~:text=Minimizing%20Legionella%20growth%20in%20complex,health%20officials%20to%20act%20quickly> (accessed on 20 April 2021)
- Meza, P (2020) Increased importance for safe Domestic Hot Water systems due to Covid-19 [LinkedIn page] <https://www.linkedin.com/pulse/increased-importance-safe-domestic-hot-water-systems-due-peter-meza/> (accessed on 20 April 2021)
- Pharmaceutical Networking, <https://www.pharmaceutical-networking.com/legionella-contamination-monitoring-solutions/> (accessed on 20 April 2021)
- Agence Régionale de Santé Grand Est https://www.grand-est.ars.sante.fr/system/files/2020-05/Reco-LEGIO-COVID_ARS-GE_DSE-ESMS%2005.2020.pdf (accessed on 20 April 2021)
- Worldometers, Covid mortality rates, <https://www.worldometers.info/coronavirus/#countries> (accessed on 23 April 2021)

