rotronic
MEASUREMENT SOLUTIONS

LEGIONELLA – AN EVER-PRESENT BACTERIAL THREAT

In 1976, 182 of more than 4000 attendees of a convention hosted by the American Legion war veteran's association at the Bellevue-Stratford Hotel in Philadelphia contracted a serious case of pneumonia, from which 29 of them died.

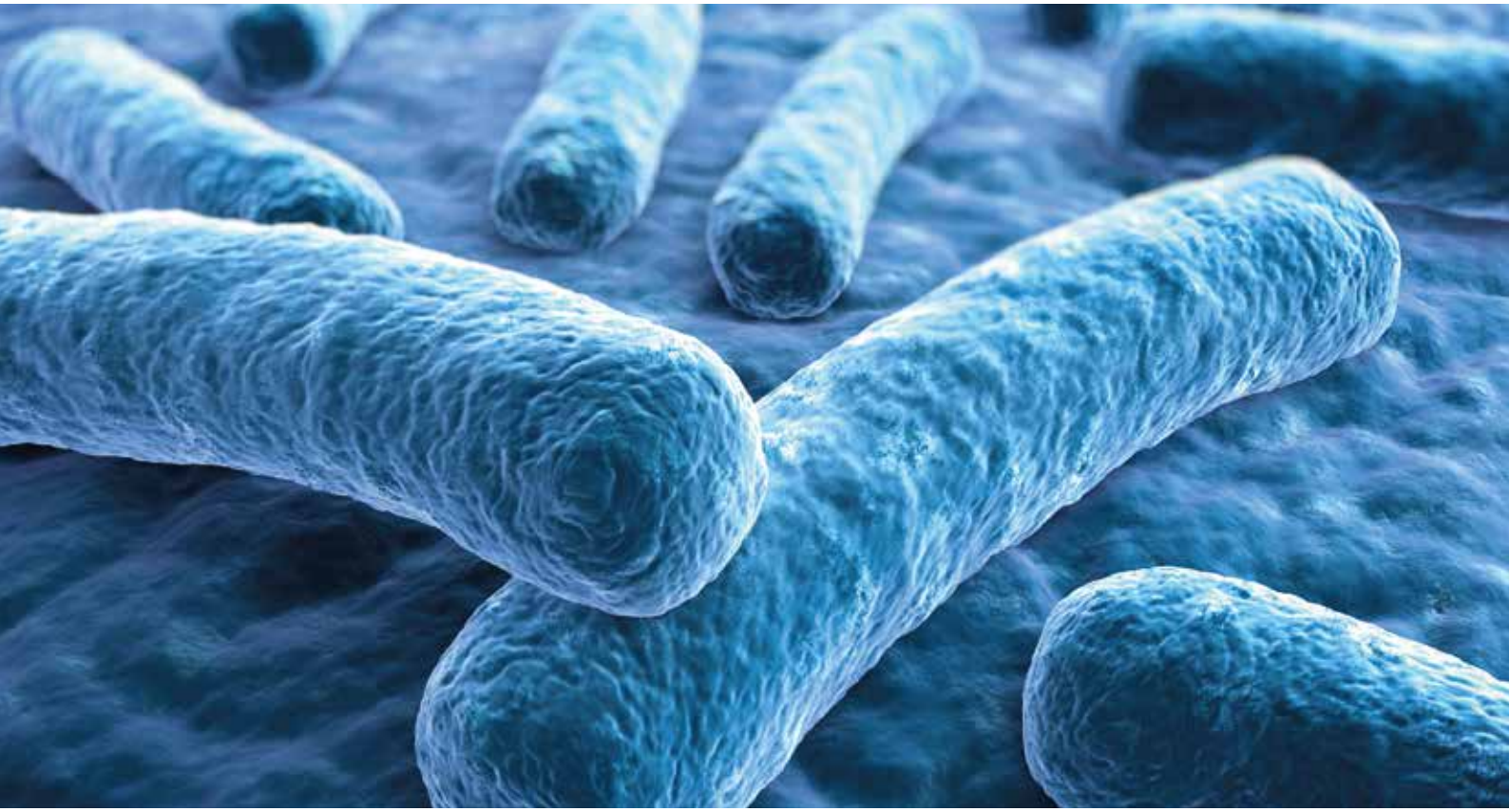


Fig. 1: Legionella bacteria under the microscope.

The US public health authorities thereupon began an intensive investigation into the then unknown causes of the mass disease, which was given the name Legionnaires' disease. Two years later legionella (Legionella pneumophila) were identified as the causative agent. They had been distributed en masse by the hotel's ventilation system. The "Legionnaires' disease" (legionellosis) triggered by inhalation shows symptoms of feverish pneumonia, which lead to death in about one-fifth of cases if not treated.

Since the main path of infection has been identified as inhalation of respirable aerosols containing the pathogen, all equipment and systems that spray, drip or atomize water come into question as sources. These can be, for example, showers, aerators in the outlets of water taps, whirlpool spas, cooling towers and air conditioning systems with mechanical air humidification.

What are legionella?

Legionella are rod-shaped, motile bacteria with a length of 2 - 5 µm and a diameter of 0.5 - 0.8 µm. They occur worldwide in numerous species and serogroups in surface water and soil.

Danger of legionella

The species "Legionella pneumophila" is responsible for more than 90% of serious cases of legionellosis. The incubation time is between 2 and 10 days.

Fig. 2: Olympic swimming – the Red Cross and FINA have fixed the water temperature for swimming competitions at between 25 °C and 28 °C.

People with weakened immune systems (the elderly, smokers, diabetics, ...) are most at risk. Men contract the disease about twice as often as women, and children only rarely. Legionellosis is not contagious.

The infection risk depends on the concentration of legionella, the pathogenicity of the strains and the resilience of the affected people. Legionella in the water systems of hospitals, retirement homes, rehabilitation centers and other care facilities can therefore have particularly grave consequences. The aim should be to keep concentration limits as low as possible, under 1000 CFU/l if possible (CFU: colony-forming unit). High-risk areas such as transplant centers and intensive care units, where people with damaged or treatment-related weakened immune systems are treated, must be completely free of legionella (0 CFU/l).

Fig. 3: The Approved Code of Practice (ACOP) L8 offers guidelines for the prevention and treatment of legionella in HVAC systems.

Reducing the risk of legionella in drinking water installations

Since legionella find optimum conditions for propagation in stagnant water in a temperature range between 25 and 55 °C, these conditions should be avoided through use of hydraulically balanced circulation lines to the tapping points and a water outlet temperature of at least 60 °C.

This is ensured by an appropriate water temperature in all circulation lines. If, after the outflow of at most 3 liters of water from a tap, the hot-water temperature is above 55 °C and the cold-water temperature is below 25 °C, this can be seen as an indication of hostile conditions for legionella in the drinking water distribution system.

Both the hot-water and cold-water lines should be insulated in keeping with the principle “keep cold water cold and keep hot water hot”.

Fig. 4: Hot-water pipes up to 70 °C in temperature can help to eliminate legionella.

It should be noted that unsuitable water pipe materials (galvanized pipes, non-certified plastic pipes or hoses, etc.) facilitate the formation of biofilms (sediments of microorganisms) as growth-inducing breeding ground for legionella on the inside of the pipes.

One preventative measure to avoid legionella is “thermal disinfection”. For full efficacy, the water heaters and water storage tanks as well as the complete hot-water pipe system including the taps must be heated to above 70 °C for at least 3 minutes by water withdrawal.

This is not readily possible in the case of dead, sprinkler and hydrant piping. Fundamentally, the complete drinking water distribution system should not contain parts with stagnant water, i.e. water that does not move for longer than 4 hours, in which a water temperature of between 25 and 55 °C can occur.

The advantage of correct thermal disinfection is that the legionella can be killed off safely and reliably in the biofilm as well without use of chemical additives. The down side is the work load, which nevertheless does not guarantee that the biofilm as cause of rapid recontamination is eliminated permanently. In addition to this, the procedure stresses the pipe materials, increases the risk of corrosion and can lead to scalding at the tapping point.

Chemical disinfection

In this process, chemical substances such as chlorine dioxide, ozone, hydrogen peroxide, hypochlorous acid, etc. are added to the drinking water to kill of the legionella in it. Due to the partly harmful residues in the lines, chemical disinfection should only be carried out by trained personnel.

UV irradiation

In this process, the tap water is passed by sources of high-energy UV radiation (wavelength 254 nm). This attacks the genetic information of the legionella, which impairs their fertility and metabolism, thereby preventing their propagation.

Filters at tapping points with pore sizes ‹ 0.5 µm can retain legionella. However, this method does not remove them from the drinking water system and does not reduce the biofilm, i.e. their growth before the filter is not inhibited in any way.

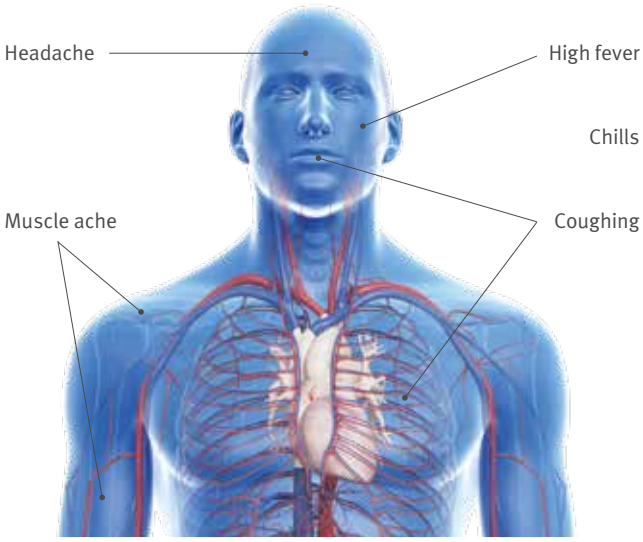


Fig. 6: Symptoms of Legionnaire's disease

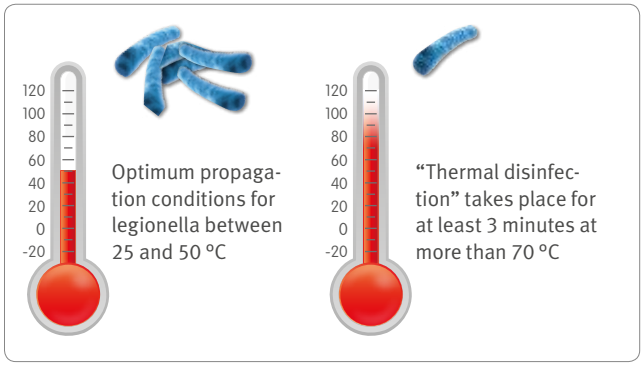


Fig. 5: Thermal disinfection

Summary

Air containing aerosols contaminated with legionella can cause severe pneumonias. The development of legionella in drinking water lines can be prevented by avoiding stagnations, a temperature range of 25 °C to 55 °C and biofilms on the insides of the pipes.

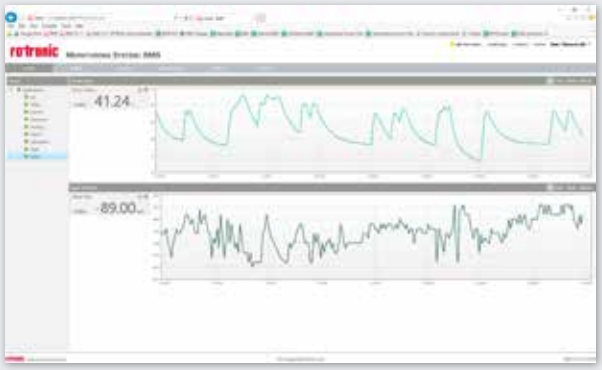
The German Drinking Water Ordinance (TrinkwV 2001) stipulates that public and commercial properties must have water samples tested by an authorized laboratory in intervals of one and three years respectively. Advance warning of risks can be obtained by logging temperature and flow velocity at critical points in the distribution system and evaluating the data.

Our solutions

Gateway
RMS-GW-868

The gateway is the interface between the wireless data logger and the server software. It can manage up to 60 data loggers simultaneously, collecting all wireless-logger measurement data, and passing them on to the server software. When several gateways are used in the same network, they are configured redundantly. If one gateway should fail, the measurement values are automatically sent to the server software via another gateway.

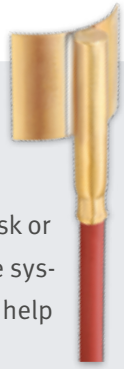
RMS software



The RMS software makes all measured values available in neat and tidy form from a central point. The RMS reporting function makes it possible for you to receive selected statistical data by email at a defined interval in time.

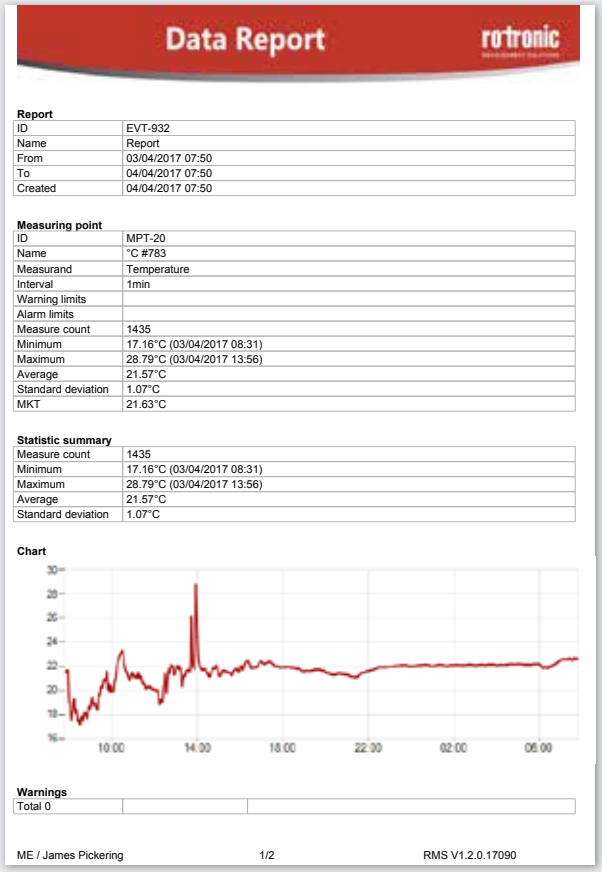
Temperature mini data logger
RMS-MLOG-T10-868

The wireless mini data logger is the low-cost data logger in the Rotronic Monitoring System. Its small housing and wireless interface make it a really flexible data logger. With this versatility, it can monitor refrigerators, incubators and water pipes.



Probe
T10-0004

The T10-0004 was developed to measure pipe temperature to test for a legionella risk or simply to monitor temperature inside pipe systems. The T10-0004 is installed with the help of a pipe clamp.



Data Report rotronic

Report

ID	EVT-932
Name	Report
From	03/04/2017 07:50
To	04/04/2017 07:50
Created	04/04/2017 07:50

Measuring point

ID	MPT-20
Name	°C #783
Measurand	Temperature
Interval	1min
Warning limits	
Alarm limits	
Measure count	1435
Minimum	17.16°C (03/04/2017 08:31)
Maximum	28.79°C (03/04/2017 13:56)
Average	21.57°C
Standard deviation	1.07°C
MKT	21.63°C

Statistic summary

Measure count	1435
Minimum	17.16°C (03/04/2017 08:31)
Maximum	28.79°C (03/04/2017 13:56)
Average	21.57°C
Standard deviation	1.07°C

Chart

Warnings

Total 0		

ME / James Pickering 1/2 RMS V1.2.0.17090

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