Hygiene and controlling bacterial proliferation

Chemical shocks are ineffective over the long term

Thermal shocks are ineffective over the long term

ABOUT LEGIONNAIRES' DISEASE

What is Legionnaires' disease?
It is a serious respiratory infection caused by a bacterium: Legionella. The illness which follows, Legionnaires' disease, is fatal in 15-20% of cases.

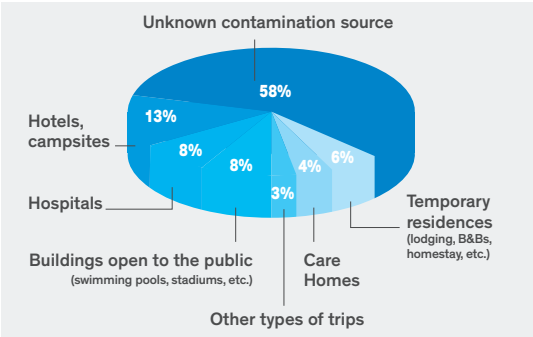
Legionella is a system bacterium which develops in warm water in pipework or cisterns. It only becomes dangerous when inhaled when it may spread into the lungs and rapidly develop in white blood cells.

Legionnaires' disease is more likely to affect adults, especially older smokers and people with respiratory problems or weak immune systems.

Legionnaires' disease is treated with antibiotics. The World Health Organization (WHO) states that the alert level for Legionella starts at 1,000 Colony Forming Units (CFU) per litre of water (250 for hospitals).
The UK alert level is 100 CFU/L.

Which installations are at risk?
Legionellae develop in stagnant water between 25-45°C, with an optimum temperature between 30-37°C. Humid areas with scale, mud or which have been affected by corrosion are more prone to Legionella development.

Environments at risk include hot water systems, cooling towers, health resorts, water fountains, shower rooms, spas, etc.



Source: French *Institute for Public Health Surveillance,* 2015, based on 1,389 declared cases

Development of Legionella per temperature

Temperature	Development of Legionella
< 20°C	Dormant
25-45°C	Multiplies
50°C	90% die within 2 hours
60°C	90% die within 2 minutes

Source: *CSTC Belgium November 2002*

Current curative treatments are ineffective
- Chemical shocks: a chlorine injection 50 mg/L for 1 hour (HSE guidance); ≥ 10 mg/L for 8 hours (WHO).
- Thermal shocks: circulating hot water at 60°C for 60 minutes (in Europe: 70°C for 30 minutes).

- **A short term effect:**
  The system can be very quickly recolonised within 3-4 weeks. The inside of the pipework is covered by a biofilm: a sort of gel which bacteria stick to, feed on and proliferate in.
  The biofilm protects them and enables them to withstand temperature variations (thermal shocks) and biocide products (chemical shocks).

  During curative treatments, the risk is not only that the bacteria will get used to the treatment and thus develop their resistance to it, but above all will provoke detachment of bacteria aggregates which will be deposited closer to the water outlet and thus, to the user.

- **Negative effect in distribution networks and drainage systems**
  They are not necessarily designed to withstand temperatures above 60°C or significant quantities of chlorine. They can cause corrosion or premature ageing of the distribution and drainage system.

- **High risk for the user**
  During the treatment, the user is exposed to high risks:
  - 3rd degree burns in the case of a thermal shock.
  - Poisoning in the case of chemical shock treatment.

- **Costly and difficult operation to undertake**
  Curative treatments are difficult to undertake fully at all points in the system (various deposits, dead-legs, heat loss, etc.). They require the water supply to be out-of-service and the mobilisation of maintenance staff.

To avoid these treatments it is important to act on four levels:
- Avoid dead-legs and water stagnation.
- Regularly maintain the system to prevent corrosion or scaling.
- Produce and store hot water at a high temperature that will prohibit bacterial proliferation.
- Maintain the temperature in the system with a circulating loop and mix the water as close as possible to the point-of-use.

The only preventive treatments that are effective in the long term are the ones recommended by the UK Health and Safety Executive (HSE) technical guidance "HSG274 Part 2" in 2014.

REGULATIONS

HSE guidance recommends the monitoring of Legionella levels where there is a high risk of contamination.
The guidance recognises that the traditional method of controlling the risk of Legionella development is to produce and distribute higher water temperatures. Yet, this significantly increases the risk of scalding at the point-of-use.
(Source: Centre for Burns, St Joseph and St Luc Hospital, Lyon, France).
- At 50°C: burns in 7 seconds and 3rd degree burns in 100 seconds.
- At 60°C: 3rd degree burns in 3 seconds on average (5 seconds for an adult, 1-2 seconds for a child).

HSG274 Part 2 recommends the installation of thermostatic mixing valves where there is a high risk of scalding to users e.g. very young, very elderly, infirm, mentally disabled and physically disabled.
- Hot water should be distributed so that it reaches a temperature of 50°C (55°C in healthcare premises) within one minute at the outlets.
- Thermostatic mixing valves should be installed as close as possible to the point-of-use.

HSG 274 Part 2, 2014

HSE guidance for the control of Legionella bacteria in hot and cold water systems states that monitoring for Legionella should be carried out:
- when water is treated with biocides or when distribution temperatures are reduced from HSE guidelines.
- where water treatment regime control levels are not being consistently achieved.
- where there is a high-risk of contamination e.g. hospitals and care homes.
- where an outbreak of legionellosis has been identified.

A risk assessment is required to identify:

Monitoring frequency of installations for all points-of-use considered at-risk:

- **Sentinel points for temperature measurement and bacteriological testing:**
  - Once a week in healthcare facilities.
  - Once a month for all other facilities receiving public.
- **Bacterial analysis:** once a year
  DELABIE recommends two water assessments: one on the first draw-off, to detect Pseudomonas aeruginosa and one on the second to detect Legionella.
  If the hot water systems haven't been used for several weeks, samples for Legionella assessment have to be taken just after the purge of the system and within two weeks before receiving the public.

Legionella monitoring levels

Alert level	< 100 CFU/L
Remedial action level	> 100 up to 1,000 CFU/L
Curative action level	> 1,000 CFU/L

CFU/L: *Colony Forming Units per litre*

The control of Legionella bacteria in hot and cold water systems

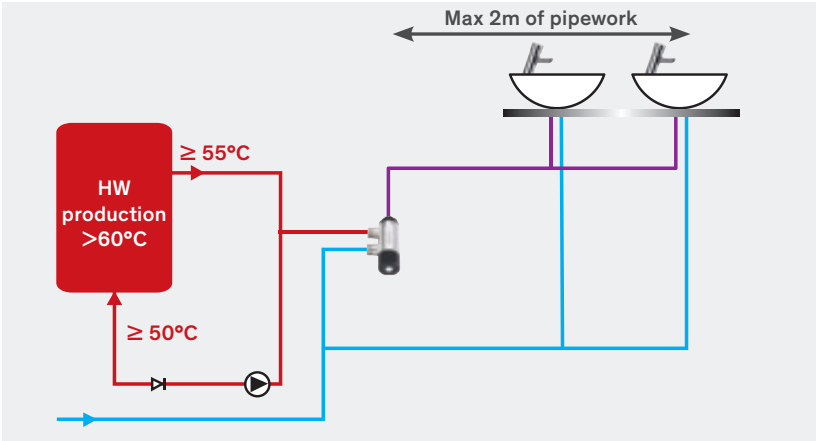
Guidance on compliance with the relevant parts of the Management of Health and Safety at Work Regulations 1999 in public premises.
(Source: UK Health and Safety Executive, HSG 274 Part 2, 2014).
It recommends:
- Minimum temperatures to limit the risk of development of Legionella.
- Maximum temperatures to limit the risk of scalding.

- **At the calorifier outlet** the hot water temperature must constantly be above 60°C.
- **In storage equipment,** water must be maintained at a minimum temperature of 60°C.
- **At every point in the distribution system,** hot water must be delivered to the outlet at 50°C (55°C in healthcare facilities) within one minute of turning on the tap.
  The HSE advises that long pipe runs between TMVs and outlets should be avoided and should not exceed 2 metres in length.
  The maximum temperature of sanitary hot water at the point-of-use is set at:
  - 44°C for bath fill (46°C if assisted)
  - 41°C for showers
  - 41°C for washbasins,
    with special dispensation for catering applications.
    (Source: Health and Safety Executive information sheet 09/12; TMVA Code of Practice, 2000).

PREMIX SECURITY

PREMIX COMFORT

PREMIX COMPACT



Pipes between centralised thermostatic mixing valves and the points-of-use should not be longer than 2 metres.

Capacity and length of pipework

Material	Pipe dimension	Pipe length for a capacity of	
		3 litres	1 litre
Copper	15 × 1	22m	7m
	18 × 1	15m	5m
	22 × 1	9m	3m
Galvanised steel	DN 15	15m	5m
	DN 20	8m	2m
PEX/PER plastic	15 × 2.5	38m	12m
	18 × 2.5	22m	7m
PR plastic	20 × 1.9	14m	4m
	25 × 1.9	8m	2m