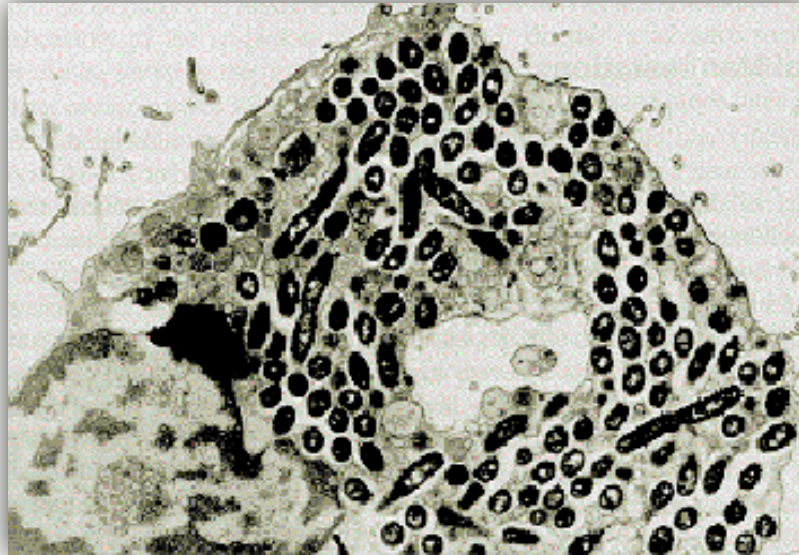


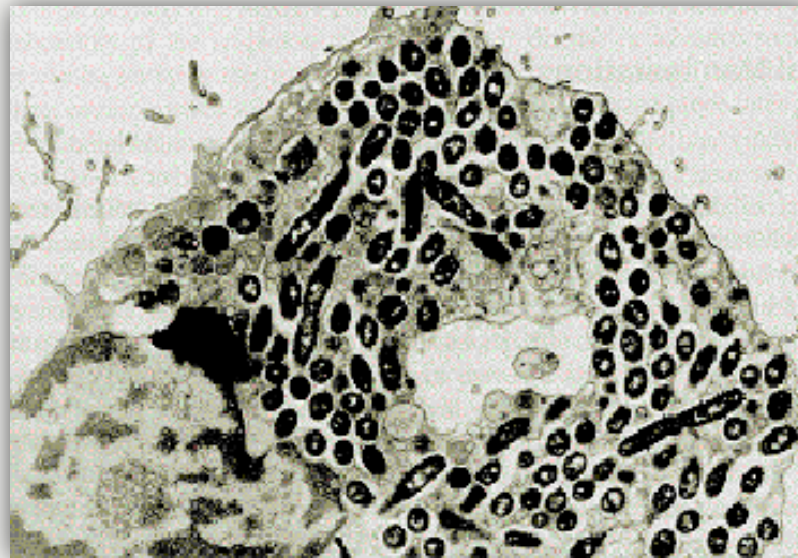
Legionella and cooling towers



The following recommendations should not be interpreted to guarantee the absence of Legionella bacteria or any other particular pathogen.

What's Legionella ?

- Aerobic Bacteria (39 species identified) among which legionella pneumophila: most commonly associated with disease outbreak (legionellosis)

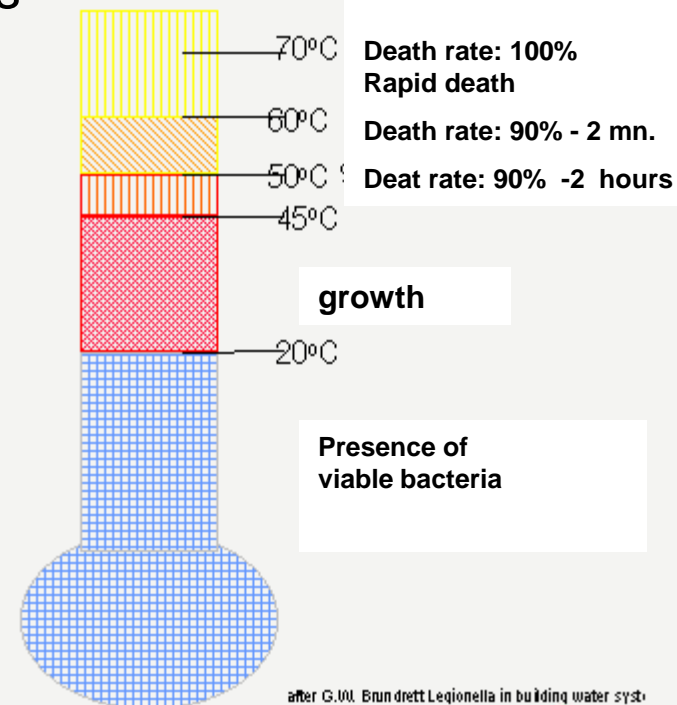


What's Legionella ?

- Living conditions:
 - Natural aquatic bodies
 - Man-made water systems
- Transmission to human beings
 - Via **air** only; **inhalation** of contaminated water under the form of **aerosol** smaller than 5 μm ; **aspiration** (people who smokes or who have lung problems)
 - **Risk factors**: cigarette smoking, chronic lung disease, immuno-depression, organ transplantation, regular use of corticosteroid medicines, age over 55.

Factors favouring the presence of Legionella

- **Stagnating water** (tanks, reservoirs, dead legs in piping systems, poor flow areas)
- **Temperature between 20 and 45°C** (under 20°C they survive over 60° they are killed)
- **pH 5.5 to 8.1**
- Presence of **ferrous ions** (from corrosion, from ferruginous water – (biocide treatments like chlorine or ozone corrode materials)
- Presence of **zinc, calcium, scale and magnesium**

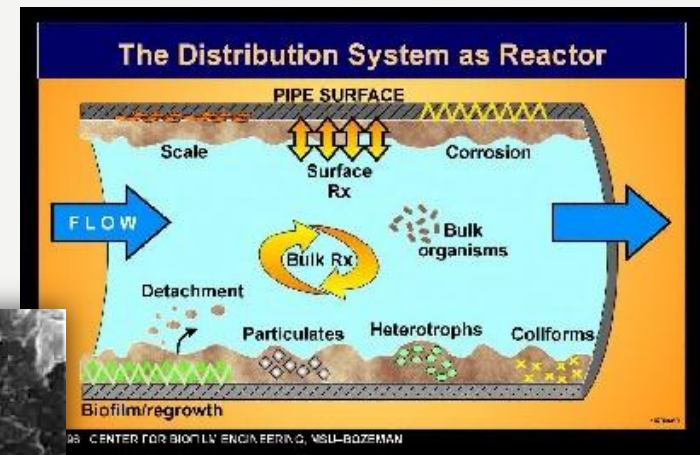
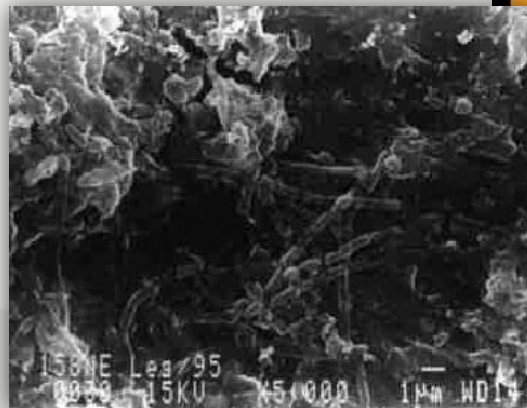


Factors favouring the presence of Legionella

- Presence of **sediment, sludge, scale, organic materials**
- **Biofilm** (layer of micro organisms contained in a matrix that may form a thin layer of slime on surfaces in contact with water).

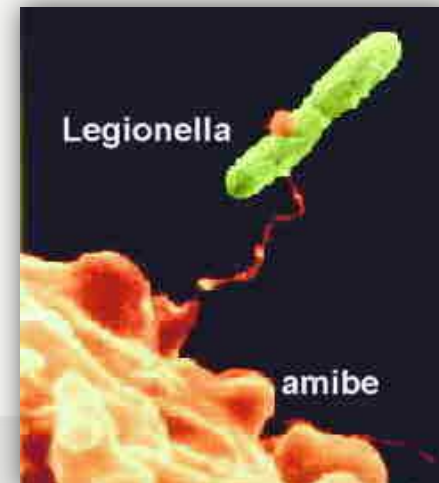
Optimal conditions for biofilm:

- Roughness of the support
- Corrosion of the material
- Wall scaling



Factors favouring the presence of Legionella

- Presence of **microorganisms** (algae, amoebae, other bacteria) that can **host legionella**.
- **Rubber, silicone and some plastics**
- **Absence of biocides** (attention to low performance of chlorine against biofilm)



Factors preventing the presence of Legionella

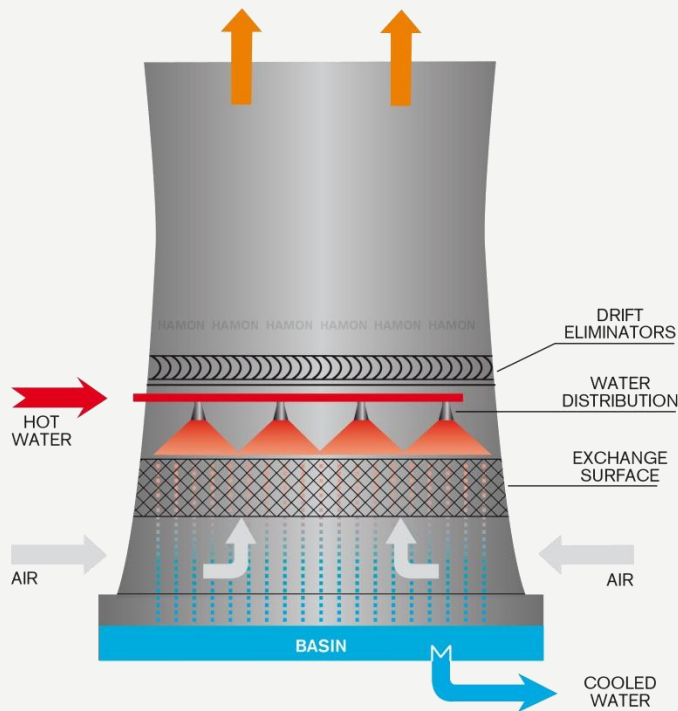
- Permanent water streaming
- Temperature under 20 and over 50°C
- Silver and copper ions
- Brominate

Sources for Legionnaire Disease

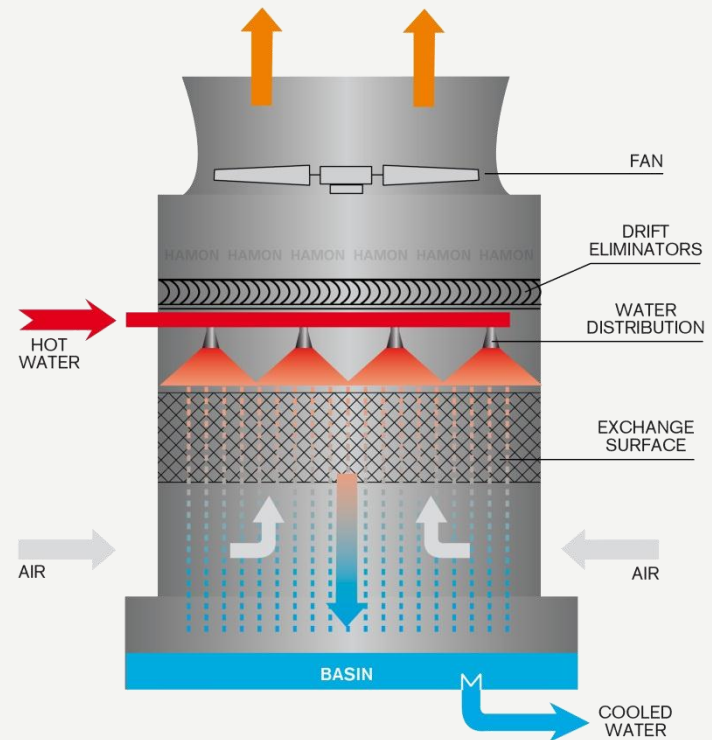
- **Major source:**
water distribution systems of large buildings (incl. hospitals and hotels)
- Mist machine, humidifiers, whirlpool spas, showers
- **Cooling towers:**
long been considered as an important source but new data have contradicted this prejudice

Flows in a cooling tower

Natural Draft



Induced Draft Counter Flow



Cooling tower

Motor Group



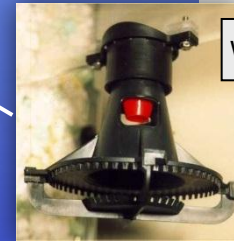
Fan stack



Drift Eliminators



Water Distribution



Louvres



Fill – film packing



Fill – grids



Prevention in CT

- Prevention must be considered at two levels :
 - Minimizing the legionella amplification
 - Preventing the bacteria diffusion

Minimizing amplification in cooling towers

General :

- Water quality evaluation
- Minimizing water stagnation
- Minimizing process leaks into the cooling system that provide nutrients to bacteria
- Maintaining overall system cleanliness
- Applying scale and corrosion inhibitors as appropriate
- Controlling the overall microbiological population

Minimizing amplification in cooling towers

New cooling tower :

Following items must be taken into account when building a new tower:

- Minimizing corrosion in the installation (**material choice**)
- Choice of **appropriate fill** (depending on water quality)
- Minimizing scaling and fouling
- Avoiding water stagnation
- **Access** to the basin, water distribution and drift eliminators have to be foreseen

Minimizing amplification in cooling towers

Appropriate maintenance of towers :

Maintaining a clean water circuit does not only prove its medical interest but also assures an optimal performance of the tower

- Mud
 - That can have formed a deposit in the basin must be removed
- Make-up system
 - Pumps must be maintained and cleanliness of the hydrant must be controlled
- Sump
 - Control the good water drainage and clean the debris
- Piping
 - Check the cleanliness and if necessary clean
- Water treatment
 - System must be regularly checked and maintained

Minimizing amplification in cooling towers



Before Cleaning



After cleaning

Preventing bacteria diffusion

General :

- Use of high-efficiency **drift eliminators**
 - at air inlet (to prevent blow-off)
 - At air outlet (plume)
- Natural draft tower
 - Height of the tower
 - High dilution of the plume



Preventing bacteria diffusion

New cooling tower :

- Use of high-efficiency **drift eliminators**
 - at air inlet (to prevent blow-off)
 - At air outlet (plume)
- Presence of inhabited buildings in the neighbourhood and orientation of winds should be taken into account

Sources of problems

- Breach of drift eliminators
- Scaling or partly filling of the spaces between the drift eliminator waves
- An increased or decreased water flow, which is no more conform to the capacity of the tower
- A deterioration of the water distribution and sprayers
- An increased or decreased fan power (change of the wind velocity through the drift eliminator can cause

CT Maintenance

A CT tower in bad condition can contaminate 50 x more than one which is perfectly designed and maintained.

- Water distribution and sprayers
 - must be in good state and function optimally
 - If sprayers are damaged they have to be replaced

- Drift eliminators
 - Must be clean, in good state, without apparent deformation
 - They must cover the whole air outlet surface
 - If dirty they must be cleaned
 - If damaged they must be replaced by the same type or an equivalent, acknowledged by the CT supplier.

CT Maintenance

- **Fill**
 - Must be clean, free of scale and fouling
 - If possible, it must be cleaned by vibrations, ultrasonic system or high pressure water system.
 - If not possible, it must be replaced

CT Maintenance

- Replacement of worn or broken parts
 - The spare parts of a CT must be replaced by identical parts by **specialists** who know the
 - water distribution type
 - drift eliminator type
 - aerodynamic characteristics of the fill (pressure loss)
 - heterogeneities of the repartition of air velocity on the drift eliminator
 - Any inappropriate replacement of those parts can generate drift increases