



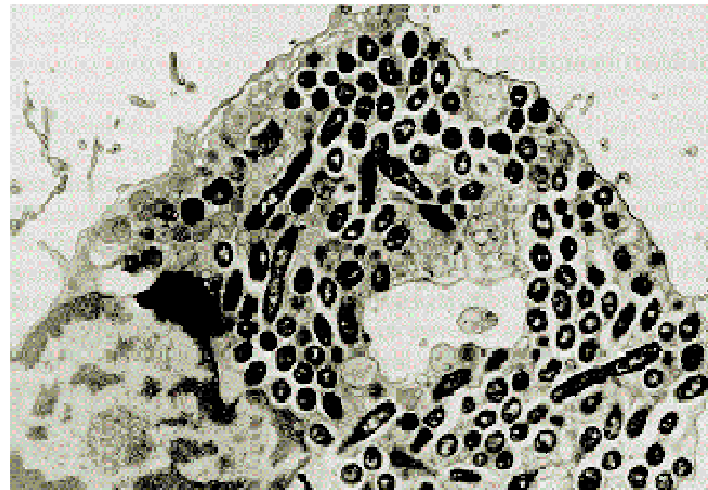
Legionella and Cooling Towers

- In no way, the following recommendations should be interpreted to guarantee the absence of Legionella bacteria or any other particular pathogen, and consequently that these measures will prevent illness



Legionella

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

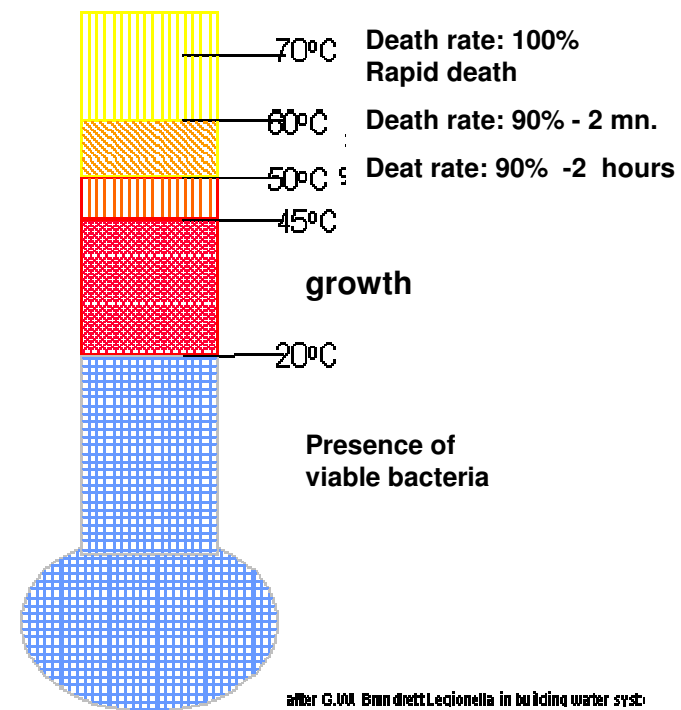


Legionella

- 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

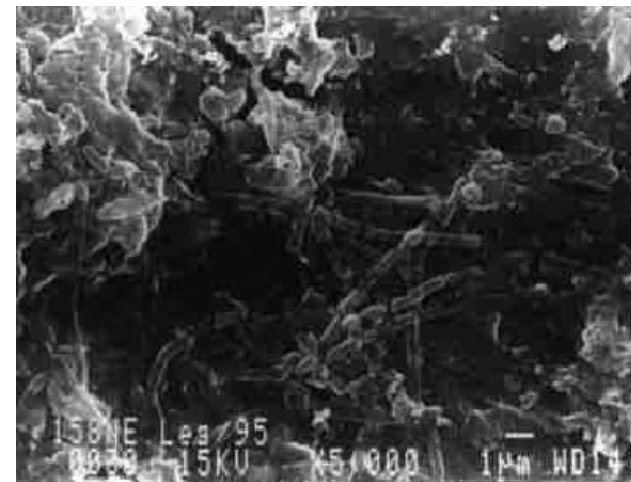
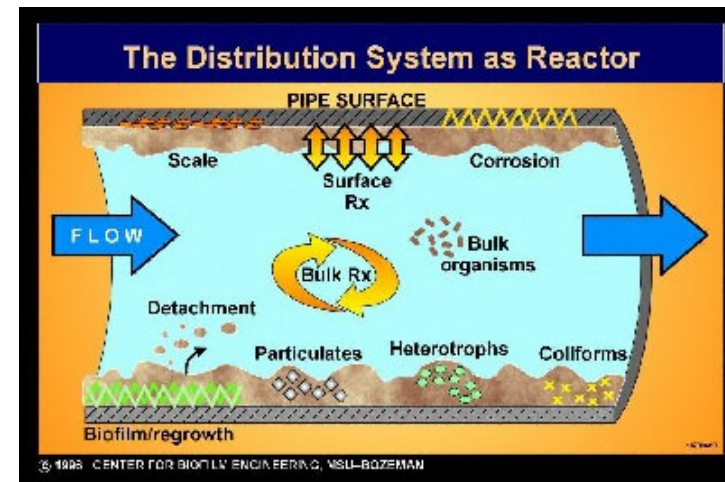
Legionella

- Factors that favour 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**



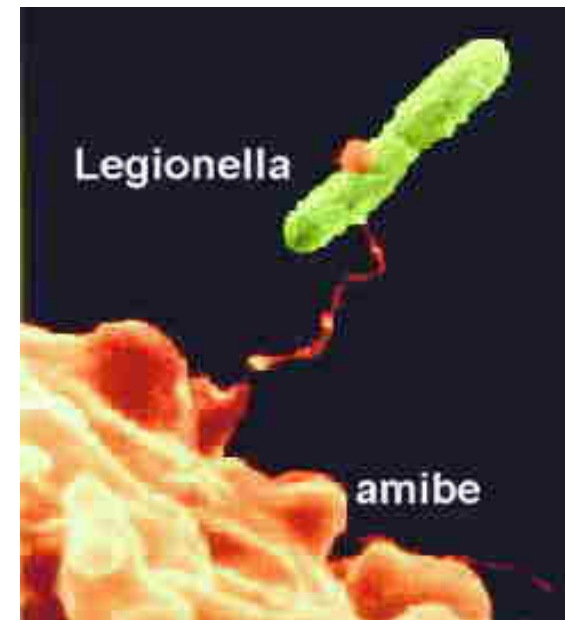
Legionella

- Factors that favour 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



Legionella

- Factors that favour 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)



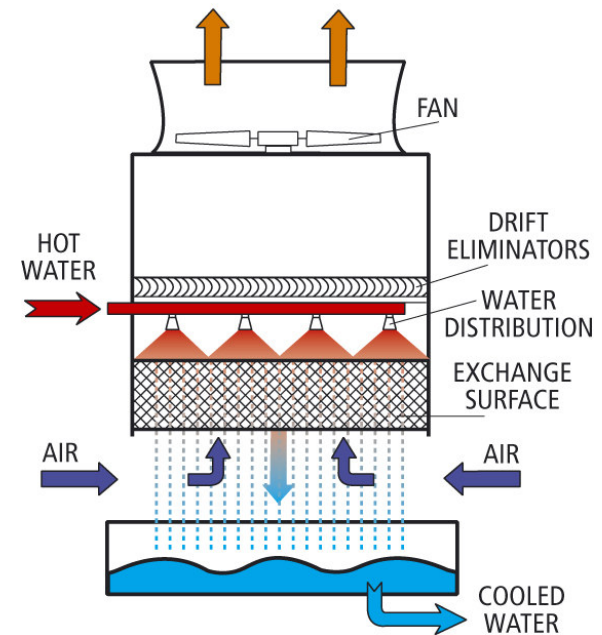
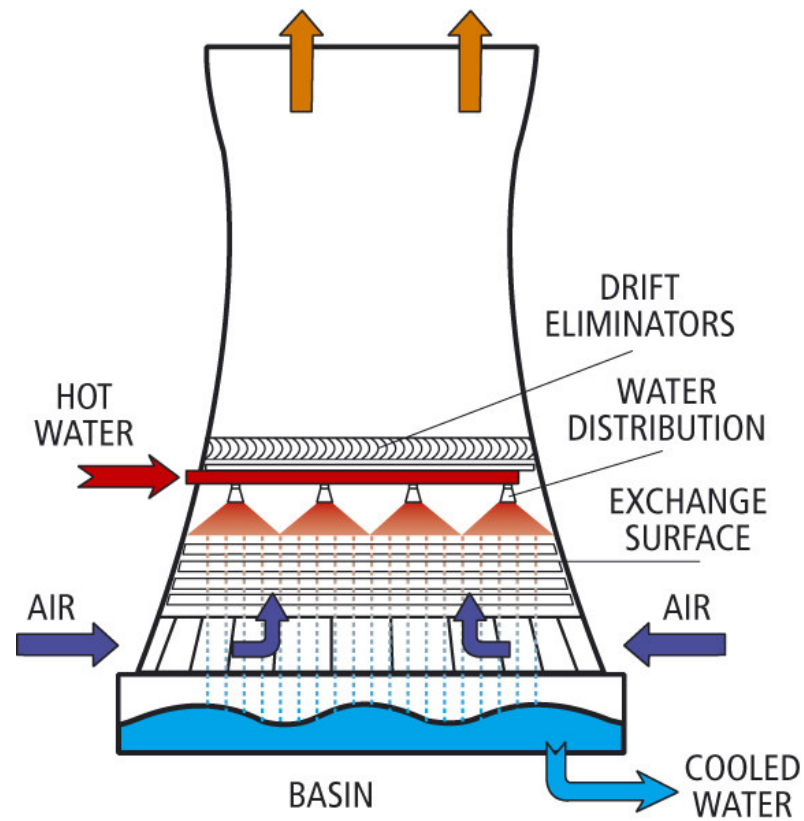
Legionella

- Factors that prevent the presence of Legionella
 - Permanent water streaming
 - Temperature under 20 and over 50 °C
 - Silver and copper ions
 - Brominate

Sources for Legionnaire Disease

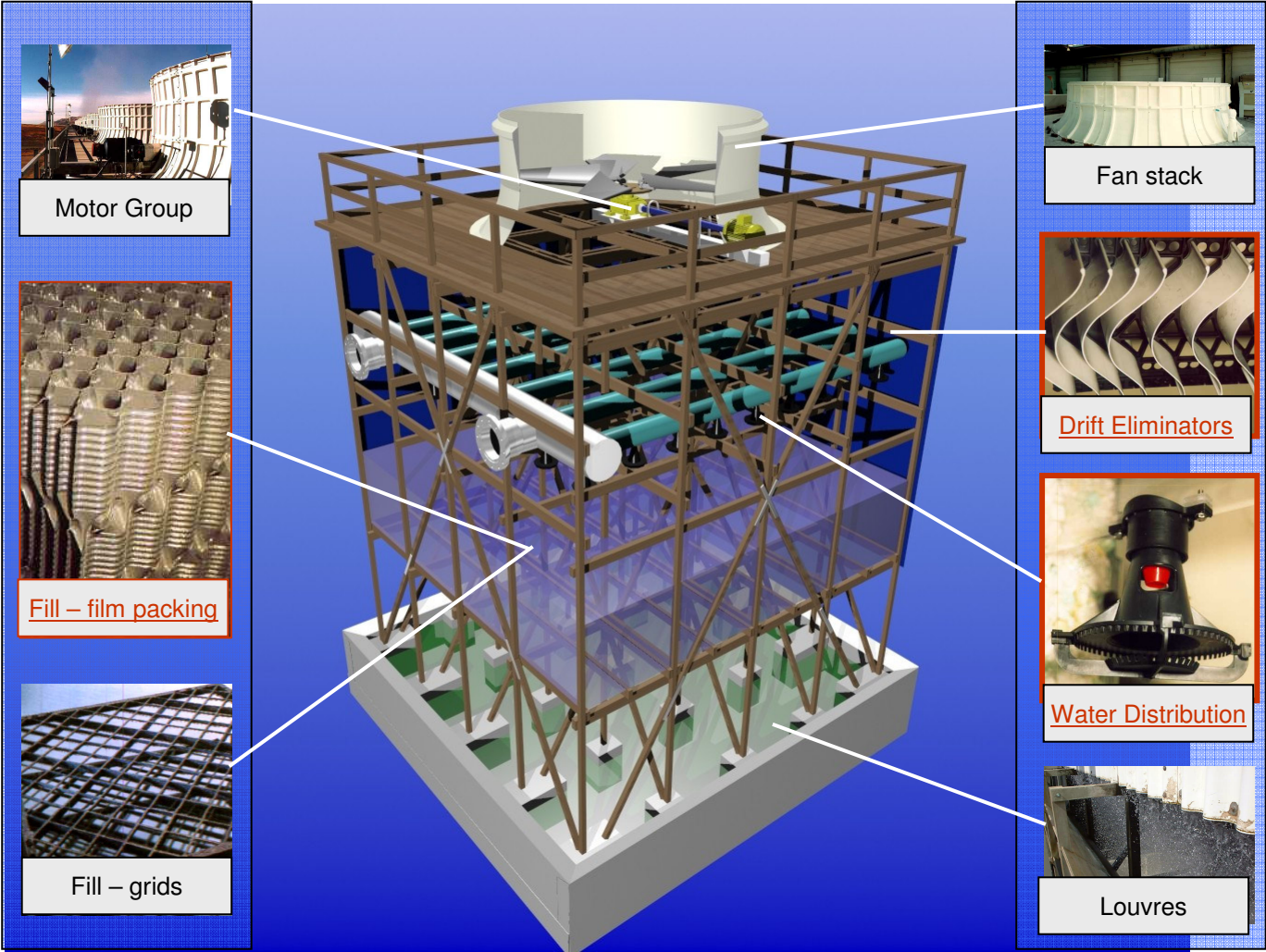
- Major source:
water distribution systems of large buildings (incl. hospitals and hotels)
- Mist machine, humidifiers, whirlpool spas, showers
- Cooling towers:
long been considered as an important source but new data have contradicted this prejudice

Flows in a cooling tower



Not at scale

Cooling tower



Prevention in c.t.

- 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

In a new 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 Maitenance

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