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**

*Death rate: 100% Rapid death
Death rate: 90% - 2 mn.
Death rate: 90% - 2 hours*
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
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 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