

## Legionella infections clearly, a threat in networks: prevention is the best cure



Millions of bacteria

Photos : Allard / REA

## Spotlight on legionella infections

Periodically, the press reports cases of legionella infection. This severe respiratory tract infection primarily affects particularly vulnerable subjects, most frequently in public institutions, hospitals, clinics, treatment centres, retirement homes, spas, hydrotherapy centres, tertiary buildings, etc.

### Networks under strict supervision

The main sources of contamination include central water distribution circuits, sanitary hot water production, long pipes with loops and dead volumes, valves and fittings, showers, humidifiers and air conditioning units.

Therefore, it is essential to set up a sanitary prevention and supervision plan. Recommendations and measures for treatment have also been laid out by law.

Faced with these sanitary requirements and obligation, it has emerged that, as demonstrated below, circuit safety lies in good installation design and thorough maintenance, to meet all the new health-related requirements.

### LEGIONELLA INFECTIONS: THE ESSENTIAL FACTS...

1) **Legionella infections are severe respiratory diseases** primarily affecting vulnerable subjects. It is not caught by ingestion, but by inhalation.

2) **Legionella infections are caused by a bacterium, legionella** which has always existed in water and remains inert at temperatures below 25°C. **It proliferates in water circuits at temperatures fluctuating between 25°C and 45°C** (sanitary hot water and air conditioning circuits).

3) **The legionella bacterium** particularly develops and fixes in the presence of high concentrations of limescale, magnesium and metallic residues such as iron, copper, zinc and

sludge essentially produced by **corrosion and scaling**.

4) **Many effective methods can be used to prevent the risk of proliferation in circuits and disinfect systems** if required, provided that they are free of limescale and corrosion, of course.

5) **Sanitary hot water production and air conditioning circuits** may be the source of the problem if they are old, subject to poor upkeep, corroded and scaled. In these cases, they could show concentrations and anomalies forming **favourable sites for bacterial fixation and proliferation**.

## flash

### NETWORKS AND HEALTH

Faced with the risks involved with "legionella" bacteria proliferation, buildings receiving the public (hotels and particularly hospitals) are mobilised in the fight to reduce or even eliminate contamination risks. At a time of extreme public awareness on matters related to the environment, food and above all health, **GIRPI felt the time was right to present one of its products under development, the HTA® system for sanitary hot and cold water distribution circuits.**

Lack of awareness of the parameters related to this extremely sensitive subject and even complete ignorance of the causes and prevention methods accompanied by the repetition of obvious falsehoods may result in many errors with regrettable consequences for health-related establishments. Therefore, the purpose of this issue of GIRPI INFO is to take stock of current knowledge on legionella infections and effective methods to prevent them and slow down proliferation. Providing you with information to enable you to make up your own mind objectively, **giving, which we think is particularly important, priority to safety and long-term reliability.**

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# CONTROLLING LEGIONELLA INFECTION DEVELOPMENT IN SANITARY HOT WATER CIRCUITS.

**A summary of the main points discussed at the CSTB meeting in March 2000 is given below. A number of professional reviews have covered these points.**

- Legionella infections are respiratory infections caused by bacteria of hydrotelluric origin, legionella. This family of Gram negative (-) bacilli includes 42 different species, but legionella pneumophila is the species most frequently involved in human disease.
- Legionella are found in the natural state in lakes and rivers. They proliferate in water circuits where the temperature of stagnant

water is between 25°C and 45°C, in the presence of high concentrations of calcium and magnesium, and metallic residues such as iron, copper and zinc

- Exposed subjects are contaminated by inhaling contaminated water diffused as an aerosol. Contamination by ingesting water has not been demonstrated. No human-to-human transmission has been demonstrated.

## PROVEN PATHOGENIC POWER

Legionella infections come in two separate clinical forms:

### › LEGIONNAIRES' DISEASE:

Severe acute respiratory infection, which must be treated with suitable antibiotics.

- The incubation time is 2 to 10 days (generally 5 to 6 days)
- Mortality is approximately 15%. It may reach 40% in hospitalised patients and higher values in immunocompromised subjects.
- The predisposing factors are: increasing age, alcohol abuse, tobacco abuse, immune deficiency, chronic respiratory diseases.

### › PONTIAC FEVER:

Benign influenza-like syndrome, not accompanied by pneumonia.

- The incubation time varies from 5 hours to 4 days (generally 24 to 48 hours)
- The subject is generally cured spontaneously in 2 to 5 days.

### › Legionella infection cases are subject to compulsory declarations since 1987.

Legionnaires' disease was first described in 1976 during an epidemic at the 58th conference of the American Legion in Philadelphia.

Since this date, several epidemics have been observed in public buildings, hotels and hospitals.

In France, 20% of the cases declared in 1997 were connected to hospital or clinic treatment and 10% following travel abroad. The use of sanitary hot water and air conditioning units was the most frequent cause of these epidemics.

## SANITARY HOT WATER CIRCUITS

- Sanitary studies essentially conducted in public places have demonstrated the presence of legionella in hot water circuits in buildings such as hospitals, hotels and tertiary sector buildings.

In the Paris area, sanitary investigations have demonstrated that almost 70% of public hot water distribution equipment contained legionella

- Other devices may be colonised by legionella individual air humidifiers, whirlpool or jacuzzi baths used for relaxation, balneotherapy and hydrotherapy, aerosol respiratory therapy equipment, decorative fountains.

## AND COOLING TOWERS

- Environments such as industrial hot circuits or refrigeration units used for air conditioning, industrial and commercial refrigeration favour legionella growth. The cooling towers located outside buildings under systems to cool these hot circuits evacuate heat outside by spraying water in fine droplets in an air stream circulating against the current using a fan, resulting in an aerosol of droplets forming the "plume".

- Aerosols from contaminated cooling towers are liable to carry legionella for several hundreds of metres.

## PREVENTING PROLIFERATION

- The difficulty in obtaining a precise evaluation of legionella infection risk means it is necessary to implement contamination prevention measures, particularly if the subjects exposed are known to be particularly vulnerable and if the technical installations of buildings receiving the public are exposed to legionella proliferation risks.

- The main objective is to combat legionella proliferation in hot water circuits.

› Each healthcare institution director must ensure regular circuit maintenance, particularly in areas at high infectious risks and keep a regularly updated file\* containing:

- the description and drawings of the various systems with definitions of constituent materials
- the maintenance and upkeep protocol for these circuits
- the results of periodical analyses
- if applicable, the circuit improvement schedule

- In buildings receiving the public, contamination prevention is above all based on good maintenance practices:

- draining, cleaning and thermal or chemical disinfection of storage tanks at least once a year, temperature above 60°C in tanks and approximately 50°C in surrounding areas

- periodical flushing of distribution circuits, scale removal, rinsing and chlorinated disinfection of valves and fittings at least once every six months.

• In the event of legionella contamination in hot water circuits, it is necessary to perform complete draining, cleaning and scale removal, rinsing followed by disinfection and rinsing of storage tanks or reservoirs, distribution circuits and valves and fittings. The disinfection should consist of hyperchlorination (50 mg/l for 12 hours) or a thermal shock by raising the temperature to 70°C at the tap outlets for 30 minutes.



Screening for legionella infection at the Paris municipal Hygiene Laboratory.

\* see DGS (French health legislation) circular No. 98/771 dated 31<sup>st</sup> December 1998

# LEGIONELLA INFECTIONS – TWO SHOCK TREATMENTS FOR CIRCUIT DECONTAMINATION

*To disinfect distribution circuits in good condition, two effective methods can be used: thermal shock and hyperchlorination*

## 1) THERMAL SHOCK

› **Temperature rise to 70°C** of the hot water in the entire circuit for an effective output at 70°C from all taps for 30 minutes ("legionella" dies above 60°C), the water is then cooled down to 55°C, in compliance with the decree dated 23/06/78.

## 2) CHLORINE SHOCK

› **Circuit chlorination measure** with hyperchlorination of tanks for 24 hours with chlorine at a concentration of 15 mg/litre in cold water (or 50 mg/litre for 12 hours) followed by draining and thorough rinsing of all piping.

› **While this technique offers several advantages** (economical, approved, no habituation, low pollution, easy monitoring), it is currently only effective on **sound circuits**.

## 3) BEHAVIOUR OF THE GIRPI HTA® SYSTEM

### • THERMAL SHOCK:

› **This solution is the most natural. It is very effective on circuits in good condition and particularly compatible with the HTA®.**

The components of the HTA® system can withstand a pressure of 6 bars and a temperature of 80°C, with a safety coefficient of 2.5. This coefficient is calculated for an operating period of 50 years.

**Other safety factor:** HTA® circuits can currently exceed 80°C, with acceptable peaks of up to 100°C.

In addition, the HTA®'s low heat conductivity makes it possible to obtain a preserved surface temperature.

### • CHLORINE SHOCK:

**This solution is also compatible with the HTA®.** However, it is necessary to check complete compatibility with certain chlorinated products liable to contain additives, which must be neutral with respect to the HTA®.

## REMARKS

• **THESE 2 METHODS HAVE NO EFFECT ON SCALED CIRCUITS.**

• **THEY HAVE A LIMITED EFFECT OVER TIME, EVEN ON SOUND CIRCUITS, AND MUST BE REPEATED AFTER ANALYSIS.**

• **THEY ARE ONLY APPLICABLE IF THE TREATED CIRCUIT IS IN GOOD CONDITION.**

• **THEY ARE NATURALLY INEFFECTIVE IN ELIMINATING LIMESCALE CONCENTRATION, SLUDGE AND PARTICULARLY CORROSION.**

• **THEREFORE, LONG-TERM MEASURES ABOVE ALL INVOLVE GOOD CIRCUIT DESIGN AND A WELL-STUDIED CHOICE OF MATERIALS.**



Analysis of water from different sources at the Paris municipal hygiene laboratory

Photos : Allard/REA

## LEGIONELLA, SURVIVAL ALSO DEPENDS ON TEMPERATURE

• between 5 and 24°C	› 1 year
• 35°	- 2 months
• 45 / 50°	- several hours
• 50°	- reduced viability
• 55°	- inactivation in a few minutes
• 60°	- inactivation in a few seconds

## MAINTENANCE

• **Installation maintenance and upkeep** (see circular dated 31/12/98) are compulsory for healthcare institutions. This makes it possible to prevent the formation of scale and metal oxide deposits, since these sites favour legionella growth, by means of:

- sampling
- regular cleaning
- suitable water treatment
- continuous disinfection in circuit



Colonies of millions of bacteria on a culture medium (Paris municipal hygiene lab).

Photos : Allard/REA

## FRENCH HEALTH LEGISLATION – CIRCULAR TO BE FOLLOWED BY HEALTHCARE INSTITUTIONS

› **The circular issued on 31<sup>st</sup> December 1998 by the French Health Authorities concerns installers.**

It underlines that "it is the **healthcare institution manager's responsibility** to check and guarantee the quality of water at outlet points and to test for legionella at least once a year".

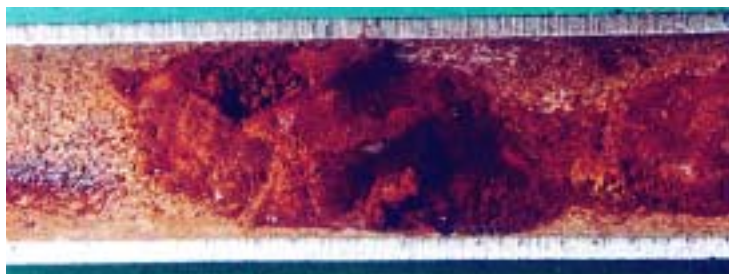
Therefore, it is necessary to ensure that **good water circuit maintenance practices** are applied in healthcare institutions, along with **methods to prevent legionella-related risk** in at-risk installations such as those in buildings receiving the public.

› **The decree issued by the Paris Prefecture on 27<sup>th</sup> April 1999 concerns refrigeration units associated with a cooling tower.**

### OUTLETS

The circular dated 31/12/98 specifies that sampling performed in self-monitoring procedures must be carried out on the circuit via outlets. It is necessary to provide a sufficient number of samples to represent the legionella colonisation.

**GIRPI has specifically developed an entire system of parts with metallic threading enabling easy connection with all types of equipment.**



Scaling (photo: CEBTP)

## CIRCUITS, CORROSION, SCALING... AN EXPERT'S OPINION

**Mr Thierry Gudin:**

**Diagnostic Disease Department at CEBTP.**

**Most corrosion or deposit formation problems in sanitary water circuits (many of which are made of galvanised steel) are linked with three parameters:**

- **The type of water**, which must be able to form protective layers on galvanised steel. Overall mineral, oxygen and bicarbonate content are the most important criteria;

- **The installation design**, particularly dimensions;

- **Operating conditions**, primarily water circulation (outlet volume and frequency), since protective layer formation is favoured by good circulation (many installations contain dead volumes, which may be sources of corrosion and bacterial nests).

When corrosion phenomena develop on metal surfaces, they induce the formation of pustules, which, in the event of bacterial contamination of the circuit, may become potential infection sites.

**In terms of legionella infection**, besides sanitary aspects, the diagnosis of a circuit must include the following steps:

- **Full inspection of circuit**, and identification of any design or production defects;

- **Water analyses to detect**, firstly, the dissolution of metals such as zinc, iron or copper (corrosion phenomenon) and, secondly, calculate its total mineralisation;

- **Selective inspection of pipe sections**, to evaluate their internal condition (presence of deposits, depth of corrosion, etc.).

Legionella infection may be treated using chlorinated products or with temperature shocks (at 70°C with opening of all outlets). In both cases, it is necessary to ensure that the installation is in good condition, since these treatments may damage the materials used.

**C-PVC is the most suitable material for decontamination operations**, and also shows a lower probability of deposit formation on its surface, since this material is more inert than metal with respect to the water transported.

However, scaling phenomena may occur and depend exclusively on the type of water (calcium-carbon balance and temperature).

Our activity in this area essentially consists of the evaluation of circuits (building managing agents, operators, insurance companies or judicial enquiries in the event of claims). We also act as consultants to installers both for correct circuit design and the choice of materials in relation to water quality and maintenance conditions, to obtain the longest possible circuit service life.

## SCALE AND CORROSION: "FRIENDS" FOR LEGIONELLA INFECTION



Internal corrosion (Photo: CEBTP)



Scaling (Photo: CEBTP)



Pitting and hollows (Photo: CEBTP)

➤ **THERE IS NO ZERO RISK WITH LEGIONELLA INFECTION**

➤ **HOWEVER, GOOD CIRCUIT DESIGN AND A CAREFUL CHOICE OF MATERIALS CAN HELP LIMIT PROLIFERATION RISKS IN CIRCUITS FROM THE OUTSET.**

### AGGRAVATING FACTORS

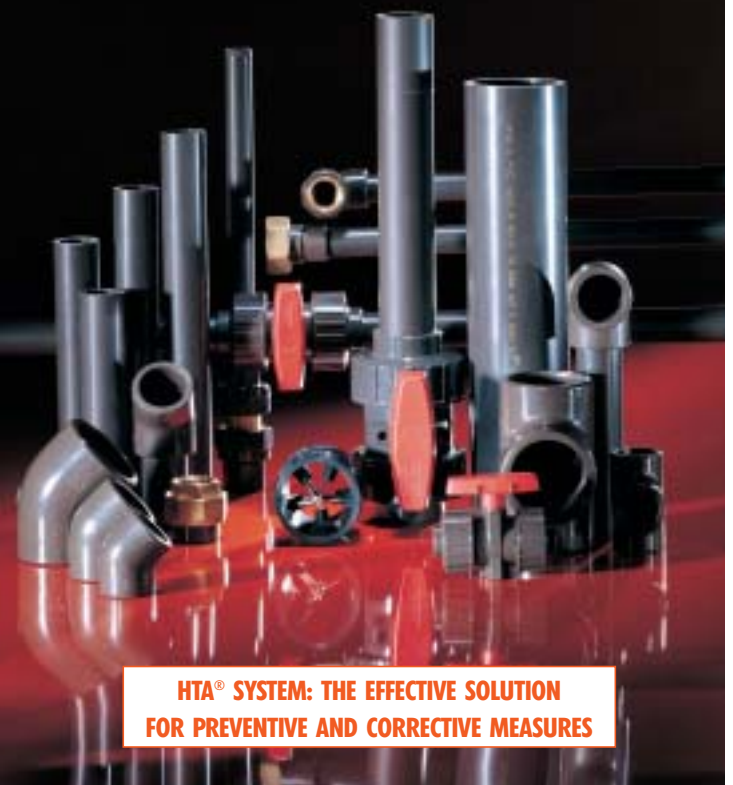
- stagnant water
- dead volumes / loops
- temperature from 25 to 45°C
- biofilm formation
- **scale** deposits and concentrations
- sludge and sediments caused by **corrosion**
- concentration (even low) of some metals such as iron, zinc, and chemicals such as potassium
- ageing installation
- poor upkeep

### THE 8 STRENGTHS OF THE HTA® IN TERMS OF HYGIENE AND SAFETY REQUIREMENTS

- 1 - The HTA® is certified for sanitary compliance** (99 MAT-PA 017)
- 2 - The HTA® is a complete, reliable and durable system** for sanitary hot and cold water distribution (reversible air conditioning columns and rising pipes).
- 3 - The HTA® can withstand 6 bars at 80°C and 4 bars at 90°C** (even with repeated water hammering) and "thermal shocks" perfectly.
- 4 - The HTA® is corrosion-proof** and is not affected by corrosive water. It is compatible with "chlorine shocks".
- 5 - The HTA® limits scaling**, which contributes to bacterial proliferation. In the event of pipe scaling, the HTA® is perfectly compatible with limescale dissolution products.
- 6 - The HTA® is neutral and compatible with food-grade fluids.**
- 7 - The HTA® is non-flammable:** CSTB category M1 and Veritas marine class 1 (N° RA 98-559-1)
- 8 - The HTA® is impermeable to oxygen**, thus preventing sludge formation which favours bacterial development.

# HTA®

## Reliability and durability



**HTA® SYSTEM: THE EFFECTIVE SOLUTION  
FOR PREVENTIVE AND CORRECTIVE MEASURES**



## COMBATING LEGIONELLA INFECTION: IN THE SHORT TERM OR LONG TERM, IT IS UP TO YOU...

*Legionella development is accelerated under certain conditions in cooling towers and hot water distribution circuits. Circuit design and the choice of materials are decisive factors in combating this bacterium.*

### DECONTAMINATION, YES! BUT UNDER CERTAIN CONDITIONS...

For a completely effective and durable result, decontamination must be performed on sound circuits, free of dead volumes, scale and corrosion.

**Therefore, the circuit to be treated must be scaled and cleaned beforehand, since it is impossible for disinfect a clogged circuit effectively**

Scale removal is a difficult and costly operation, subject to a number of constraints: in hospital environments, it is difficult to shut off a circuit completely to clean it.

**Problem:** how can you deoxidise a circuit already damaged by corrosion or even pitted with holes? (the case of many circuits in use for over 10 years).

In many cases, the best solution may consist of renovating the circuit with materials which have lower scaling risks and are corrosion-proof.

### GIRPI'S HTA® SYSTEM: EASIER MAINTENANCE

- Made of a neutral and inert material, GIRPI's HTA® system is completely corrosion-proof and limits scaling.

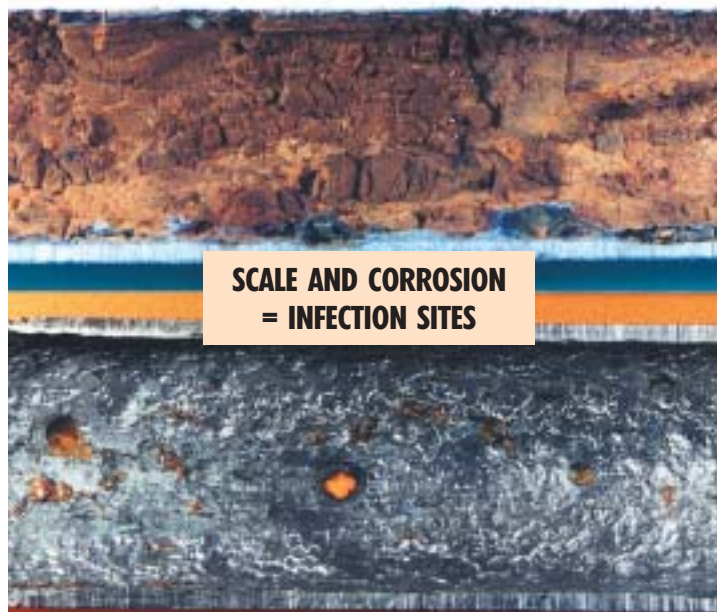
required using acidic products which do not damage the circuit's walls.

- In addition, the **very nature of the material** makes it possible to remove scale from the pipe if

- **Impermeable to oxygen**, it prevents sludge formation resulting in bacterial proliferation.

## PREVENTION IS THE BEST CURE TO ENSURE CIRCUIT SAFETY, YOU NEED:

- A GOOD DESIGN
- TO CHOOSE THE RIGHT MATERIALS
- TO APPLY PREVENTIVE MEASURES ON A CONTINUOUS BASIS
- THOROUGH INSTALLATION MAINTENANCE:  
SAMPLING - CLEANING - TREATMENT



Photos : CEBTP

### THE FOLLOWING NEW AND RENOVATED HEALTHCARE OR HYDROTHERAPY INSTITUTIONS HAVE OPTED FOR THE HTA® SYSTEM.

Le Havre hospital - Roanne hospital complex - Sornain hospital (near Valenciennes) - Sablé-sur-Sarthe hospital complex - "La Bole Eden" retirement complex at La Baule - La Roche Posay treatment centre - Prechacq thermal baths - Dax hospital - Niort hospital - Caen hospital - Bains les Bains thermal baths - Sinceny retirement home.



Le Havre hospital

### WRITE TO US!

We want to hear about your experience and projects!

Explain and present a project characterising your know-how, we are interested in finding out about you to include you in our future issues.

Société GIRPI

Rue Robert Ancel - BP 36 - 76700 Harfleur - France  
Tél : +33 (0)2 32 79 60 00 - Fax : +33 (0)2 32 79 60 28