

## Prevention and control of the Legionnaire's disease



In our centre we follow all the procedures to prevent and control the Legionnaire's disease. We aim to find out the principles and procedures to prevent and control the Legionnaire's disease to protect our patients and our operators and ensure their safety.

The Legionella are microorganisms that are widely widespread in nature, where they are associated with the presence of water, above all warm water. From the natural environments, the Legionella pass to the artificial environments and colonize the water networks. We can find these bacteria above all in swimming pools, spas, fountains, cooling towers, air treatment plants. What promotes their proliferation is above all stagnant water or closed-circuit water. Some kinds of Legionella can cause diseases to the human being, such as high temperature or, in the worst cases, pneumonia, which can lead to the death.

Legionella like most warm water habitats.

The environmental conditions, which promote their growth are:

- for their survival, water temperature between  $+5,7^{\circ}\text{C}$  and  $+60^{\circ}\text{C}$  (in lab conditions at  $+60^{\circ}\text{C}$  Legionella die after about 2 minutes; under  $+20^{\circ}\text{C}$  the bacteria survive but do not proliferate);
- for their proliferation, water temperature between  $+25^{\circ}\text{C}$  and  $+45^{\circ}\text{C}$ ; ideal growth temperature:  $+37^{\circ}\text{C}$ ;
- pH values between 5,5 and 8,1;
- presence of seaweeds and amoebas;
- presence of biofilm (organic compounds matrix, polymers, natural salts and microorganisms) on the walls of water systems, to which the Legionella bacteria attach and where they find protection from the standard biocides of the water treatment.

The Legionella pneumophila is the primary human pathogenic bacterium in the group of the Legionellaceae.

The Legionnaires' disease is an infectious disease, which can appear in different forms:

1. Legionnaires' disease: this is the worst form of the infection. It appears as an acute pneumonia with a 2-10 days incubation time. Sometimes extrapulmonary symptoms such as neurological, gastrointestinal and cardiac manifestations as well as different complications can appear. This disease has a 10% deadliness;

2. Pontiac fever: it is a flu-like disease, with a 24-48 hours incubation time. The symptoms are fever, general unease, myalgia, headache and sometimes cough. These symptoms disappear after 2-5 days.

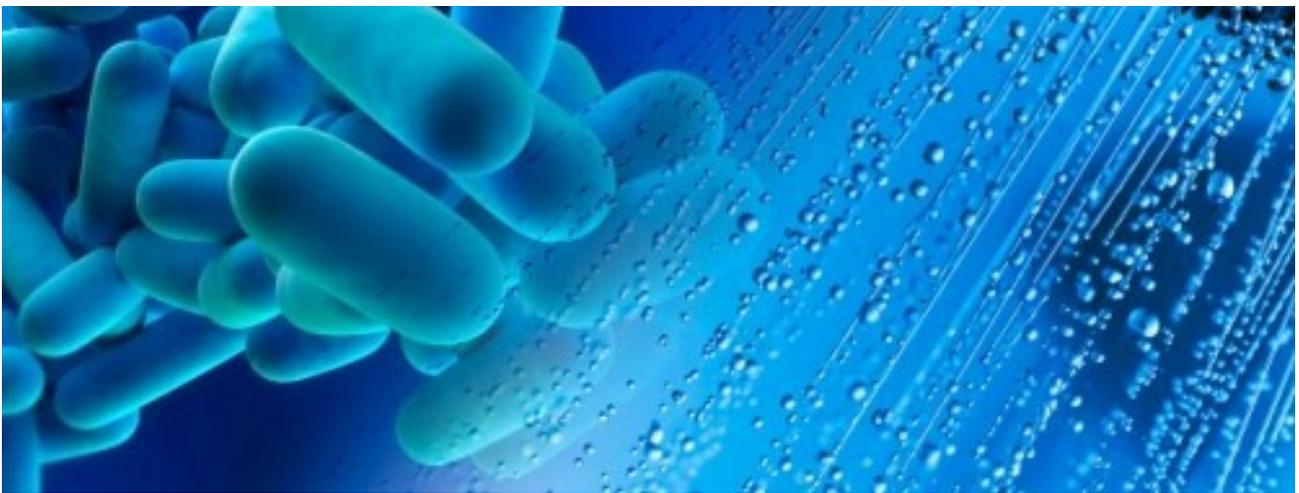
3. subclinic form: no clinic symptoms appear. It can be stated only if antibodies against Legionella are found.

4.

The main risk factors, which favour the onset of the disease are:

- old age;
- immunodeficiency;
- chronic-degenerative pathologies;
- alcoholism and smoke;
- male gender.

The risk to get infected depends anyway on the personal sensibility.



To state the infecting dose for the human being is not easy. Anyway, it is commonly believed that Legionella concentrations between 100 and 10.000 UFC/litre can cause one infection case a year and Legionella concentrations between 10.000 and 10.000.000 UFC/litre can cause sporadic cases. The main transmission way of the disease is the inhalation of aerosol containing Legionella bacteria or the aspiration of infected water (nasogastric tube, aerosol devices and oxygen therapy): the Legionella bacteria penetrate into the host through the mucosa of the first airways and reaches then the lungs. The smaller the water drops are, the more dangerous they are. As a matter of fact, less than 5 micron drops can reach the lower airways more easily.

Potential transmission points can be all the devices where water at a +25°C - +42°C temperature is vaporized, such as:

- rain showers for water and sanitary systems;
- cooling towers and air humidification devices.

Therefore, water and air systems are considered highly risky as they are potential Legionella infection and proliferation sources because of both the water temperature and the easy development of aerosol.

The White Book about Legionella by AICARR reports the following diagram about the most risky areas:

Temperature effects on the reproduction mechanisms of Legionella bacteria and working areas in some applications.

For the correct evaluation of the risk, which our clinic can run, the water and air systems have been checked to locate the critical points which can be risky for patients and/or operators. Particular attention has been given to the logistics, to the maintenance conditions and to the evaluation of the

use of the plants in the different areas of the clinic. The presence of low occupation areas, which can favour the bacterium proliferation, has been checked.

The importance of the Legionella risk control depends on:

- size and type of the plants as well as number and turn-over of the exposed people;
- working exposition of the people in charge of specific maintenance works (prevention treatments, decontamination treatments, etc.).

Moreover, the risk gets higher if the people who are exposed to the risk is ill or particularly sensitive.

## WATER SYSTEM

The water used in the clinic comes from the public water main. This water is heated through a natural gas wall boiler. A water recirculation system is working all the time to ensure the immediate hot water supply to the furthest points of the plant. This avoids the water stagnation in the pipes. Pipes and joints are made of a multilayer material, which is highly resistant to high pressure and high working temperature as well as to corrosion. Moreover, this material is oxygen-tight, excludes any electro-chemical interaction with the laying environment, has very little leaks and is highly hygienic.

The total number of the dental units is 4. These are connected to the water system through pipes and joints which are made of multilayer material.

## AIR SYSTEM

The heating and air system is a ceiling, aerothermal one. It is composed of a single outer central air unit (UTA), where the air is heated or cooled after being filtered and then sent to the distribution channels through a fan. At the end the air comes to the end elements (grills), which are located on the ceiling of the different rooms. This way a good air change and an efficient air conditioning is ensured.

## WATER SYSTEM

### Supply

Water is supplied through the public water main.

The chlorine concentration which is usually contained in the water used by human beings is generally not enough to ensure the absence of Legionella bacteria in the distribution network. The temperature of the inlet water is hardly higher than +20°C, but according to some specialist literature Legionella bacteria can be found also in cold water. For this reason, the spread of Legionella bacteria is to be considered a danger, although a quite little one.

### The sanitary cold water supply

The water supply has been recently built. But over time biofilm and scales may have formed. These cause the spread of Legionella bacteria because of the presence of nutrients and microbes that favour their survival.

At the end points of the water supply there are taps with fine filters to save energy and filter impurities. These filters favour the water vaporization.

As temperature is generally not higher than +20°C, the risk of Legionella bacteria spread is a medium one, and considering the filter size the dispersal risk is a medium one.

In light of the above remarks, and above all considering the presence in the operative rooms of the dental units, which favour the water vaporization in the environment, and considering the aerosol formed through the rotating devices used during treatments, in our clinic the risk of a Legionella bacteria amplification, dispersal and transmission is a medium-high one.

### The sanitary hot water supply

All the remarks made for the sanitary cold water supply apply also to the sanitary hot water supply. A further critical factor in this case is the higher temperature as well as the presence of heating elements along the water route. As far as the hot water temperature is concerned the Presidential Decree 412/93 about energy saving measures sets the highest temperature of the water supplied to

the circuit at +48,5°C. This temperature range is between the “ideal growth” stage and the “slow deactivation” stage of the microorganism.

The recirculation system in our clinic excludes the presence of stagnant water. Therefore, the risk is a medium one.

## AIR SYSTEM

The air heating/cooling system

The heating and air system is a ceiling, aerothermal one. It is composed of a single outer central air unit (UTA), where the air is heated or cooled after being filtered and then sent to the distribution channels through a fan. At the end the air comes to the end elements (grills), which are located on the ceiling of each room. So a good air change and an efficient air conditioning is ensured.

The risk of amplification, dispersal and transmission is a medium one.

## DESCRIPTION OF THE PREVENTION MEASURES

To correctly face the risk of the Legionnaire’s disease it is necessary to find out the critical points of the system and take precautionary steps to protect the user against the risk of the Legionnaire’s disease, considering the equipment, which is in the clinic, as well as the feasibility/sustainability of the decided measures.

As for the risk assessment, which has been made in the previous chapter, the critical points we have found out are the following:

- a) Supply end points such as sterilization room, toilets, operating rooms (dental units, circuits, suction cannulas, rotating systems...). In these pipe sections a biofilm and/or limestone layer, where Legionella bacteria may build a nest and reproduce, may form.
- b) Condensation collecting bowls, where water may become stagnant, thus favouring the reproduction of Legionella bacteria.
- c) UTA batteries (outside), fan-coil and air-conditioning system, where dirt may accumulate.
- d) UTA air filters (outside), where dirt may accumulate.
- e) Air passing channels near the air grills as well as the ceiling grills themselves.

To control the above mentioned critical points PRECAUTIONARY MEASURES are taken.

All ordinary and extraordinary maintenance/sanitization works, which are made for the water and air systems, are documented and registered together with the documents issued by the qualified technicians, which are kept in the clinic.

## DESCRIPTION OF THE MONITORING MEASURES

The use of monitoring protocols enables us to have the risk of the Legionnaire’s disease under control and to take corrective measures where necessary.

The MONITORING ACTIONS, which we have taken, are the following:

- Check on the presence of Legionella bacteria in the water system and in the air system according to the yearly Sampling Plan.

The registrations and the test reports with the analytical results are stored for at least 4 years.

In case of non-conformity and to check the effectiveness of the corrective measure, which have taken, further control samplings are made as often as required by the norms.

## NON-CONFORMITY AND CORRECTIVE MEASURES

If the monitoring measures show a situation, which does not comply with the requirements and may therefore jeopardize the health of the people attending the clinic, some corrective measures must be

taken to bring back the risk to safety standards.

Hereunder are the charts of 13rd January 2015 about the management/control of the Legionella risk described in the national guidelines, which give information on the Legionnaire's disease.

*Impianto Idrico – Concentrazione di Legionella e Tipo di Intervento*

Legionella (ufc/l)	Intervento
<100 ufc/l	Nessun intervento
100 ufc/l < X < 1.000 ufc/l	Verificare che siano state applicate le misure di prevenzione individuate
1.000 ufc/l < X < 10.000 ufc/l	In assenza di casi di legionellosi, verificare che siano state applicate le misure di prevenzione individuate ed effettuare una nuova valutazione del rischio
	In presenza di un caso singolo o di un Cluster, rivedere le misure di controllo messe in atto ed effettuare una bonifica
>10.000 ufc/l	Mettere subito in atto Azioni Correttive di bonifica. Verificare successivamente i risultati, sia dopo la bonifica, sia periodicamente.

*Impianto di condizionamento – Concentrazione di Legionella e Tipo di Intervento*

Legionella (ufc/l)	Intervento
<1.000 ufc/l	Nessun intervento
1.000 ufc/l < X < 10.000 ufc/l	In assenza di casi di legionellosi, verificare che siano state applicate le misure di prevenzione individuate ed effettuare una nuova valutazione del rischio
	In presenza di un caso singolo o di un Cluster, rivedere le misure di controllo messe in atto ed effettuare una bonifica
>10.000 ufc/l	Mettere subito in atto Azioni Correttive di bonifica. Verificare successivamente i risultati, sia dopo la bonifica, sia periodicamente.

Hereunder are the charts which sum up the results of the microbiological analysis with the resulting test report issued by the C.E.A.R. Laboratori Riuniti srl (Merone).

**IMPIANTO IDRICO – CONCENTRAZIONE DI LEGIONELLA E TIPO DI INTERVENTO**

Luogo Prelievo	Risultati Analisi Microbiologica	Legionella (ufc/l)	Intervento
Riunito nr. 3	ACQUA FREDDA: <10 ufc/l	<100 ufc/l	Nessun intervento
Riunito nr.5	ACQUA FREDDA: <10 ufc/l	<100 ufc/l	Nessun intervento
Sala Sterilizzazione	ACQUA CALDA: <10 ufc/l	<100 ufc/l	Nessun intervento
	ACQUA FREDDA: <10 ufc/l	<100 ufc/l	Nessun intervento
Sala Operatoria	ACQUA CALDA: <10 ufc/l	<100 ufc/l	Nessun intervento

***IMPIANTO DI CONDIZIONAMENTO – CONCENTRAZIONE DI LEGIONELLA E TIPO DI INTERVENTO***

<b>Luogo Prelievo</b>	<b>Risultati Analisi Microbiologica</b>	<b>Legionella (ufc/l)</b>	<b>Intervento</b>
<b>Sala Riunito nr. 3</b>	<10 ufc/sponge	<1.000 ufc/l	Nessun intervento
<b>Sala Riunito nr. 5</b>	<10 ufc/sponge	<1.000 ufc/l	Nessun intervento
<b>Sala Operatoria nr. 1</b>	<10 ufc/sponge	<1.000 ufc/l	Nessun intervento

The examinations and the tests that have been made by the centre, show positive results, as can be deduced from the attached file.