



## Occurrence of Legionella – Risk assessment

Occurrence of Legionella must because of the relative seriousness with infection be taken serious.

On the Danish environment ministries homepage

<http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/Udgiv/publikationer/2004/87-7614-158-6/html/helepubl.htm>

a report can be found dated January 2004 with the following title: *Occurrence of Legionella – Risk assessment*.

The following text is a short summarize of this report in preparation for making the risk and the prevention possibilities regarding high-pressure humidification visible.

The purpose with the report is to give a status over relevant knowledge on the area and from there be able to make a more concrete risk assessment of a line of situations and systems, there are relevant under Danish conditions.

Danish drinking water is estimated not to be a risk, because of temperature is to low to propagation of Legionella. The report conclude that results from the investigations for propagation of Legionella always must be seen in connection with the conditions on the spot as water temperature, risk for stagnant water, aerosol mould and staying time. The report furthermore concludes that a limit value has not been fixed for the content of Legionella bacteria, because there are so many factors that determine whether Legionella is dangerous or not. In some cases a limit value would therefore be too lenient and in others too strict and it can be misleading.

If the condition for propagation is to be found, there will be a potential risk.

Legionella pneumophila is the most frequent cause to Legionella disease with human beings. It is 1 out of 40 species belonging to the bacteria family. The species can be split up in 3 different subspecies. All Legionella species can be considered as a potential cause for disease, but it is a minority of the species there concrete has been the cause to disease to human beings.

Legionella is growing optimal in the temperature area from 30 – 40 degrees, but can grow in the interval approx. 20 – 50 degrees and survive in a bigger interval. Stagnant water with a relativ high content of nutrient, which also is optimal for making biological percolator soil, gives possibility for propagation of Legionella. Biological percolator soil is a composition of organic material and micro organics which are growing on surfaces in aqueous environments. Amoeba and other protozoon's are a natural part of biological percolator soil.

Legionella pneumophila lives in the environment primarily as intracellular parasite at amoebas. The bacteria can survive in a long time extra cellular. The mechanism that Legionella use as a parasite in amoebas with propagation intracellular is overall the same which is decisive for the Legionella can parasite humane cells, and with that cause the disease.

The results of the analyses is connected about the knowledge about organism's propagation conditions and the technical conditions on the water systems gives a morpho-objective perception, which can be useful for the concrete evaluation and for prevention.



You can distinguish between arrangements which must be a prevention for establishment and growing, and arrangements there must reduce the amount of already occur Legionella.

The essential factor for preventing growing of Legionella in water consists of avoiding up-propagation temperature 20 – 50 degrees, stagnant water and high concentrations of nutrient for thereby to reduce the morpho-objective perception start.

The environments that fulfil the optimal growing conditions for Legionella, is lukewarm stagnant water with a high organic content.

Several outbreaks of legionellose can be led back to that either the installations hasn't been correct maintained or the installations has not been used for a while.

UV-treatment of the water is among other a method to limit the growing of bacteria. This method together with others, hasn't achieved an approval from the authority and for most of the methods there are only a limit of documentation for the efficiency in praxis.

*Our supplier of UV treatments says that: "this type of radiation on the bacteria has a effect of the free bacteria, but the system has no effect on the growing of bacteria in the amoebas".*

Legionella will mostly infect by breathing in aerosols, but can also infect via aspiration, including failure swallow.

There are never proved an unambiguous dose -response connection for Legionella at human beings while there has been found high concentrations of Legionella without sickness and reverse has seen sickness, where the water test afterwards only showed moderate content of Legionella. An explanation can be that water tests often are taken a while after the patient has been infected. The bacterial count can on this time be considerable different from the bacterial count on the time of infect. The propagation of the bacteria to the high numbers in each amoebas, and thereby the risk for infection via an amoebas also will take part in confusion the picture.

For most of the sporadic Danish cases it has succeeded to trace the source of infection to the warm potable water.

The temperature is a decisive fact for the risk of a propagation of the Legionella. But Legionella is not especially quickly growing and the time at a given temperature is therefore of great important.

#### **Temperature degrees Celsius**

#### **Risk assessment**

<20

Survival must be expected but without propagation

20 – 50

Weak to strong growing. The Intensity demands of the time at these temperatures. The limit at 30 – 40 degrees is counted as the optimal for growing

>50

Weak to strong inactivation.



It is important to be aware of, the conditions where the Legionella can survive only is acceptable as far as there in proceeding hasn't been possibility for propagation.

The use of surface water together with the temperature impact is a decisive importance for the quality of the raw water. In Denmark the raw water mainly comes from the subsoil water. Amoebas and Legionella have much easier access to subsoil water.

The demand of temperature for Danish drinking water is max. 12 degrees, where it is estimated that Legionella wouldn't be able to grow, but still can survive. It's estimated that Legionella doesn't pose a problem for the drinking water in Denmark.

The authority of the Netherlands has set an acceptant limit for Legionella in the tap water at 50 cfu/litre at the tap places with critical aerosol formation. The limit is however estimated to be low seen from the risk angel.

## **Conclusion**

The problem with Legionella ought to be prevented in a suitable way and there must be shown extra care towards the risk personal group, as ex. sick and older people.

Legionella must be considered as naturally incoming environment bacteria, which doesn't become a problem before there is a propagation condition for it.

The essential factor for preventing growing of Legionella in water:

- Stagnant water
- Water temperature
- High concentrations of nutrient

These statements are taken directly form the Danish environment authority's homepage. For further information or for a more deep info please look at the following link:

<http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/Udgiv/publikationer/2004/87-7614-158-6/html/helepubl.htm>

Overall seen the problems med Legionella has to be seen in systems where there is warm water and not in coldwater systems.

## **Humidification with Airtec® high-pressure humidification systems.**

Airtec® systems are developed regarding the ISO 9001, ISO 14001 and ISO 22000 - Quality, Environment and Hygiene. This means that from Airtec®'s point of view the system lives up to the highest demands to these conditions.

We recommend that the systems are installed by a technician from Airtec® to avoid incorrect installation.



All systems ought to be serviced by a technician from Airtec® to secure that all safety functions in the system is functional. We recommend servicing our systems twice a year.

The customers ought to make checks on the system and if there are any problems they must immediately contact Airtec®. The own control ought to be done once a week and consist of a going through of the systems functions as described in the delivered User Manual.

### **Functionality of the Airtec® ISO 22000 HACCP system**

- Cold water system. Waterworks temperature approximately 8 – 10 degrees.
- System control changes the water in the system several times per day
- 100 % VSD (frequency inverted) controlled pump system
- RO system membrane filters up to 100 % of all bacteria
- UV radiation disinfects bacteria
- Hygienic design of system.
- Small hoses to minimise the water in the system
- Own control programme and log

The water there is being used in the system is subsoil water which often is delivered from the waterworks, with a temperature around 8 degrees. Airtec® can naturally not answer for the quality of the subsoil water at the end-user. There must be conscious control with that.

With adjusted pump systems you can avoid an unnecessary heat supply to the water and thereby there is no heat supply to the water worth mentioning. It means that the water in a fully functional system is far under the 20 degrees, which is the limit for where the bacteria are propagated. Airtec® uses a frequency control on the pumps which will take care of producing exactly the correct amount of water needed. When the pump isn't frequency controlled is the pump from Airtec® carefully adjusted the each customers needs.

To avoid further heat development and subsoil water, the water is changed continuous ever 6 hour, even though there isn't any need of humidification. This is adjusted by the control unit from Airtec® and the system will be forced to start.

The Reverse Osmosis system can be connected to Airtec®'s humidification systems and it gives a very fine filtration of the water, which will remove both nutrients and bacteria from the system. The Membrane is adjusted the water molecule and therefore it wont let any pollution as heavy metal, chemicals, vira, bacteria through, because all these substances are bigger than a water molecule. All substances will be rejected, but oxygen - O<sub>2</sub> and CO<sub>2</sub> – which a gasses and smaller than the water molecule, will slip through the osmosis membrane, so that the natural oxygen in the water will be kept. The Reverse Osmosis system can naturally be connected to those systems which have not got such a water treatment system today.

UV disinfection can also prevent in handling the bacteria formation in the system. But it doesn't work on amoebas.



If the subscription around running and servicing the system is overruled of the customers there is a minimal risk for bacteria formation in the system. The importance of service and own control can't be pointed out enough and must be done continuously.

Airtec® High-pressure humidification systems is working with 50 bar pressure. A living organism will be strongly influenced by sudden change of the pressure in the surrounding environment. In this case the pressure will be changed from 50 bars to atmospheres pressure.

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