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Showers and other aerosole-producing devices may spread legionella

Possible technical emergency measures

There are no generally valid "cooking recipes" to deal with legionella contaminated systems because each water system is very individual. Useful first measures typically are:

- Information of crew and passengers
- Increase of hot water temperature (Caution: Avoid scalding!)
- Flushing of all taps and other devices containing water (hot water and cold water system, especially seldom used parts)
- Check of proper function of existing disinfection devices

Legal requirements

Not only based on the MLC 2006, and much more detailed defined in the German Infection Protection Act, the International Health Regulations (IHR) and the Drinking Water Act, operators of mobile potable water systems (as ships are) are obliged to inform the authorities and to initiate different measures in different situations.

- According to the German IHR-Act the governmental Port Health Authorities are the competent authorities for surveillance of hygiene on board ships, including water safety.
- Drinking water has to be tested regularly for the parameter Legionella species. In case of results > 100 CFU / 100 ml this analysis results and the initiated control measures have to be reported to the Port Health Authority.
- According to the Infection Protection Act, any proven case of human Legionella infection has to be reported immediately to the Health Authorities (including patient's name)

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Legionella on board

Risks and preventive measures in water systems on board ships

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Legionella…

Legionella pneumophila, picture from a scanning electron microscope



Reliable risk assessments require multiple samples.



Proper temperatures make the difference.



Biofilms and incrustations provide nutrition and protection against disinfection for microbial life.

Legionella species?

Legionella are potentially life threatening bacteria living in water systems. They have a rod shape and a length of 2 - 20 micrometers. This is less than 1/50 of the diameter of human hair. There are existing approximately 60 different types of Legionella, altogether called Legionella species. In 90% of all cases the dangerous subspecies Legionella pneumophila is responsible for the two possible types of illness. The usually less dangerous Pontiac fever typically shows symptoms like flu: headache, muscle pain, dry cough and fever. Time from infection to the beginning of the first symptoms (so called incubation period) is in average 24 - 48 hours. The by far more dangerous disease is the so called legionnaire's disease. In this case severe pneumonia may pose a life threatening situation. Typically the illness starts after an incubation period of 2 - 10 days with symptoms like nervous cough, headache, fever and shivering, sometimes diarrhea, nausea and vomiting. Lethality of this illness is 10 - 15 %. A direct human-to-human transmission is not known and seems to be unlikely.

Where do we find legionella species?

Legionella are germs which are widely found in aquatic environments. If contaminated water is sprayed around in very small droplets (aerosols), the pathogens can reach the human lung by normal breathing. There they can start the infection. Because the typical way of infection is by the lungs, all aerosol-producing facilities pose a possible health risk. That includes on board not only showers or whirlpools, but also decorative fountains, humidifiers or high pressure cleaners. It is crucial to consider that legionella species require specific conditions to survive in water systems. Water temperatures between 25 °C and 45 °C intensively promotes emergence and increase of legionella contamination. Existing incrustations or biofilms in the piping system supply nutrients and themselves render disinfection measures ineffective. Stagnating water, i.e. in so called dead legs of the piping system usually leads to systemic contamination.

What are possible preventive measures?

At first, a potable water system needs to be properly constructed according to the specific technical standards. That means amongst others to avoid dead legs, choose the right plumbing materials and to manage the water system in a safe and hygienic manner. For legionella prevention in hot water systems it is crucial to keep the hot water temperature always above 55 °C in all parts of the hot water system. Therefore calorifiers should be set to a temperature of at least 60 °C or more. To avoid heat losses, all parts of the piping and other parts of the water system need to be well insulated. Cold water systems should be insulated against heat exposure as well. Cold water temperatures need to be always below 25 °C, better below 20 °C. In some tropical areas this seems to be impossible so that in these cases specific barriers like continuously chemical or physical disinfection measures should be applied. In case of physical disinfection methods it needs to be considered, that not all available UV-"Sterilizers" show the advertised disinfection performance in reality. Last but not least a regular professional and reliable water analysis is of outstanding importance.

What happens in case of complaints?

It needs wide experience, specific knowledge and a little bit of patience to perform a professional examination of a potable water system on board. Sampling points need to be defined thoroughly and the water sample needs to be taken by a specially educated professional who has to use dedicated sterile sampling containers. The water needs to be analyzed by professional external laboratories what usually takes at least 7 days. Whenever a sample analysis results in more than 100 CFU / 100 ml the operator of the water system has to initiate control measures. Besides performing a systemic disinfection (if necessary) it is essential to find the source of contamination. Normally, in case of medium or severe contamination, constructional interventions are required.

If a potential health risk for the consumer can't be excluded the health authorities may require immediate specific measures and prohibit the use of the system temporarily.

Of major importance is the awareness of ship's crew and ship's doctor concerning passengers or crew members showing the above mentioned symptoms. In these particular cases the responsible physician ashore should be informed about a possible legionella infection so that the patient can be tested to verify the suspicion.