

LEGIONELLA AND COPPER PLUMBING

Lack of thought at the design stage, poor choice of materials and failure to correctly install and properly maintain water systems in buildings can lead to serious health hazards. These can arise as a result of high levels of micro-organisms in the water, such as *Legionella pneumophila*. Once established in the system these infestations can be difficult to eradicate.

Copper is by far the safest choice of plumbing material. It has many proven advantages over other plumbing materials for suppressing colonisation and growth of a wide variety of micro-organisms.

History

Gardeners and wine growers in particular have long used copper based solutions, such as Bordeaux mixture, to prevent the growth of fungi on vines and by spraying against potato blight.

Biofouling of plumbing systems

Mains water is disinfected at the water treatment plant by the use of chlorine. This kills pathogens known to cause illness in man, such as cholera, typhoid, etc. However, the water is not sterile when it reaches the plumbing system. The quality of the mains supply does not solely determine the quality of the water at the tap. Figure 1 illustrates the likely risks associated with the temperature of various water services. Dead-legs and long horizontal runs of pipework, especially if oversized, as well as overlarge storage cisterns and hot water storage tanks can lead to long periods of stagnation. If suitable nutrients and temperatures (between about 20 and 50°C) are present then a biofilm can form. A biofilm is a layer of living micro-organisms on the inside surfaces of the system. Nutrients can be present in the water supply, or they can be plasticisers

and other organic materials leached from plastic pipework or cisterns. The biofilm can develop in as little as 14 days. As time goes by the micro-organisms can grow and eventually portions of the biofilm can break away causing a dramatic upsurge in the level of harmful micro-organisms in the water discharging from the tap. If the water discharge creates an aerosol (a mist of tiny droplets) and contains *Legionella pneumophila*, which is breathed into the lungs, then potentially fatal Legionnaires disease can result. Air conditioning wet cooling towers, showers and whirlpool baths, for example, can all create this risk.

Prevention

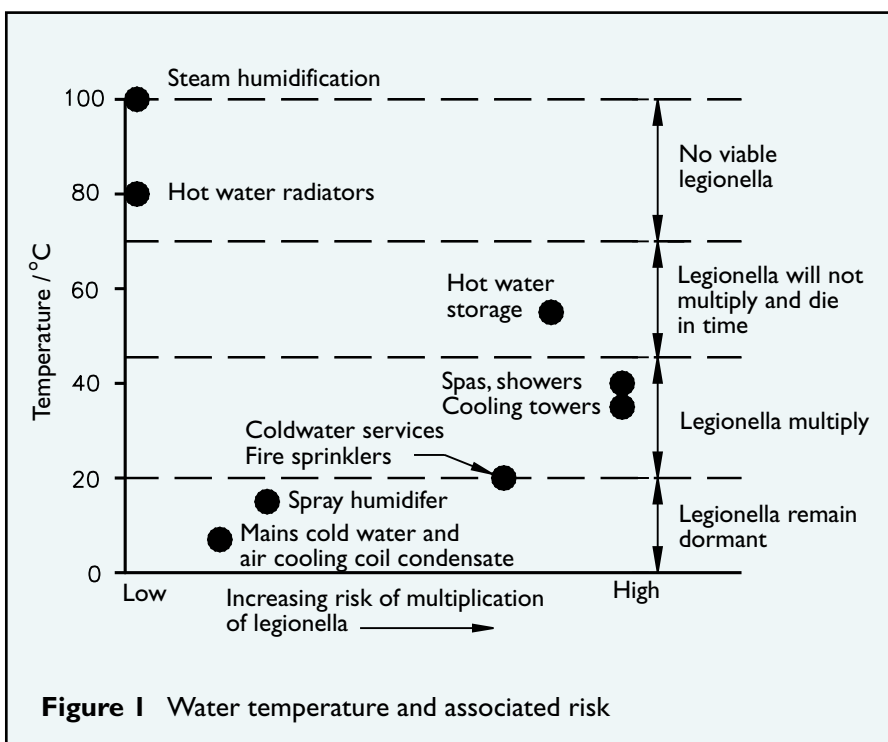
The risk of biofouling can be minimised at the design stage by specifying copper wherever possible. Studies by a number of public health laboratories have shown that of all the plumbing materials only copper consistently has any effect in suppressing micro-organisms. It has been shown to do this in both hard and soft water over a wide range of temperatures. Furthermore, the studies found that plastics like polybutylene increased the growth of biofilm compared to copper and neutral glass.

Stagnation

By taking care that the pipes and storage vessels are not significantly oversized stagnation risk will be minimised. Water fittings should be grouped so that long horizontal runs of tube supplying single, infrequently used fittings are avoided. By minimising the length of time that the water remains in the system any microorganisms present will have less time to multiply.

Disinfection of water services

When commissioning potable water installations follow the guidelines laid



down in BS 6700 as well as the chemical suppliers handling and safety instructions. For single private dwellings a thorough flush with fresh water from the mains is all that is necessary. For larger installations the water supplier should be notified before disinfection using sodium hypochlorite is carried out. (Household bleach powder contains approximately 5% available chlorine.) Flush the system to remove all visible dirt and debris then add sufficient sodium hypochlorite to give a measured strength of 50ppm (parts per million) in the cistern. Leave this to stand for 1 hour then open taps in turn working away from cistern until the water smells of chlorine then close the tap. During this process the cistern should be regularly checked and topped up with 50ppm chlorinated water. Once the pipework system is full of chlorinated water, leave it to stand for an hour. The level of residual chlorine at the furthest tap should then be measured. If this is less than 20ppm the process should be repeated. Finally the system should be thoroughly flushed out with clean water until all the residual chlorine is removed.

Assessing existing installations for risk

If a risk assessment of the installation is to be carried out look for the following points:

- long dead-legs;
- occasionally used taps and showers;
- the type and quality of any spare washers and the jointing materials used, they should all be WRC approved type;
- blanked off branches left for future extensions or after the use of the building has changed.

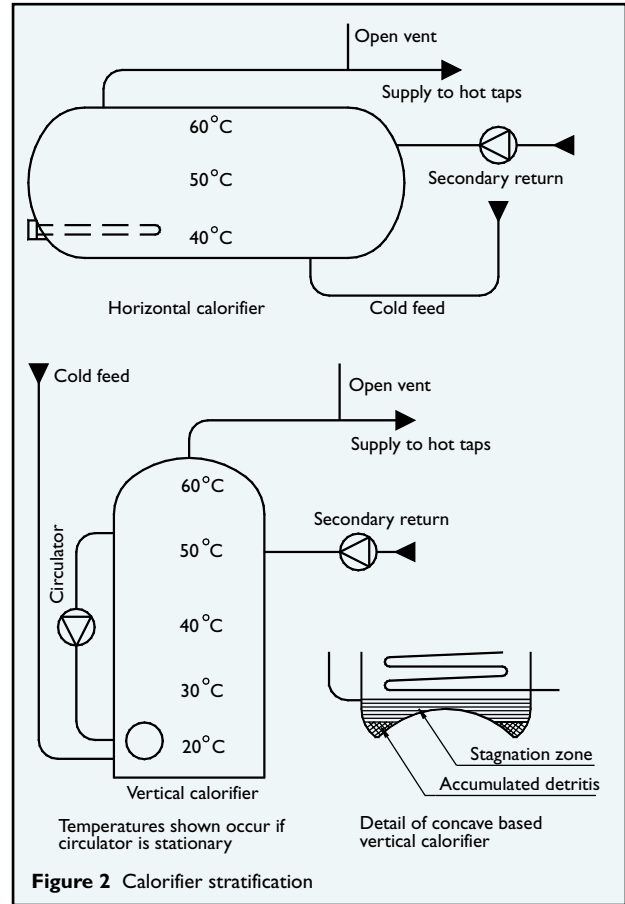
If the above are found: try to remove any redundant or occasionally used water fittings and blank off branches at the mains end of the run. If long dead-legs are present consider the use of secondary circulation.

Check the hot water storage calorifier and measure its stratification temperature, see Figure 2. If the bottom temperature is low consider fitting a circulator to allow pasteurisation by raising the temperature. Figure 3 shows the typical effect of running the circulator overnight. Measure the temperature of water leaving the calorifier and compare this to the thermostat setting.

Check the water temperature returning to the calorifier through any pumped secondary loop, if below 50°C consider ways to improve it.

Check the cold water storage cistern(s), it should comply with bylaw 30, see Figure 3. Measure up the cistern and estimate its water storage capacity, if this seems excessive, isolate or tie up the float operated valve and check the rate of drop of the water level. From this drop estimate the daily water consumption.

If the cistern(s) has a storage capacity



of several days consumption consider options to reduce the capacity to only one day, possibly by lowering the float operated valve and overflow pipe.

Prevention of contamination can be summarised as:

- keep the system clean;
- keep the water moving;
- keep it hot, above 55°C the microorganisms are killed; or,
- keep it cold, below 20°C they remain dormant.

Further information on the control of Legionellosis can be found in HSE guidelines HSG70 and CIBSE technical memorandum TM13.

Conclusion

Specifying and installing copper plumbing systems will go a long way to give peace of mind by affording a reduction in the risk of colonisation of the system by micro-organisms. Copper and a well designed and maintained system will help to minimise the risk to our customers from diseases that can be communicated through the water service. It just isn't worth the risk of specifying anything else.

