

Legionellosis. Hot and Cold Water Systems



The following screens will outline the control of Legionella with specific regard to hot and cold water systems.



Introduction

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- Historically, hot and cold water systems have been associated with more reported cases of legionnaires disease than the more publicised outbreaks associated with cooling towers. There have been fewer outbreaks in recent years but poorly maintained and badly designed systems still present a significant risk.
- We need to consider all elements of a water system (incoming water , storage vessels and outlets) and assess the risks of proliferation of Legionella and possible dissemination.
- A typical hot and cold water system is illustrated in a few slides time but before looking at this slide let us consider again the ideal growth conditions for Legionella and the causal chain for infection to occur.
- There are a wide variety of system designs including recirculating gravity systems , non-recirculating gravity systems and pressurised systems. You should consider the risks as presented and how they apply to your own unique systems.



Legionella Needs

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- 🌐 All organisms have their favored temperatures and Legionella is no exception
 - 20 to 45 °C is ideal for growth and reproduction
 - below 20 °C the rate of cell reproduction is significantly inhibited
 - at 45 to 50 °C cell multiplication is reduced but cells are still viable
 - above 60 °C cells start to die and the numbers fall rapidly

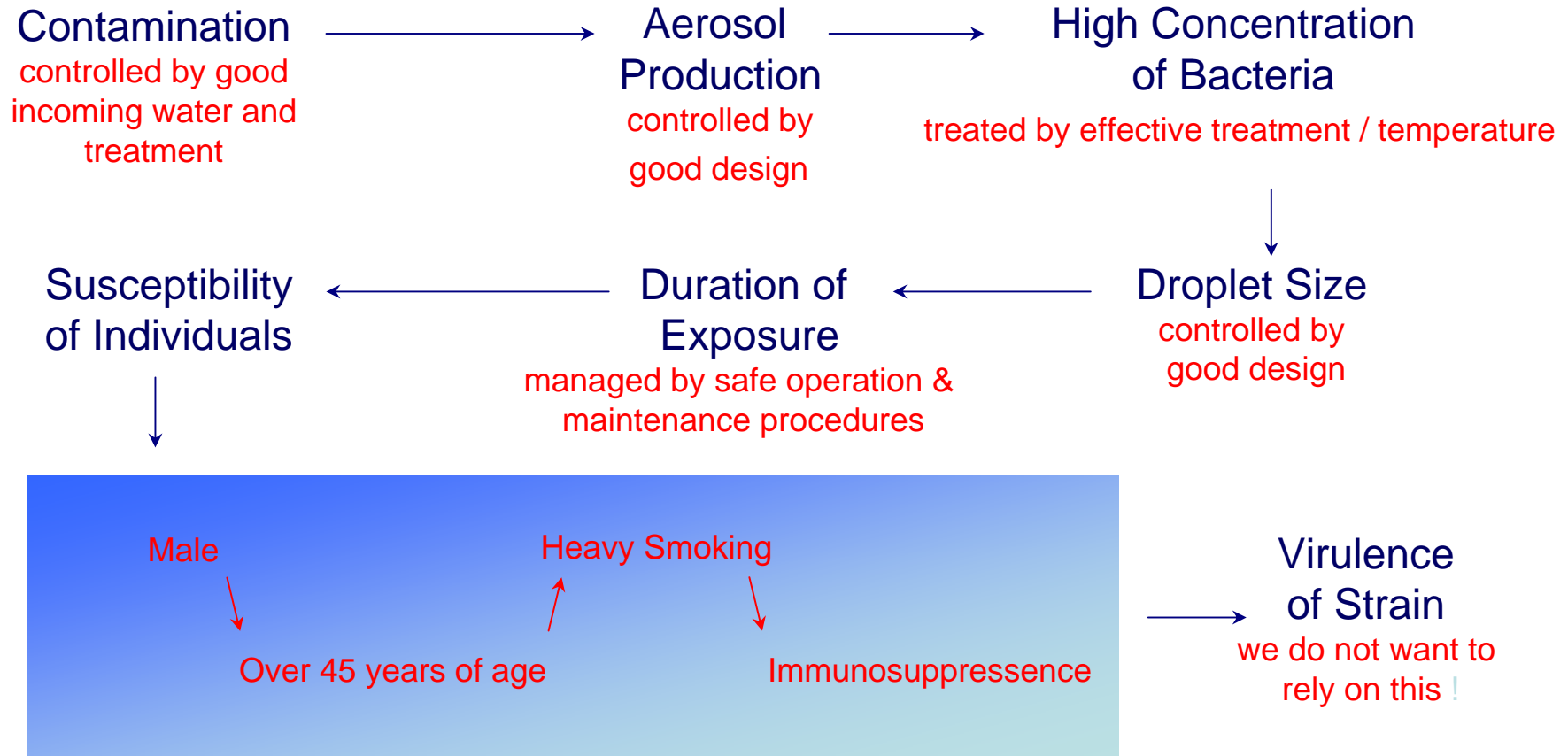
- 🌐 **Nutrients**
 - Legionella requires very specific nutrients, such as Iron. For this reason corrosion free systems will help reduce possible contamination and bacterial ‘hideouts’

- 🌐 **Habitats**
 - All microbes grow better if undisturbed and out of reach of biocides such as chlorine

- 🌐 **Oxygen**
 - Oxygen can enter water systems through a number of routes such as the make up ball valves to cold water storage tanks. Mains water is in itself sufficiently oxygenated to support microbial growth



Causal Chain





COSHH Primary Objective

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“The primary objective should be to avoid conditions which permit legionella bacteria to proliferate and to avoid creating a spray or aerosol. It may be possible to prevent the risk of exposure by, for example, using dry cooling plant, adiabatic cooling systems or point-of-use heaters (with minimal or no storage). Where this is impractical, the risk may be controlled by minimising the release of droplets and by ensuring water conditions prevent the proliferation of legionella bacteria.”

- ACoP L8



Just because there's always been a cold water storage cistern does not mean that one is actually necessary. An evaluation of removing the tank should at least be carried out before remedial works are carried out.



Incoming Water Supply

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- Water systems can be contaminated with Legionella from small numbers of the bacteria entering via the mains water that is taken on board vessels. This is unlikely but not impossible
- The water supply companies can only maintain wholesome water quality up to the point of supply. In this case, the offshore supply boat. Assumptions that treatment such as Chloramination are based on little, if any supporting evidence.
- ConocoPhillips** automatically dose water on bunkering. If residual protection was present, these doses would be an underestimate. Tests have shown this not to be the case. Furthermore a recent comparison between water treated on the platform for use and a supply boats tank ready for supply was three orders of magnitude higher on the boat that on the platform.
- Further growth of Legionella will only occur in the presence of higher temperatures such as heat gain in plant rooms and with nutrients and stagnation. In the absence of dosing, it is crucial that supply boats keep effective temperature control records.



Cold Water Systems

[Operation & Monitoring]

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- **Cold water should be below 20°C at all times**
- The incoming cold water temperature should be measured regularly
- Cold water storage tanks should be visually inspected **annually** and should be cleaned and disinfected if necessary and any faults rectified. This should also apply to supply boats
- Check nearest and furthest cold water outlet temperatures are below 20°C within 2 mins. flow on a **monthly** basis.
- A representative number of cold water outlets should also be tested on a rotational basis **once a year**.
- Install high use outlets upstream of lower use outlets to maintain flow.
- Review cold water circuit plans annually and remove redundant outlets



Hot Water Systems

[Design & Construction]

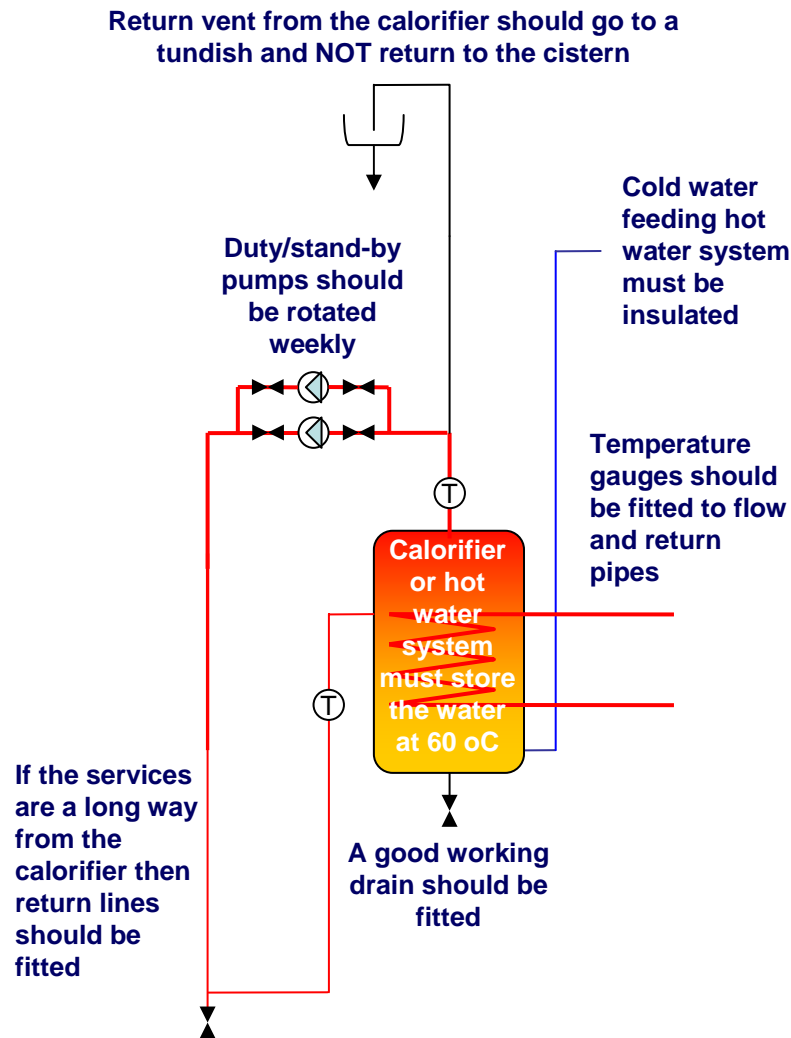
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- Hot water systems pose the greatest threat of legionellosis - consider 'point of use' water heaters as an alternative to stored hot water systems
- Calorifiers should be sized to meet normal daily requirements whilst maintaining flow temperatures of 60°C
- Multiple calorifiers should be connected in parallel
- All calorifiers should have an accessible drain valve at their lowest point
- Return temperatures should be >50°C and outlet temperatures should achieve 50°C within 1 minute
- Timer controlled shunt pumps should be considered if water temperatures cannot be maintained above 60°C throughout the calorifier at all times
- Hot water distribution pipes should be insulated and trace heating employed where necessary

Hot Water Systems

[Design & Construction]



Hot Water Systems



Hot Water Systems

[Operation & Monitoring]

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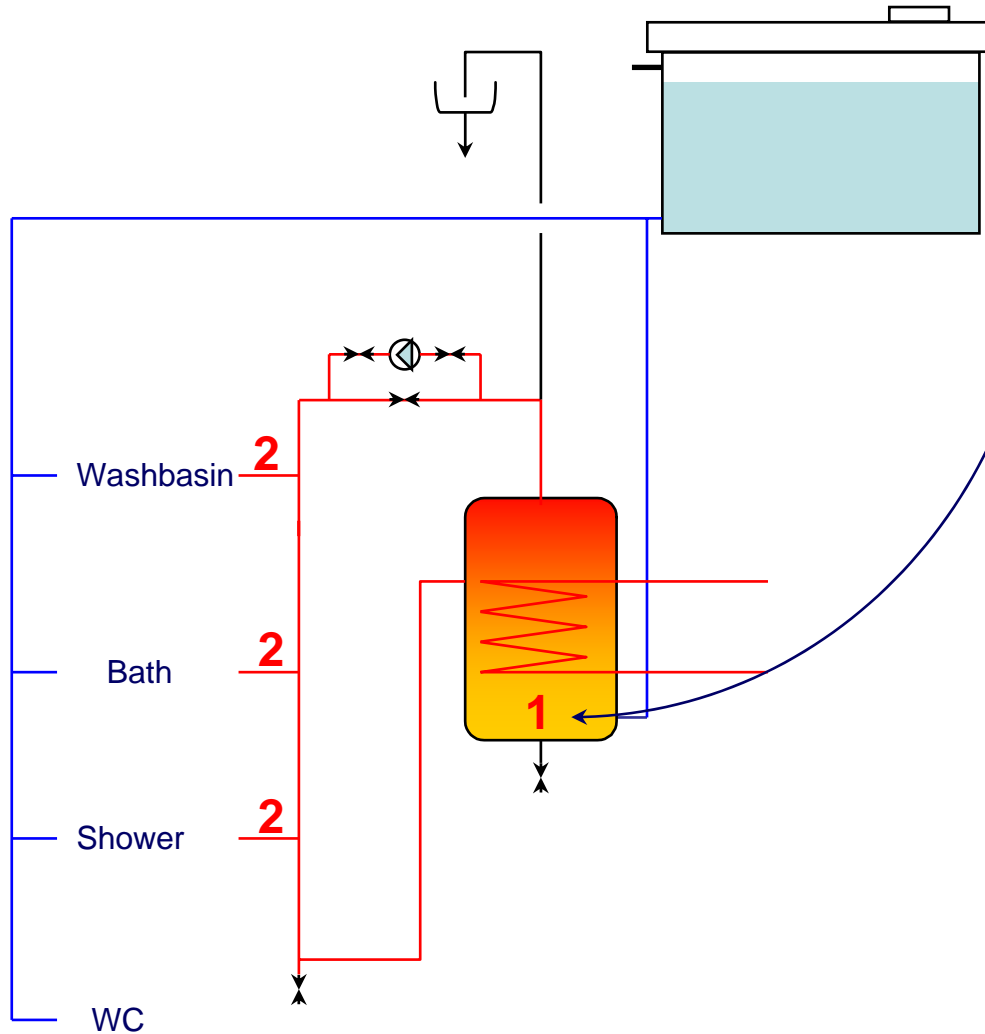
- Calorifiers on standby use or out of service for >7 days should be thermally disinfected at 60°C for on hour
- AVOID TEMPERATURES BETWEEN 20°C AND 50°C
- Store hot water >60°C and distribute >50°C
- Where scalding is a risk, use thermostatic mixing valves
- Remove dead-legs and cut back redundant outlets
- Infrequently used outlets and particularly showers, should be flushed **weekly** for several minutes to prevent stagnation
- Calorifiers should be drained and inspected **annually** . The system should then be cleaned and disinfected
- Flow and return temperatures should be logged **monthly**. Software Management Systems (S.M.S.) may be used to automate this task
- Check that the nearest and furthest hot water outlet temperatures are above 50°C within 1 min flow on a **monthly** basis and a representative number of other outlets **once a year**



Hot Water Systems

[Reason for Maintaining Temperature]

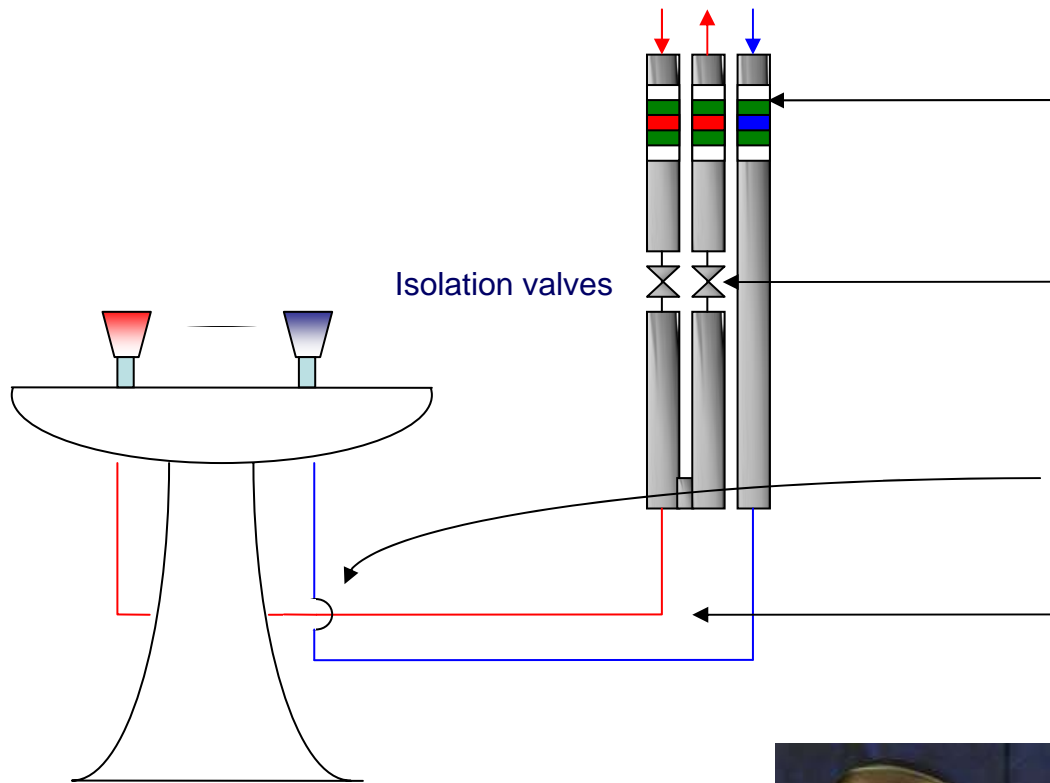
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- Stratification, scale and sediment can lead to a **primary** legionella reservoir establishing itself in the base of the calorifier.
- Should the temperature drop during a period of peak demand, legionella can escape into the main circuit where it can establish itself into the distribution legs as a **secondary** reservoir.
- Thermal disinfection of the calorifier now becomes ineffective as legionella in the distribution legs and can seed the rest of the system

Distribution Systems

[Design & Construction]



Ensure pipe work in the ducts is fully insulated and clearly identified.

Check valves to ensure good circulation and one is not acting as a dead leg.

Check that hot and cold pipes do not touch.

Ensure the hot pipe is above the cold pipe or that both are insulated individually to prevent thermal gain.

Outlets and especially aerosol producing ones like showers, must be checked and maintained.





Schematics

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- Schematics are required for complex water systems such as larger hot and cold water systems
- The schematics should contain all relevant associated plant and valves
- They should identify all associated pipe work, including blind ends and dead legs which should be highlighted
- The plans for both the hot and cold water circuits should be checked annually to ensure that they are up to date and updated if necessary



Cleaning & Disinfection

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- Systems should be cleaned and chemically or thermally disinfected, if the system has been altered or contaminated by maintenance activities, or after an outbreak or when inspection suggests it is necessary
- CHEMICAL DISINFECTION - (Usually to BS6700:1997) Chlorinate tank to 20-50 mg/l free chlorine and flush through *ALL* of the system and then leave to stand from one hour at 50 mg/l free chlorine or two hours at 20 mg/l depending on the initial concentration
1hr @ 50 mg/l or 2hrs @ 20 mg/l
- THERMAL DISINFECTION - Circulate water at >60°C for at least one hour flushing each outlet at full temperature for at least 5 minutes
- Chlorine Dioxide may also be used as a disinfectant and you should use the product as directed by your supplier
- Shower heads should be dismantled , cleaned, descaled and disinfected on a **Quarterly** basis
- Third party contractors should provide evidence of competency of personnel and a certificate of completion detailing the chemical or temperature levels monitored throughout any disinfection process



Record Keeping

[hot and cold water systems]



It does not matter what monitoring activities are carried out or how successful they are, if they are not logged in a specific logbook or computerised system, they are not deemed to have been done at all !

Record systems should include the following information:

- Details of the risk assessment
 - this must be current, including schematics and clearly defined lines of communication
- Details of precautionary measures implemented
 - this is the information detailed in the written scheme
- Monitoring, inspection, test and check results
 - a record of all results including signatures, dates and what was actioned when out of specification
 - a record of analyses (as appropriate)
 - an asset inspection record, including subsequent remedial actions
 - a record of cleaning and disinfection, including details of chlorination levels, temperatures (during pasteurisation) and certification
 - personnel training records

Risk assessments & control schemes should be kept whilst current & for 2 years after that period. Monitoring results should be retained for 5 years.



Record Keeping

- 🌐 You should be aware of the lines of communication
- 🌐 You must report all matters and results promptly
- 🌐 Data must be inserted into the appropriate record systems

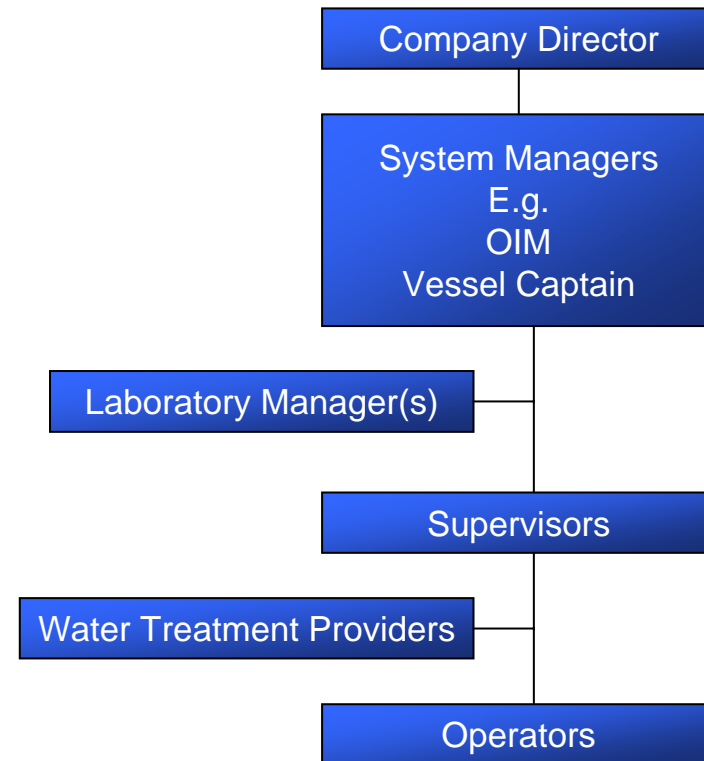
Remember

Outside contractors cannot take on your responsibility for health & safety, they can only act in an advisory capacity. They have a responsibility to give you best advice at all times.

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Example of
typical reporting
structure

