

Clostridium Perfringens – Guidance for Local Authorities

Description and Background

Clostridia are a group of anaerobic bacteria found in the environment and the gut of many warm blooded mammals, including a significant proportion of humans. *Clostridium perfringens* is the characteristic species, and the one tested for under the Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017. Its presence in drinking water indicates that there is faecal contamination of the supply.

Clostridia are spore forming and do not multiply in the water but spores recovered from water samples may be incubated under special conditions in the laboratory. All *Clostridia* spores are very resistant to harsh conditions, including disinfection chemicals and UV light, which means they can persist through the disinfection process and last for long periods in water supplies. This characteristic means that they are commonly used as indicators of historic faecal contamination, both before and after the disinfection process.

The size of *Clostridia* spores means that they can be a useful surrogate for *Cryptosporidium* and their presence on a system with a physical barrier process such as filtration may indicate that it has been less than effective and, consequently, the supply may be at risk from *Cryptosporidium*.

Health Significance

Clostridium perfringens can cause gastro-intestinal problems when consumed in large quantities. Low levels of *Clostridium* spores, in themselves, are unlikely to present a significant risk to healthy individuals directly from consuming contaminated drinking water. The main risk from this organism is where spores from contaminated drinking water are able to multiply in incorrectly cooked or stored foodstuffs. In these circumstances serious gastrointestinal disease can result.

The value of monitoring for *Clostridium perfringens* in drinking water comes from its role as an indicator of historic or intermittent faecal contamination and the effectiveness of any filtration process. Detections of this organism should serve as a trigger for a thorough investigation of the supply and any treatment process.

Where large numbers (more than one or two) *Clostridium perfringens* are detected in a sample, or if in any doubt, medical advice should be sought.

Risk Assessment and Monitoring

Sampling for *Clostridium perfringens* is only a statutory requirement for regulated supplies. The sample frequency is enhanced to check monitoring where the water source is, or could be, influenced by surface water. However, it may be useful to sample for it for exempt supplies if there are concerns about surface water infiltration and the consistent microbiological safety of the supply and a thorough investigation is required.

What if it fails?

Failures for *Clostridium perfringens* should trigger an investigation of the supply and any treatment. As any disinfection process is unlikely to be effective against this organism, its presence on its own (i.e. without coliforms or *E.coli*) should not be taken to indicate that disinfection has been compromised.

It should be remembered that where *Clostridium perfringens* is detected, there is also the potential for *Cryptosporidium* to be present, with potentially more serious implications for health.

Check the following:

- Potential contamination of the source, or infiltration of dirty water or sewage into raw water pipework;
- The effectiveness of any filtration or barrier process such as a membrane – if *Clostridium* is being detected, the process may be compromised; even if it is currently operational, is this consistent and could it have been compromised in the past?
- Is there any potential for contamination of the supply post-treatment, for example via ingress into pipework or tanks?

Options for resolving at source

Usual options for minimising the microbiological loading at source, for example by preventing animal access to the source.

Treatment

If there is no filtration / barrier process, the repeated detection of *Clostridium* in a supply could indicate a significant (and unmonitored) risk from *Cryptosporidium*. In order to fully protect the health of those consuming the supply, a filtration system capable of removing particles down to a size of less than 1µm (and, ideally, 0.5µm) should be installed. Such a barrier treatment process is also the only means of ensuring *Clostridium* spores are removed from the supply and that samples taken for this parameter are compliant with the regulations. A correctly installed and maintained UV treatment system offers protection from *Cryptosporidium*.

It is unlikely that simple sand filtration alone will consistently meet the required standard of filtration. Professional advice should be sought as to the most appropriate sort of filter to use on a specific supply. Options for effective treatment include :

- Cartridge filters. It will be necessary to install a number of these in series with descending levels of filtration down to less than 1µm. A suitable size for first stage in the filtration process will depend on the quality of the incoming water, but 20µm would be a typical value.
- Membrane treatment. Membranes of ultrafiltration and finer (i.e. UF, NF and RO) should be capable of removing *Clostridium* and *Cryptosporidium* from a supply. These will incur a significant installation and ongoing maintenance cost. Water losses from the reject stream may be an issue where water resources are tight.
- Mechanical filtration. These are filters consisting of fibres or other fixed materials that are automatically and repeatedly cleaned to maintain effectiveness. Various designs are available, with some being more appropriate than others in different

situations. Many automatically wash, meaning they can be a good option for larger supplies with a high amount of particulate in the water.

There is evidence that UV treatment may have some efficacy against *Clostridium* spores, however their high resistance means that the UV fluences required are likely to be far higher than for the other bacterial pathogens. Values of 95 mJ/cm² have been quoted in order to achieve 2 log removal (i.e. a 99% reduction), against UV fluences of 9 mJ/cm² for *E.coli*¹. Consequently, UV should only be considered for treatment of *Clostridium* with extreme caution, and expert advice should be sought to ensure any units are correctly sized and operated.

¹ Smeets , Rietveld, Hijnen , Medema, and Stenström 2006
Microrisk: Efficacy of Water Treatment Processes, European Union

Information for Owners and Users

FAQ sheet provided below

Clostridium Perfringens – What You Need to Know – FAQ



CDC / Don Stalons

My water supply has failed for *Clostridium perfringens* – what does that mean?

Clostridia are a group of bacteria that are very long lasting and resistant to harsh conditions, including the methods often used to disinfect water. When they are found in water samples it can be a sign that, although any disinfection process may be working effectively, the supply may have been contaminated in the past. It may also mean that any filtration process is not working effectively and the supply may be at risk from the organism known as *Cryptosporidium*, which can cause illness.

Can *Clostridium perfringens* make my family and me ill?

It's unlikely to cause illness if everyone is in good health and the bacteria are only present in small quantities in drinking water, but it does pose a significant health risk to those with impaired immune systems or if contaminated water is used to prepare food. These bacteria shouldn't be present in drinking water and an appropriate, effectively maintained treatment process should remove them.

I have a “regulated” supply that is failing for *Clostridium perfringens*. The council have told me they are considering serving an enforcement notice on me. What do I need to do?

Firstly examine your water supply system to understand whether it is possible to improve the protection at the source, for example from grazing animals, or whether there could be any locations where contamination can enter the water on its way to the point at which the water is consumed. Producing a Water Safety Plan or management plan for the supply may help you to do this. Flushing the system through may also prove helpful in case the contamination is historic. If you decide that treatment is necessary, you should take professional advice on installing a filtration system capable of removing particles down to 0.5 micrometre in size.

Can't I just add extra chlorine into the supply to make it pass?

Unfortunately *Clostridium* is resistant to chlorine and this will have little or no effect. Protection of the supply and adequate filtration are necessary.

I already have UV treatment. Why is my supply still failing?

Clostridium bacteria are far more resistant to UV light than other bacteria. It may be that your UV system is not sufficiently sized or powered to deactivate *Clostridium*. Poor maintenance and the presence of other substances such as iron or organic material in the water can also reduce the effectiveness of UV.

Is there any assistance with the expense of installing treatment?

The Scottish Government provides a grant of £800 per property to make improvements to a private supply. This money may be combined with grants for other properties on the same supply. Grants are administered by your local authority and you should contact the Environmental Health Department of the relevant authority for advice.

Further advice on the safe treatment of private water supplies and the Private Water Supply Grant Scheme may be obtained from the Environmental Health Department of your local authority.