

Microbial Treatment Options for Private Drinking Water Systems

Note:

Recommendations in this document are technical in nature and therefore intended to be used in conjunction with a water treatment consultant. All water treatment equipment, components and chemicals should be certified to National Sanitation Foundation (NSF) standards or equivalent.

When is microbial treatment recommended?

Microbial treatment of a private water system is recommended when a water system's source water is subject to significant microbial contamination. When water supplies are not continuously disinfected and are at risk of significant microbial contamination, it is recommended that the water not be consumed unless it is boiled first. Water supplies that are typically considered microbiologically unsafe or contaminated include:

- Surface water sources,
- Groundwater sources that are influenced by surface water sources or are considered at risk of microbiological contamination,
- Groundwater sources that show seasonal, consistent or intermittent presence of Total Coliform and / or E. coli after proper shock chlorination is conducted.

What is continuous disinfection?

Continuous disinfection is any reliable method of water treatment that consistently and deliberately ensures water is safe from microbial contamination. Disinfection kills or inactivates microbial contaminants (germs) that may be present in a water source and can be achieved by the addition of a water treatment process which may include Ultraviolet (UV) Light, Chlorine, or both. When considering which type of water disinfection system to install in your home it is important to consider the effectiveness and limitations of each process.

Conventional disinfection standards recommend the destruction or inactivation of waterborne disease causing viruses, bacteria and protozoa to acceptable public health levels.

What part of your water supply should be continuously disinfected?

All water that may be consumed by household members should be continuously disinfected. Exposure to harmful microbes may occur from ingesting a very small amount of contaminated water. Disinfect all water that will be used for drinking, food preparation, brushing teeth and bathing. Continuous disinfection treatment systems are typically installed at the point of entry inside the home, usually in a basement.

What is Ultraviolet (UV) light disinfection?

Disinfection using ultraviolet (UV) light is a method that uses short wavelength ultraviolet light to kill or inactivate almost all harmful bacteria, viruses and protozoa in drinking water. It does this by damaging the genetic code of the organism, which renders it harmless because it cannot replicate to the large numbers needed to make people sick. Only one microorganism is not effectively inactivated by UV light disinfection: Adenovirus. When using surface water or when using groundwater that is at risk of contamination with human feces, it is recommended that both UV light and chlorine disinfection be used for added protection against Adenovirus.

What is Chlorine disinfection?

Disinfection using chlorine is a process where chlorine is added to drinking water in order to kill or inactivate harmful bacteria and viruses. Chlorine disinfection tends to be much less effective against waterborne protozoa (e.g. Giardia or Cryptosporidium), therefore, when using this method of disinfection a critically important filtration step is required to remove these organisms.

The table on the following page provides a comparison between UV light disinfection and chlorine disinfection.

Continuous Disinfection Comparison: UV or Chlorine, which one should I choose for my private water system?

Treatment Consideration	UV	Chlorine	Comparison Notes
Effectively destroys viruses, bacteria, and protozoa?	Yes	No	<p>UV disinfection is effective against all major waterborne disease causing organisms. Where source water may be potentially contaminated by human feces it is recommended that an additional disinfection treatment such as chlorine is used for added protection against Adenovirus.</p> <p>Chlorine disinfection is effective against viruses and bacteria. It is not effective against protozoa microorganisms.</p>
<i>Failsafe included?</i>	Yes	No	<p>UV disinfection treatment units shut down (water is not produced) when it no longer is effectively treating the water.</p> <p>Chlorine disinfection has no shut down feature in a private water system. Frequent problems such as running out of chlorine, delivery line plugging, metering pump failure may occur without warning prior to using the water.</p>
<i>Additional contact time requirements?</i>	No	Yes	<p>UV disinfection contact time is incorporated inside the unit.</p> <p>Chlorine disinfection requires contact time in a household setting. This usually requires adding in a contact tank in a basement immediately after chlorine is injected to ensure chlorine disinfection is effective.</p>
<i>Dosage monitoring needed?</i>	No	Yes	<p>UV disinfection dosage monitoring is automatic with NSF A or equivalent systems. When dosage is not met, the system shuts off, although if maintenance schedules are followed this should not occur.</p> <p>Chlorine disinfection residuals need to be checked regularly. This requires significant operator knowledge about chlorine theory and requires a chlorine test kit with up to date reagents.</p>
<i>Requires pre-treatment?</i>	Usually	Yes	<p>UV disinfection only requires significant pre-treatment when UV transmittance is not met. Substances that reduce UV Transmittance may include tannin, turbidity, iron, manganese, hardness. Most come with a standard particle filter.</p> <p>Chlorine disinfection requires effective prefiltration to remove protozoa. Typical filtration includes a series of cartridge filters with a final absolute 1 micron cartridge filter. Additional pre-treatment may also be needed for effective operation.</p>
<i>Operator maintenance</i>	Low - High	High	<p>UV pre-treatment maintenance can be significant in some cases where source water quality is poor. Effort is dependant on type of pre-treatment equipment. UV unit requires bulb changing and sleeve cleaning as per manufacturer.</p> <p>Chlorine disinfection requires routine (daily to weekly) replacement of chlorine disinfectant. Preventative maintenance of the metering pump, metering line, dosing vat, pre treatment is typically needed. Chlorine pre-treatment can be significant in some cases where source water is poor. Operator will need to be knowledgeable about chlorine theory to effectively operate the system.</p>
<i>Cost of maintenance – disinfection unit only.</i>	Lower	Higher	<p>Considering just the disinfection component, UV disinfection units are generally less expensive to maintain than chlorine disinfection units. UV disinfection will require specified replacement bulbs and power to operate the bulb. Chlorine disinfection will require replacement filters, metering pump parts, power and frequent replacement of chlorine solution.</p>