How do I remove pathogenic organisms (bacteria, cysts, spores and viruses) from water?

Pathogenic organisms come in many shapes and sizes ranging from bacteria, cysts, spores, viruses, protozoa, and fungus. Some pathogens are actually beneficial to our environment while others are extremely dangerous such as fecal coliform bacteria, Legionella, cryptosporidium. One of the most common paths that pathogenic organisms utilize to propagate is water!

Decontaminate the Source *The first approach to a well or water supply contaminated with a pathogenic organism is to try and eliminate the source of the contamination. In cases where the contamination source is easily identified, this is simple. For example, if a storage tank has a dead animal in it, the animal would be removed and the water in the tank would be heavily chlorinated. The chlorinated water is then flushed into the distribution pipelines until chlorine is present throughout the system. The system is then flushed to remove all chlorine and a bacteria sample taken and analyzed to ensure the water is safe for consumption. If the source of contamination is not easily identified or is recurrent, one of the following methods of continuous pathogen removal should be implemented to insure safe water:*
Ultraviolet (UV) light is commonly used reduce health risks posed by waterborne pathogens. Ultraviolet light works by taking away the ability of the organisms to reproduce. The key factor in the ability of pathogenic organisms to harm a human is found in the organisms ability to quickly reproduce. A single bacterium can reproduce itself into hundreds of millions of bacteria in a few hours if left to their own devices! If that bacteria is sterile, it cannot reproduce, and will likely cause little to no harm.

Chlorin*e is a common disinfectant and is often used on small, medium and large scale unless you are in the winemaking industry. Chlorine is injected into the water to kill or neutralize pathogenic organisms. Chlorine is usually dosed into the water so that there is an excess available to ensure that the water stays free of pathogens as it travels the long distances through distribution pipes to the households. Chlorine systems require regular water testing and maintenance. Drawbacks to chlorine usage include taste and odor problems. It is a matter of preference, but we find some residential, food and beverage customers shy away from chlorine usage.*

Ozone *is another technology that is commonly used to disinfect water. Ozone is a heavy duty disinfectant that literally takes the pathogenic organisms and tears them apart. Ozone levels used for disinfection in water are not harmful for humans and ozone does not leave an aftertaste like chlorine. Ozone is typically generated at the water treatments site and does not require the continued purchase of chlorine or other chemicals. Ozone systems, however, do require regular maintenance. Residual ozone in your water has a relatively short half-life so it is not able to disinfect long distances of contaminated pipeline.*

Slow Sand Filtration *Slow Sand filtration is an age old technique that requires very little energy input and can produce clean water. Slow sand filtration systems require careful design and planning as well as regular basic maintenance. Slow sand filtration requires that water move through a sand bed with a depth of 24 to 36" under minimal head pressures. A layer forms on top of the slow sand filter that digests pathogenic organisms. The first few inches of the slow sand filter catch particulate matter. One of the drawbacks of slow sand filtration is the space requirement. A system capable of providing 10 Gallons per minute would take up 40 square feet. Slow sand filtration is a "green" technology that uses natural components from our environment and no electricity to produce pure clean water. This technology is often implemented in the humanitarian projects many of our staff work with overseas since construction and maintenance are simple and straight forward with excellent quality water.*

Diatomaceous Earth*. Diatomaceous Earth is a technology where water is forced through a fabric that is coated with diatomaceous earth. Since DE is extremely jagged on a microscopic level, it is an excellent filter that catches suspended solids that can harbor bacteria and slices/shreds them as they are caught. DE filters require regular maintenance and a dedicated pumping system but can have a small footprint for a relatively high volume output.*

There are a myriad of filtration designs, some of which utilize combinations of the above-mentioned technologies to ensure complete pathogen removal. Whichever technology(s) is utilized must be properly designed by a water professional and have regular maintenance performed in order to ensure that performance is ensured. Any specialty filtration technique, when improperly designed, installed or maintained can leave your water supply at risk of bacterial contamination. Systems that use of any type of pathogen removal should be closely monitored and regularly tested to ensure the safety of the consumer.