

Surface Water Filtration – Pathogen Removal

NONCOMMUNITY PUBLIC WATER SUPPLY PROGRAM

Regulatory Requirements

The Surface Water Treatment Rules within the federal Safe Drinking Water Act (SDWA) require all Public Water Systems (PWS) using surface water sources to treat for *Cryptosporidium*, *Giardia*, and viruses. Treatment for these pathogens requires a combination of filtration and disinfection. *Cryptosporidium* is highly resistant to chlorine disinfection and is smaller in size than *Giardia*. 99 percent (%), or 2-log, removal of *Cryptosporidium* by filtration is required. *Giardia* must be removed and/or inactivated in the amount of 99.9%, or 3-log, through either filtration or disinfection or a combination of the two. Similarly, 99.99%, or 4-log removal or inactivation of viruses must be accomplished, through either filtration or disinfection or a combination of the two.

The total log removal and/or inactivation credit for a contaminant in any given treatment process is cumulative, meaning the individual removal and inactivation credits granted to each element of a treatment system are added to determine the total credit for the system. For example, a system that employs chlorine disinfection and bag filtration might receive 1-log inactivation credit for *Giardia* from the disinfection process and 2-log removal credit for *Giardia* from the bag filter. Adding the two together, the system meets the requirement of 3-log removal and/or inactivation of *Giardia*.

Filtration Technologies

Cryptosporidium, *Giardia*, and viruses are microscopic pathogens. As such, their removal via filtration requires a very small pore size. Final filters that receive log removal credits at small systems include bag, cartridge, and membrane filters. These types of filters remove particles primarily through a sieving mechanism, similar to a pasta strainer. The smaller the holes, or pores, the smaller the particles the filter is capable of removing. Pore sizes are often reported in micrometers (μm), also referred to as microns. Generally speaking, pore sizes below 3 μm are required to remove *Cryptosporidium* and *Giardia* cysts, and pore sizes much less than 1 μm are required to remove viruses.

In addition to having small pore sizes, filters used for the removal of pathogens must undergo a testing and laboratory certification process to verify their ability to remove pathogens. This process results in a removal credit being granted to the filter specific to each class of pathogen. There are relatively few products on the market that have undergone this certification process and are also sized appropriately for small public water systems. Contact MDH for information on products that have undergone the required certification process and are appropriate for small systems.

A special type of media filter treatment system more common in large facilities and municipalities involves the use of a coagulant and a set of large, gravity-driven sand filters. These filtration systems are referred to as conventional or direct filtration depending on the

PATHOGEN REMOVAL

treatment steps included. The removal mechanisms for these types of filtration systems are more reliant on settling and adsorption than sieving. Instead of a certification process, conventional and direct filtration processes are granted pathogen removal credit based on design and operating criteria that were determined through direct measurement of performance at a large number of treatment systems.

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