

Surface Water Filtration – Pre-Treatment

NONCOMMUNITY PUBLIC WATER SUPPLY PROGRAM

Purpose of Pre-Treatment

Surface water sources usually contain large amounts of particulate material, ranging in size from visible pieces of sediment to microscopic organisms. A primary objective of surface water treatment is the removal of particles, including organisms such as *Giardia* and *Cryptosporidium*.

Particle removal is most commonly achieved through filtration, the process of separating solids from a fluid. The size of the pores in a filter is one element that determines the size of particle that can be removed. For the removal of pathogenic organisms, a very small pore size (<2 microns) is required. Larger sediment can be removed with much larger pore sizes. While filters with small pores are capable of removing more material, this means that more material will build up on the upstream side, causing the filter to clog, or foul, faster. Because the manufacturing of a filter with small, uniform pores requires greater quality control, they are also more expensive than filters with larger and nonuniform pore sizes. As such, surface water filtration is usually conducted in a stepwise manner, with a series of filters designed to first remove large particles and gradually move down to the smallest particles. This progression saves both money and maintenance efforts by maximizing the lifespan and effectiveness of each filter in the series.

Types of Filtration

There are numerous types of filters that can be used for pre-treatment, with each having unique characteristics.

Media filters are filters that are composed of a tank filled with granular material. The media can be composed of sand, gravel, anthracite, or a proprietary material such as Macrolite. These filters are designed to be backwashed regularly, avoiding the need for frequent media replacement. Straining and adsorption are two important mechanisms with these filters.

Bag Filters are disposable fabric filters that are placed inside a housing fitted for a particular filter. Bag filters look like a giant sock and come in a wide range of pore sizes. Water passes from the inside of the bag to the outside. Bag filters are convenient and easy to use but may clog frequently and can tear or rupture if not handled properly.

Cartridge Filters are another form of disposable filter and are perhaps the most widely available. Like bag filters, they are placed into a fitted housing, but they are made of a rigid, pleated material.

What Type of Pre-Filtration Should I Install?

The type and amount of pre-filtration will depend on the quality of the surface water source and the type of final filter used. Certain systems may not need any pre-filtration if the water source is of high quality or if the facility does not use very much water. However, if a particular lake is known to have high turbidity or if the intake structure is located on the downwind side of a lake during storms, greater level of pre-filtration may be needed. It is best to optimize the location of the intake structure to minimize the amount of treatment

PRE-TREATMENT

needed. In any case, pre-filtration should be installed that is capable of handling the worst expected water quality conditions. If the facility uses a large quantity of water, greater levels of pre-filtration may also be needed.

For small facilities, pressure media filters, such as sand, anthracite, or Macrolite filters, are generally sufficient to handle poor water quality conditions and will effectively remove the largest particles. They need to be sized appropriately to operate effectively; the flow through the sand filters should not exceed three gallons per minute per square foot of media surface area.

Bag and cartridge filters can provide additional removal of finer particles downstream of pressure media filters, or they may be used as stand-alone pre-filtration on good quality water sources. Multiple filters may be placed in series beginning with the largest pore size and incrementally getting smaller.

Finally, the type of pre-filtration may differ based on the type of final filter that is installed. Backwashable membrane filters, for instance, may be able to handle high particulate loads because they can be cleaned regularly, and fouling can be reversed. More comprehensive pre-treatment may be needed for expensive, small-pore size bag filters which are known to plug up rapidly and cannot be cleaned.

Chemical Pre-Treatment

Large treatment facilities and membrane treatment facilities may opt to use chemical coagulants as part of their pre-treatment process. These coagulants help reduce the organic and particulate constituents of the water supply by forcing them to settle out

as a precipitate that can then be filtered. If coagulants are used, jar-testing should be conducted prior to installation to verify the most effective type and dosage of coagulant. Jar-testing should be conducted periodically throughout the year under different conditions so that modifications to the dosage can be made as needed.

Minnesota Department of Health
Noncommunity Public Water Supply Unit
PO Box 64975
St. Paul, MN 55164-0975
651-201-4700
health.drinking_water@state.mn.us
www.health.state.mn.us

02/12/24

To obtain this information in a different format, call:
651-201-4700