Filter Backwash

Tips for surface water sources with rapid rate filtration

Rapid rate filter at Longview being backwashed following an inspection.

Filter backwash is integral to the operation of a rapid rate filter. Properly operated backwash processes can significantly reduce the risk that disease-causing organisms will enter the water distribution system.

During normal operations, a clean filter accumulates and stores contaminants it captures from the water primarily by attachment or adhesion that occurs when particles stick to the surface of filter grains or previously deposited material.

As this process continues, the open spaces between the grains of the filter gradually fill in and there is an increased resistance to flow, which is measured as filter headloss. Eventually, if filters are not backwashed, filter breakthrough occurs – sending contaminants into the water distribution system.

Filters should be backwashed before breakthrough occurs to avoid unnecessary health risk to your customers.

The purpose of backwashing is to clean the filters. This prevents filter breakthrough and prepares the filter media physically and chemically to begin filtering again.

Efficient backwashing removes the captured particles from the filter without losing the anthracite or sand media. In actual practice, it is normal to lose up to an inch of media per year during backwashing. If backwash rates are too high, significantly more media could vanish, and filter performance can be compromised. In either case, it is important to replace any missing media during your annual filter inspection and maintenance check!

Generally, the most effective backwashing results when there is adequate expansion of the filter bed. This is caused by an upward flow of water fluidizing the media bed, increasing the space between the media grains and causing the media to occupy more volume. Fluidization promotes collisions of the media grains, which scours away surface deposits.

If the filter is not adequately cleaned during backwashes, successive runs may result in a build-up of dirt and coagulant deposits, leading to problems such as mud-ball formation and development of cracks or fissures in the media. Filter cracking, in turn, promotes short-circuiting through the filter, and reduces the effectiveness of the filtration barrier.

Effective backwashing depends on achieving a balance in factors. What works at one facility may not be optimal for another. With the following guidelines in mind, you can modify your standard backwashing procedure to help you produce the safest water you can for your community.

Guidelines for filter backwashing

Bed expansion. In most cases, the optimal backwash flow rate will result in at least a 20 percent expansion of the filter bed. For example, if your filter has 32-inches of combined anthracite or sand media, the expanded depth of the media should be at least 38-inches. Information on an effective low-cost tool that can be made for monitoring bed expansion is on the Pennsylvania Department of Environmental Protection's Web site at http://www.dep.state.pa.us/dep/deputate/watermgt/WSM/WSM_DWM/FPPE/Filter_Bed_Expansion.pdf

Determining optimal backwash flow rate. The key factors effecting expansion of the filter bed are backwash flow rate and the thickness, or viscosity, of the water. For a given flow rate, colder water will result in greater expansion of the filter bed because it is more viscous than warmer water. Since water viscosity varies significantly with the normal range of seasonal temperatures encountered at many water treatment plants, backwash flow rates should be adjusted as temperatures change throughout the year to ensure correct bed expansion.

When temperatures go up, backwash flow rates need to go up, too. And, when temperatures go down, flow rates need to go down. For more information on this topic, visit the Ohio State Environmental Protection Agency's Web site at http://www.epa.state.oh.us/ddagw/Documents/OAWWA%20Filter%20Assessment%20Articles.pdf

Auxiliary scouring. Air scour and hydraulic surface washers significantly improve backwashing performance. If you are having problems with mudball formation, these tools offer a good potential solution, and should be evaluated.

How clean is clean enough? Over-washing, which is backwashing for an extended period, actually increases the time the filter needs to ripen when returning to service. One way to determine when to terminate backwashing is to look at the turbidity of the waste washwater. 10 NTU is a generally accepted value for termination of backwashing. After backwashing, filtered water should be sent to waste until the turbidity drops below 0.1 NTU.