Enhancing the Performance of Multimedia Filters

There are a number of granular filter configurations, including pressure systems, gravity systems, vertical and horizontal vessels, single, dual and multimedia filters. For most applications, turbidity can be reduced to sufficiently low levels by multimedia filters. Multimedia filters have a unique filtering ability due to the reverse grading of the media. With the coarsest layer at the top of the bed and the finest layer on the bottom, the filter can retain finer particles and has a greater solids holding capacity than other types of sediment filters. However, for critical applications such as pretreatment to reverse osmosis systems, special considerations may be required.

Due to the variations in the types and chemistries of contaminants, pilot studies are generally required for an equipment manufacturer to offer a performance guarantee for a filtration system. While many waters can be treated effectively by simple filtration, the addition of a small amount of coagulant (properly dosed) will substantially reduce turbidity leakage. When this is done, effective cleaning of the media frequently requires additional steps and associated hardware to achieve optimum performance from the filter.

When treating water supplies containing high levels of silt, or when a coagulant aid is fed upstream of the filter, there exists the potential for the formation of “mud balls” in the media. Surface wash and air scour systems have been used successfully to remove strongly attached particles from the media. These particles are what cause mud balls. Surface wash cleans the top portion of the media bed where mud balls begin to form. The most common design for surface wash uses a hub-radial or header-lateral distributor located just above the media bed. The orifices in the laterals are oriented to direct flow to the media surface to assist in breaking up accumulated particles at the top of the bed prior to backwashing.

Air scour systems inject air directly into the media bed, relying on the turbulence created by the combined action of air and water to scrub the media and release the accumulated particles so they can be backwashed out. The air scour system uses a stainless steel header-lateral distributor located in the media bed, along with structural supports, plus additional hardware, so the cost is more significant.

To retrofit a filter in the field to incorporate either of these techniques, the following items need to be considered:

- Additional nozzles for air/water injection
- Additional internal distributors and associated supports
- Re-certification of ASME Code vessels (when nozzles and supports are added)

- Lining repair Additional piping and valves Flow meter(s)
- Control system upgrades to accommodate the additional process steps

Several manufacturers also offer an “air-assisted backwash”, which injects air and water simultaneously during the backwash step. The overall backwash volume is the same; however, half of the flow is water and the other half is air. This technique can be useful in applications where the backwash water volume is limited, and does not require as much additional hardware as a full air scour design.

In many cases, the performance of a filter system can be improved by upgrading the internal distribution system(s). Many of the older generation filters (circa 1950-1970) use fairly unsophisticated distributor designs, which by their nature cannot provide the uniform flow necessary for service and backwash collection. Upgrading of the filter’s internals can often be a cost-effective approach to field retrofit a filtration system without major modifications to the pressure vessels themselves.