By Ken Bridges

Prolonging Plant Life

Cost-conscious water plant rehabilitation and system upgrades

Fiscal budgets continue to tighten in these rough times. Money for water plant expansions is often postponed or cancelled, while demands for increased water quantities and quality never seem to end. Rather than expanding plants or building new ones, many communities are rehabilitating or upgrading existing plants and filters to meet water demands.

Often, proper rehabilitation and system upgrades can extend the useful life of these plants for another 20 years.

Many existing water plants are able to increase output and improve quality by performing system upgrades. Water sources vary as much as the communities they serve; thus, each individual plant upgrade must be reviewed as a unique opportunity. Proper plant operations—and the operators that keep those plants running—are the best resource available to optimize output.

Although many feel that water technology has become a science, there are plant supervisors using creative methods to optimize their plants' performance on a daily basis. Giving qualified operations staff the tools to carry out preventative maintenance and proactive rehabilitation of equipment is essential to a plant's longevity. Maintaining structural integrity of the filters is a matter of necessity rather than convenience.

When filters need rehabilitation or upgrades, often the filters and their components have to be taken offline for a period of time in order for these changes to be performed. Plants that do not have the luxury of low-demand seasons or alternate water sources may need to rely on temporary mobile facilities to produce water during filter rehabilitation. These mobile systems can be housed in a trailer, as shown in Figure 1. The temporary plants can be mobilized and hooked up to the system, if necessary, to produce water for the community. This allows bypassing the existing water system for a period of time while it is rehabilitated.

Utilizing qualified engineers, contractors and reliable vendors is essential to ensure that the work performed will endure in the foreseeable future. As an example, many steel structures or equipment have not been properly cared for over the years, and the inevitable rust has deteriorated their integrity. An example of this is shown in Figure 2. A contractor who understands and has had experience dealing with corrosion and its repair is essential to proper rehabilitation. Often, deteriorated plants can be restored to a useful life with proper rehabilitation.

The decision to rehabilitate a steel structure depends heavily on the integrity of the steel plate. Even though many steel tanks have not received proper preventative maintenance and are severely rusted, ultrasonic thickness testing meters are available to aid in determining the structural worthiness of the steel. In many cases, steel structures that aesthetically appear to be in very poor condition can be brought back to life with proper surface conditioning and repainting.

Controls

The most popular upgrade to aging systems has been replacing the original control panel. Upgrading from old cams, timers or MS DOS-supported programmable logic controllers (PLCs) to newer PLCs with a human-machine interface (HMI), as seen in Figure 3, allows the operator flexibility in programming filter functions that optimize the filtration cycles.

With updated PLCs and controls, the qualified operator has the ability to perform design-of-experiment (DOE) testing to optimize filter function, rather than having to rely on timed cycles or preset limits. New control systems turn filter function optimization from chaotic trial and error to a user-friendly optimization schedule. Adding a SCADA interface adds to the ease of remotely manipulating filter functions and data acquisition. It also allows filter operation, alarm monitoring and filter data and history accumulation to be accomplished remotely.

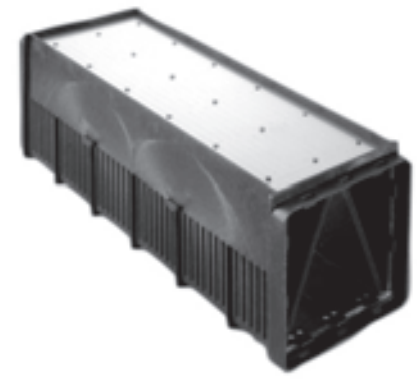

Figure 4. Direct Media Retention Underdrain

Filters

Reconditioning the filter section not only allows the operating life to be extended, but it may also optimize or increase filter performance. Because filter backwash is a major source of wasted effluent water and filter production time, optimizing the filter function to increase efficiency has become a key focus. Rather than simply extending the time of the filter cycle between backwashes, the cycle can be set to trigger on headloss or turbidity, which also aids in optimizing filter performance.

The addition of an air scour sequence to the filter backwash function greatly increases the cleaning potential of the filter bed during backwash. Air scour through direct retention underdrains has several advantages. Direct media retention underdrains, as illustrated in Figure 4, eliminate the need for support gravel that encases "pipe-and-lateral" underdrain designs; therefore, only the media (anthracite, sand and garnet) needed directly for filtration is used.

Air is introduced by a high-volume, low-pressure blower through the underdrain to aid in the fluidization of the media during backwash. This method is most efficient in cleaning the media during backwash, resulting in longer filter runs. Thus, there is less waste and more plant productivity.

Once filter operation is maximized, working to optimize the clarification and settling functions can potentially reduce the turbidity that is entering the filter bed section, thus extending the time between backwashes.

Clarifiers

Clarifiers are often the first filtration step in significantly reducing turbidity prior to final filtration stages. Retrofitting or rehabilitating the clarifier section with improved, more efficient or cleaner media reduces the amount of the turbidity passed on to the filter bed. Improving clarifier efficiency and eliminating clarifier disruptions such as turbidity breakthrough significantly reduces the need to

Figure 1. Mobile Operating System Trailers

Figure 2. Rust Deterioration of a Steel Tank

Figure 3. Human-Machine Interface Panels

Figure 5. Barrier SUN UV System

backwash the filter bed, thus improving filtration operation and efficiency.

For flashy water sources that frequently see high turbidity spikes, adding tube settlers prior to the clarifiers eliminates the operational strain on the clarifiers, thereby reducing system waste. Many facilities are adding tube settlers to existing basins or adding new tube settling equipment prior to the clarifiers to reduce water turbidity early in the overall filtration process.

Filter-to-Waste

Adding a filter-to-waste sequence after the filter backwash cycle reduces the amount of turbidity that enters the clearwell directly after a backwash. Directing effluent discharges temporarily to waste until optimal turbidity levels are achieved prevents turbidity spikes from entering the clearwell. It also reduces the possibility that very high turbidity spikes from filter malfunction will enter the clearwell.

UV

Ultraviolet (UV) disinfection lamps, as shown in Figure 5, introduced into the filter effluent stream are very effective in disinfecting the water and helping to control the level of disinfection byproducts in the distribution system. Unfortunately, these retrofits are often very difficult to install.

This is important because filter effluent piping efficiently discharges directly to clearwells. In addition, many facilities have limited space available between the end of the filter and external facility walls. Because of this, retrofitting UV mechanisms to effluent discharge piping becomes a challenge. Complex piping changes are typically needed to install the UV mechanism. This is compounded more if system redundancy is required.

Quality & Efficiency

Retrofits, rehabilitation or upgrades to existing facilities range from very simple adjustments to major system reconfigurations. Making sure that qualified engineers, contractors and vendors are involved early in the planning will allow for a smooth transition. The goal is to end up with the highest-quality water delivered from a highly efficient facility. WWD

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