



Filtration Is Key To Efficient Wastewater Management

*By: Jim Lauria
Amiad Filtration Systems
Oxnard, CA*

Wastewater can be defined and handled in any number of ways, from industrial process water slated for return to the environment, to reclaimed irrigation tailwater used to water crops downstream, to state-of-the-art toilet-to-tap projects. But no matter what the source and what the use of the water, 21st century filtration technology will play a vital role in ensuring efficient wastewater management – and it will be increasingly important as water scarcity and regulatory pressure increase demands on wastewater managers.

As with any source water, there are two key questions to ask when it comes to filtering wastewater. What's upstream? What's downstream?

From upstream, of course, come the particles that must be removed. Municipal and livestock waste are likely to primarily contain organic particles, which tend to be deformable and thus may be difficult to capture with screens and very expensive to filter with cartridges or bags. In those cases, settling tanks and coagulants tend to be both effective and cost-efficient methods of removal. Industrial wastewater could contain a host of solids, both suspended and dissolved. In all cases, a particle size distribution (PSD) test is a very useful tool in determining the degree of filtration required and the filtration technology that could be most effective.

Just as important as the contents of the water is the intended use of the treated water. Water destined for irrigating non-food crops needs only to be filtered well enough to prevent plugging of spray nozzles or drip tape. Water that will be returned to the environment is governed by state regulations such as California's Title 22, which stipulates the combination of total suspended solids (TSS) removal and disinfection that must be performed in order for the water to be discharged. And water intended for food crops or human consumption must clearly be disinfected to remove pathogens – using systems that must in turn be protected from solids by a good filtration system upstream.

Injection Well Disposal

Wastewater disposal through deep injection wells appears to be a simple tactic to managing large volumes of wastewater – the water ends up hundreds of feet below the ground, and the earth acts as a vast sand media filter to remove contaminants at its own pace.

But managing costly wells requires careful attention to the contents of the wastewater. For example, a facility in Louisiana is excavating salt caverns to create a storage facility for liquid natural gas by pumping fresh water into the subsurface salt deposit, dissolving the salt, pumping up the brine solution, and disposing of the brine by deep well injection.

The brine must first be thoroughly filtered in order to prevent plugging of the rock strata receiving the wastewater, which is called the receiving formation. If sediments with the brine fill the subsurface cracks and pores in the receiving formation, productivity of the injection well system suffers dramatically. As the



well plugs severely, the company is forced to conduct an acid treatment – at \$7,000 per well – or a \$150,000-per-well process of refracturing the formation.

Instead, the company focuses its efforts on good water management on the surface. To effectively filter sand, silt, clay and metal oxides from its 8,000 gallon-per-minute (gpm) flow, it installed a battery of 50-micron automatic self-cleaning screen filters for primary filtration, followed by automatic self-cleaning microfiber filters that deliver filtration to the 7-micron level.

The automatic screen filters initiate a self-cleaning process when a target pressure differential is reached between the inlet and outlet sides of the filter. An exhaust valve is opened and water rushes from inside the filter to the lower atmospheric pressure of the exhaust system, removing filter cake from the screen and carrying it out of the system. A set of suction nozzles focuses that back flush on less than one square inch of the screen at a time, ensuring thorough cleaning. Mounted on a scanner that rotates in a spiral pattern, the nozzles cover the entire screen in a 25-to-40-second cleaning cycle. The entire process happens automatically, without interrupting the filtration process.

The automatic microfiber filtration system delivers self-cleaning action at a finer level of filtration. Particles are captured in polyester fibers that are tightly wound around plastic cores. When a pressure differential is reached between the inlet and outlet sides of the system, a high-powered stream of cleaning water is directed at the specially patterned plastic core, and deflected back through the fibers, dislodging the solids.

The company originally used 15-micron bag filters and 15-micron cartridge filters after the screen units, but replaced them with the thread filters to eliminate the materials cost, labor and disposal of bags and cartridges. The result has been savings of \$50,000 per day – ensuring a return on investment in just a few months, and a significant ROE, or Return on Environment.

Protecting Irrigation Systems

Irrigation can be an extremely beneficial use of wastewater, and as competition for diminishing supplies increases, we can expect to see more industrial and municipal wastewater put to use growing crops. Irrigation is an outlet in which downstream conditions have a tremendous impact on filtration choices. Running dairy manure through a high-pressure, high-volume “big gun” nozzle in a hayfield may just require a simple basket filter to keep debris out of the system. On the opposite extreme, the fine emitters of drip irrigation systems demand extremely low levels of TSS – and if they are watering crops for human consumption, may need to carry disinfected water.

Sand media filters are often used in irrigation installations, and their centuries-old technology has proven itself time and again. However, where disposal of back flush water is a challenge – such as in an increasing number of agricultural regions where tailwater is highly regulated – the low back flush volume of automatic self-cleaning screen filters has proven to be a significant benefit. Sand media filters also have a very large physical footprint, which can be a disadvantage where space is valuable or tight.

Whatever the technology, high reliability and low labor demand are especially important in irrigation settings. Growing plants have little patience for downed systems, and many farms, golf courses and commercial landscape installations are too large to commit substantial labor resources to babysitting filters that require monitoring, manual cleaning, or cartridge replacement.

Safeguarding Disinfection Systems

Where water is recycled for uses that require the removal of pathogens and constituents that can contribute off-flavors or colors, membranes, chemicals or UV disinfection are vital. And upstream of those systems, pre-filtration plays an important role in improving their efficiency and protecting them from TSS.



In the case of membranes, pre-filtration can prevent a host of problems, from sediment build-up to the introduction of scale, bacteria or even mollusk larvae and other biological contaminants. That reduces the need for costly, chemical-intensive and membrane-degrading clean-out procedures, and keeps the membranes operating at higher efficiencies.

Multi-stage filtration systems are gaining ground in pre-filtration installations. One or two stages of filtration of larger particles can reduce the pressure on the polishing stage, in turn minimizing the spend on cartridges, bags or chemicals. Rather than relying on a costly fine cartridge filter to perform primary filtration, a multi-stage system allows it to focus on the smallest particles. Similarly, thorough removal of TSS allows wastewater managers to optimize their use of disinfection chemicals by removing particles that could tie up valuable product.

In UV systems, thorough pre-filtration has two benefits. Sediment can create shadows that could allow pathogens to escape the full force of the UV light. It can also coat the lens of the system, reducing the intensity of the beams reaching the water.

The combination of a 20-micron automatic self-cleaning microfiber filter and a disinfection system such as an approved UV unit was recently approved by the State of California under its Title 22 water quality regulations, which govern the treatment of wastewater for environmental discharge. Such regulations will grow increasingly common as states codify practices for point source discharge – and good filtration choices will become ever more vital.

Meter Minders

As water reuse systems gain popularity and water sources continue to dwindle, users and regulatory entities will be sure to want to measure the use of wastewater. Like irrigation nozzles or industrial valves – which are commonly protected by filtration systems – water meters are prone to fouling and damage by suspended sediment.

Small, self-cleaning screen filtration systems before meters have proven themselves to be highly effective and extremely useful in keeping meters running reliably.

Clearly, the uses of filtration continue to expand, and the options available continue to grow. As wastewater use and re-use become even more widely adopted, filtration will play a key role in helping water managers meet society's need for managed wastewater, and as discharge is increasingly scrutinized, filtration will help protect the environment and the industries responsible for managing our most precious resource.

About the Author

Jim Lauria is vice president of sales & marketing for Amiad Filtration Systems, a manufacturer of clean technology water filtration systems for agricultural, industrial and municipal applications. He has over thirty years of experience in liquid/solid separation processes, water treatment and resource optimization. Prior to joining Amiad, Jim owned Team Chemistry LLC, a consultancy that focused on developing new business opportunities for clients' water treatment technologies. Before that he was president of an \$80M filtration media company and during that time provided peer review for the World Health Organization's publication on drinking water treatment. He also led a team in partnership with a university that pioneered arsenic reduction in drinking water. He holds a Bachelor of Chemical Engineering degree from Manhattan College.