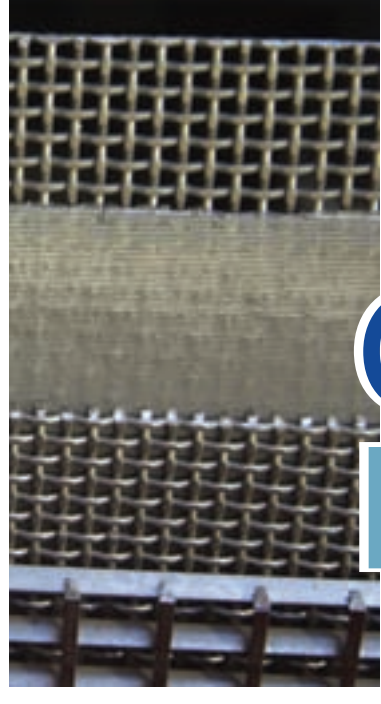

Counting Every Drop

Automatic self-cleaning screen filters give an Arizona RO system a boost

By Jim Lauria

Reverse osmosis (RO) technology allowed the city of Goodyear, Ariz., to tap brackish groundwater to supply a thirsty, growing city. It soon became apparent, however, that adding a bank of automatic screen filters to pretreat the well water helped dramatically reduce costs and boost the system's efficiency.

ARTICLE SUMMARY

Challenge: The growing city of Goodyear, Ariz., faced drought conditions and well closings. A brackish well saved the city, but its RO systems fouled quickly.

Solution: City officials selected automatic, self-cleaning, low-water-waste screen filters to capture particles larger than 5 microns.

Conclusion: The filters minimized backflush, reduced RO skid operating costs and increased water recovery, helping Goodyear stave off water emergencies and provide residents with reliable drinking water.

Adding automatic self-cleaning screen filters to a brackish well desalination system dramatically reduced cartridge and labor costs for the city. ***(Photo courtesy of Keith Edwards, city of Goodyear.)***

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RO, desalination, groundwater, screen filters

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In 2003, Goodyear's leaders were facing a water emergency. Nine years of drought parched the area, while an 18% annual growth rate challenged groundwater supplies. To make matters worse, one of the city's wells was closed due to contamination from a nearby Superfund site, and three more were taken offline because of increasing levels of nitrates.

Desalinating Groundwater

A brackish well saved the city from declaring an emergency and placing a moratorium on construction, but it required four skid-mounted RO systems—each capable of producing 300 gal per minute (gpm)—to desalinate the salt-laden water before blending it with water from other wells.

In addition to salts in the new well water, there was sediment—enough to push the silt density index of the feedwater to more than 3. The 1-micron wound cartridge filters protecting the RO membranes fouled quickly, requiring replacement every 10 days, and the membranes were clogging frequently. The cartridges could not keep up with the sediment load, and the costs were quickly mounting. The annual cost approached $29,000 in new cartridges alone, plus the cost of labor and disposal.

Goodyear's Public Works and Water Resources Department (PWWRD) realized it would quickly pay off to protect not only the membranes but also the cartridge filters. The first step was to place 5-micron cartridges upstream, which extended the interval between changes to 30 days. Costs, though, remained high.

The city considered installing sand media filters upstream to capture 5-micron-plus particles, but it chose Amiad EBS automatic screen filters because of their self-cleaning capabilities, minimal maintenance requirements and low water waste, according to PWWRD Deputy Director Jerry Postema.

Fast & Efficient

Each filter captures suspended sediment in its stainless steel weave-wire screen. When a target differential is achieved between the inlet and outlet sides of the screen—or at a programmed interval—an outlet valve is opened. Pressurized water inside the filter streams toward the atmospheric pressure of the outlet, pushing filter cake through a set of small nozzles that focuses the flushing power of the system while minimizing the amount of water required to backflush. The 25- to 40-second cleaning cycle produces as little as 25% of the amount of backflush water produced by sand media systems, and it takes place while each filter continues performing its job.

Postema said the city also added a sulfuric acid feed system upstream of the membranes to increase membrane flow performance and protect the sensitive RO systems from premature scaling. A sodium hydroxide stabilization feed was installed downstream of the RO skids to bring the pH of the treated water back to target levels.

Introducing the self-cleaning screen filters created pressure swings in the system during the self-cleaning cycle, Postema noted, but staggering the cleaning times of each unit and setting booster pumps on the RO skids to ramp up and down to compensate for pressure changes keeps the system running smoothly.

Meeting Municipal Needs

Minimizing backflush, which is directed into a nearby dry well, has been a significant benefit to the city, which like all growing municipalities in the arid West, counts every drop of water. Goodyear also brought a less silty well online to augment production from the first brackish well. The operation has expanded from its original four trains to seven trains to better address local demand.

Even with three additional RO skids, filtration operating costs have dropped significantly since Goodyear installed its automatic self-cleaning screen systems. Today, the 5-micron filters are changed out every six months at an equipment cost of $5,280 annually, and the 1-micron filters need to be changed out once a year—a $1,400 investment. In all, the city is paying more than $20,000 per year less for new cartridges than it originally invested for the four-train system. It also is saving hours of labor each month on maintenance and changeouts—a sum that Postema has estimated to likely at least equal the savings on supplies every year.

With all the improvements, water recovery has risen from 70% to 80%, according to Postema, and permeate production is 300 gpm per train. Blended with fresh well water, the system now produces 335 gpm of finished product water per train, and tests are underway to bring the system up to run at its full design capacity of 85% recovery and 440 gpm per train.

Fine-tuning its RO desalination system, the city of Goodyear has been able to stave off water emergencies and supply its growing population with 5.5 million gal per day of wholesome drinking water from a source that not long ago would not have been viable.

Multistage filtration and an acid feed system keep Goodyear's drinking water treatment efficient, reliable and cost-effective. WWD

Jim Lauria is vice president, sales and marketing, for Amiad Filtration Systems. Lauria can be reached by e-mail at jim@amiadusa.com.

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