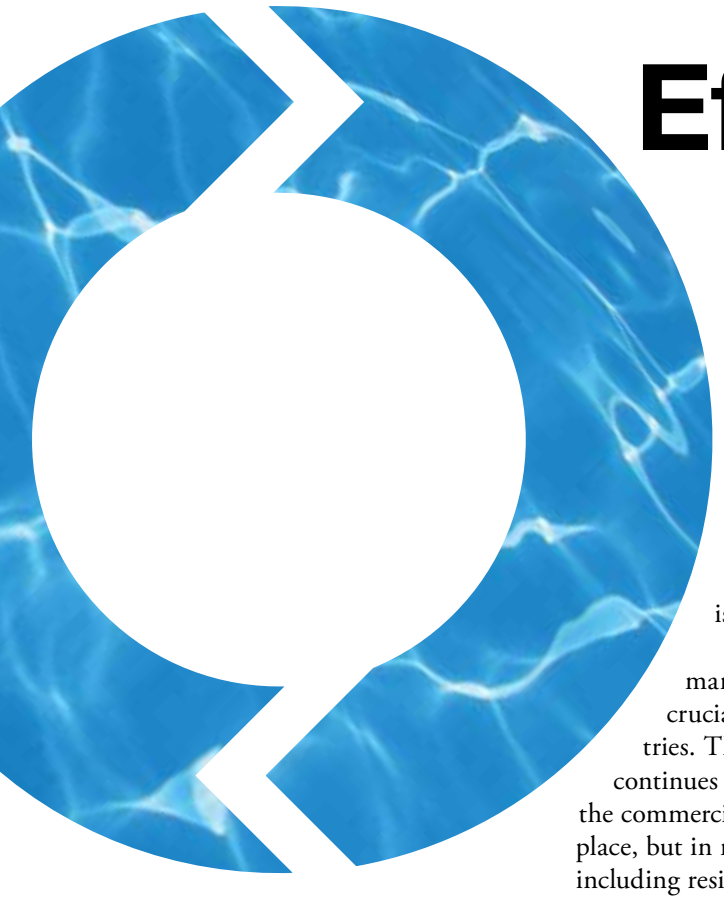

Efficient & Effective Water Reuse

Make the most of water resources with a strategic reuse plan

Water has always been an essential ingredient in industrial production, but today, it is also a key strategic asset.

Effective water resource management has become a crucial issue for most industries. The demand for water continues to escalate—not only in the commercial and industrial marketplace, but in many other sectors, including residential and agricultural, which are competing for the same precious resource. Increasing water scarcity also is adding to the problem. The situation is further compounded by a progressively tough regulatory environment that places additional requirements on industries to make sure that the water they use and dispose of meets strict guidelines.

It is no wonder that strategies for reclamation and reuse are growing in importance.

Reclamation & Reuse

Typical industrial water treatment scenarios fall into three categories. At the front end is process water treatment, in which the plant takes water from a municipal supply or well and treats it to the quality needed for a specific application. At the back end, the water that has been used in the plant is treated to a level at which it can be effectively discharged while also meeting regulatory requirements.

In between are reclamation and reuse, utilizing water treatment solutions that enable manufacturers to take water from the production process and treat it so that it can be reused efficiently. This helps reduce demand on municipal water supplies or other source water—thus enhancing sustainability—and increases operational efficiencies and helps reduce costs. Additionally, an effective reuse program can be the difference between a plant receiving a permit or not, because, in many cases, the permit to build a plant is contingent on ensuring that water usage meets an acceptable level.

A Step-by-Step Process

The following are some ways plants can help manage this important resource, including the assessment process that can help shape their water management strategies.

Prior to starting any water reuse program, a plant should implement a wastewater minimization program. This type of program establishes a baseline, such as a water-to-use ratio, as a starting point, and identifies how much water it takes to make a unit of product.

Employees should be involved in the program as well. It is important to educate them on the benefits of minimizing water use and how it affects the plant's profitability. They should be invited to brainstorm ways to reduce water use and review actual or design water needs per unit operation within the plant. This process not only helps create a sense of ownership in the program, but also can lead to unexpected insights into avenues for water savings.

Adding devices such as orifices or valves to control flows is relatively inexpensive, and reduces some of the human factor in setting or adjusting these flows. Adding process flow programming to clamp flows on specific operations also helps control water use in more complex systems.

Once the plant has operated for some time under these new conditions and achieved a new baseline, it is ready for the next step: water reuse and enhanced wastewater minimization.

Looking for reuse opportunities within a plant can be a complex exercise, so it is important to identify several considerations prior to implementing a reuse program. For example, define the goals for reuse. Determine how much water you want to recycle, and how you are going to use it. This will help define the water quality needed. There also is a decision to make about which water within the plant to recycle: either the combined waste stream (end of pipe) or select individual waste streams. Consistency of the waste stream, plant layout, recycle flow needed and impact on new plant waste streams need to be reviewed to make this decision.

Applications in which recycled water can be used vary considerably from plant to plant, but the following are some general ideas that might be helpful. Keep in mind that, typically, the better the reuse water quality desired, the higher the treatment costs.

If you decide to look at individual waste streams within the plant to recycle, then understanding the plant's water balance—including individual waste stream flows and typical water quality at each process site—will help in determining which waste streams to consider and the impact that recycling them will have on the plant's end-of-pipe water quality. It is possible to achieve the water recycling goal but negatively impact the end-of-pipe waste stream, resulting in possible additional waste discharge charges or discharge violations.

Water purification equipment also can play a role in water recycling and waste minimization. One factor is whether the plant has existing reverse osmosis (RO) or nanofiltration (NF) water systems. These systems are used in a variety of plants, from food and beverage to power and general industrial. They typically operate at 70% to 75% recovery for every gallon of water produced. The reject water is low in suspended solids and concentrated with the dissolved ions removed by the membrane. This stream also is typically consistent, which makes it easier to treat.

With the right water chemistry, it is possible to add a reclaim RO system to the reject waste stream and recover another 50% to 60%. The product water from the reclaim unit is typically of equal or better quality than the plant's inlet water and can be recycled easily within the plant or sent to the front end on the first membrane system to be used for process.

Reuse Strategies in Practice

In one example, Culligan worked with a major beverage producer and was able to save $244,000 per year by reducing water and wastewater treatment costs as a result of saving 26 million gal. This project provided the plant a return on investment of 1.5 years.

When it comes to process waste streams that have suspended solids and include possible clean-in-place or process chemicals, the first step is to understand the variability of these streams. When treating this water, solids must first be reduced through media filtration or ultrafiltration (UF). Once the suspended solids are reduced—and depending on the reuse application and the water quality needed—the wastewater may have to be treated with an RO or NF system that then reduces dissolved chemicals, proteins, yeast or other contaminants. The treated product water then can be chlorinated and reused within the facility.

In another example, Culligan worked with a large brewery that had a limited water supply. To increase water efficiency, the effluent from the biological waste stream was treated and reused. Using Culligan's pressurized clarification, UF and RO systems, the waste stream was treated and reused for cooling tower and boiler makeup water and process flush water.

If oils are involved in a waste stream, additional pretreatment steps are needed. Oil has a tendency to cause solids to stick together and can foul membranes. For instance, in the oil sands of western Canada, in order to meet national regulations, a site must recycle 90% of the water used on site. As a result, a variety of technologies are used to recover high-salinity produced oil waters. To start, the water stream is de-oiled through centrifugal separators. With dissolved air flotation or inducted air flotation, the water can be polished to remove trace oils with walnut shell filtration. Warm or hot lime processing then is used, followed by ion exchange to recycle water back to the steam generator, from which the steam is sent back to the oilfield. These same technologies can be used to recover many manufacturing plant waste streams.

Waste minimization and recycling can go hand in hand. Sometimes it is just as important to reduce the effluent discharge as it is to recycle the water. Many waste streams become more concentrated as a result of reuse. Hence, the waste stream typically is limited by the amount of hardness and/or silica in the water. As they concentrate, these two constituents tend to precipitate, creating scale and limiting the ability to treat the waste stream. Culligan uses controlled chemical addition in a reaction tank and tubular UF to precipitate the scale-forming constituents. This precipitated sludge then is sent to a press for dewatering and is removed from the site. Now lower in hardness and silica, the effluent from the UF system can be reused or sent to an RO or NF unit for high-purity water needs. This system can reduce plant waste streams up to 90%.

All of these technologies can be used in a variety of manufacturing plants that are interested in improving their water-to-use ratios and limiting the amount of water consumed, as well as the amount of wastewater leaving the plant. In many cases, these projects not only provide a great sustainability message and help manage an important strategic asset—they also provide a sound return on investment for the plant. *wqp*

Ed Orvidas is director industrial strategic accounts for Culligan Matrix Solutions. Orvidas can be reached at ed.orvidas@culligan.com.

For more information on this subject write in 1002 on this issue's reader service card.