

Chemicals: Getting In Gear

By Gary Dewolf, July 05, 2016

Large U.S. chemical manufacturer enhances water treatment efficiency.



Chemical companies are among the biggest water users on the planet, requiring almost 3 lb of water for every pound of chemical they produce. About 70% of this water must be cleaned and treated before it can be discharged, after being used only once.

Treating wastewater prior to disposal is not just a process requirement—it also is an important part of a company's brand. Chemical companies must be good stewards of the environment, and good neighbors in their respective communities. Negative publicity that could accompany U.S. Environmental Protection Agency (EPA) audits, fines or potential lawsuits must be avoided at all costs, and many of the issues that cause negative publicity involve the treatment and disposal of wastewater.

From a financial perspective, chemical companies invest billions each year for water acquisition, treatment and disposal. The management of water and the infrastructure needed to treat it is a critical activity. Savings of just 1% to 2% in this area can add up to hundreds of millions of dollars each year.

Pumping infrastructure is a good place to find efficiencies. The largest chemical producer in the U.S. deploys thousands of pumps in each of its facilities. Some of these pumps are used to inject precise volumes of chemicals and water into different processes to make chemical products ranging from consumer items (such as plastics and adhesives), to agricultural products (such as pesticides and crop protection products), to infrastructure chemicals (such as coating materials or insulation) to hundreds of other products.

Making these products is somewhat like preparing a meal: The process follows a recipe of different ingredients, mixed at specific times under certain temperatures to produce the desired item. For these processes, chemicals are precisely dosed using reciprocating (or metering) pumps, which are highly engineered and built to be accurate.

When a given process is finished, the water used to make the product must be treated prior to disposal. Some of the chemicals

used in these procedures are highly toxic, so a variety of treatment processes such as disinfection, dechlorination, denitrification, coagulation and flocculation, algae control, odor and color control must be undertaken to dilute and neutralize the wastewater before it can be properly disposed of. Restoring the alkalinity of process water is controlled by using harsh chemicals such as sodium hydroxide, calcium carbonate or hydrochloric acids to correct pH levels. Disinfectants such as chlorine or sodium hypochlorite are also used to improve odor and kill unwanted microorganisms.

For these water treatment applications, reciprocating and rotary gear pumps are used.

A Reduction Intention

In addition to reducing the amount of water consumed for operations, this chemical company also had a goal of reducing the costs of processing, treating and discharging water. To reach this goal, it identified three key areas:

1. Update the pumping infrastructure: Deploy more efficient reciprocating pumps with better turndown capabilities that enable the plant to use fewer chemicals in several of its processes.
2. Evaluate the mix of pumps used in the plant and replace some of the more-expensive aging reciprocating pumps with less-expensive rotary gear pumps capable of accomplishing certain tasks.
3. Streamline maintenance activities, in an effort to minimize plant downtime.

A Mix of Pumps

While reciprocating pumps are best suited for metering applications that make certain products, once the product is made, there are numerous applications where a less-expensive rotary gear pump is well suited to treat and clean the wastewater used

in the initial process. Rotary gear pumps are suited to provide high-volume flows. They are less sensitive to changes in liquid viscosity, and they do not require ancillary components like pulsation dampeners or pressurized supply tanks for liquids that do not flow freely.

Although rotary gear pumps are primarily designed for high-volume and pulse-free flows, this chemical company used bypass metering, variable speed metering and ratio metering to vary the pumps' output and optimize them for water treatment applications. As a result, the chemical manufacturer recognized a number of advantages:

Enhanced safety: Because exposure to the chemicals used to treat wastewater, such as chlorine gas, can cause respiratory issues for employees, great care should be taken to ensure that leaks do not occur when dosing hazardous chemicals. Sealless gear pumps offer fewer points of failure because there are no leak points for harsh chemicals to damage the pump or the surrounding equipment. By replacing some of the reciprocating pumps with seal-less rotary gear pumps, the plant ensured a higher level of safety for plant employees.

Streamlined maintenance: Maintenance costs must be measured beyond the physical expense of the parts and tools, or the engineers who wield them. Maintaining the pumping infrastructure affects process uptime, which has a direct effect on the bottom line.

The biggest maintenance savings start with a simple design. If the pump's gears are not readily accessible, then engineers need to decouple the motor, close the valves and remove piping at both the suction and discharge ports of the pump. This chemical plant specifically chose rotary gear pumps that feature a front pull-out design that is easy to access and can be repaired in place. This minimizes downtime by eliminating the need to lock out/tag out the pump and move it to the repair shop—which, in this plant, would need to be done by a separate union employee.

Maintenance activities also are streamlined by deploying pumps that require fewer parts. In this case, the plant replaced older pumps that had more than 40 parts with new pumps featuring fewer than 20 parts. As a result, it is now easier for the maintenance team to stock and order kits—with just a single part number—made up of gears, bearings, O-rings and liners. With the newer pumps, the spare parts are symmetrical, only fitting in one way, which makes for quick and mistake-proof replacement.

Increased uptime: Maintenance costs for a single repair will always be insignificant compared to the costs associated with lost production and process restarts. The true ROI for maintenance is always connected to a plant's uptime. This chemical company runs operations continuously, 24 hours a day, 365 days a year, even through the holidays. Because it never shuts down, up-

time is its single most important factor. By updating the pumping infrastructure with rotary gear pumps that are easier to maintain, the plant operators gained flexibility to schedule maintenance between shifts, or whenever it is most opportune to do so.

An Efficient Solution

An efficient pumping infrastructure and a streamlined predictive maintenance program have helped this chemical manufacturer maximize uptime, avoid costly accidents, comply with EPA regulations, avoid potential fines and minimize the downtime and disruption that might accompany audits. It also has enabled them to be a better environmental steward and neighbor in each community where their plants are located.

At first glance, the equipment and maintenance savings derived from upgrading the pumping infrastructure might seem minimal—measured in tens of thousands of dollars. But they play a role in helping the company achieve its larger goal of managing its water envelope globally, where a 1% to 2% savings on a multi-billion dollar investment is measured in the hundreds of millions of dollars each year.

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