When CPVC Beats Steel For Corrosive Piping

Donald Townley, PE, business manager for Corzan Industrial Systems

Industrial wastewater treatment plants have always presented significant challenges for piping systems, not only because of the highly corrosive chemicals being transported throughout the system, but also because of demanding schedules that, typically, mandate a 24/7 operation.

In recent years, however, the demands on these systems have increased greatly, largely as a result of newer disinfection technologies and chemical treatment processes, as well as more complex equipment designs and specification processes. Stricter discharge regulations, higher EPA standards, fewer sludge disposal options, and higher-volume plant flows continue to challenge both the operations and the profitability of plants of all sizes.

The piping material chosen can have a significant impact on the plant’s bottom line. That’s why it’s important to specify a reliable material with a proven track record for reducing total installed costs and providing a safe, fully compliant performance.

Historically, many industrial wastewater treatment plants have relied on steel or

other higher alloys for their piping systems. With the stronger disinfectants being used today to meet stricter EPA standards, however, these traditional systems are showing greater vulnerability to pitting, corrosion and premature leaks and failures. Chemical corrosion is a reality for many plants as a result of the strong acids and bases used for pH neutralization. Such was the case for Lubrizol's Avon Lake (Ohio) wastewater treatment plant.

To effectively treat a diverse mix of process waste streams before sending its water back to the local municipal plant, Lubrizol uses an alum-based polymer coagulant to break solids out of the solution and into suspension. The coagulant, which weighs 25 percent more than water, is pumped through a one-inch line and fed into the wastewater in a mix tank. Given the low pH level of the feed stream, corrosion had been an ongoing problem with the pump room's stainless steel piping system.

In fact, the stainless steel line had only been in operation for two years when it first started to corrode. The ongoing pitting and corrosion created the need for frequent maintenance and costly repairs. By the third year of operation, the plant's maintenance team was spending an unjustified amount of time repairing the pipe or replacing full sections. Downtime was a concern, as was the safety of plant workers who needed to be protected from overhead leaks.

As a result, the decision was made to completely replace the stainless steel line with a material that could provide a safer, more reliable performance. Knowing that the piping material would need to hold up to low pH levels and highly caustic treatment chemicals, the team identified chlorinated polyvinyl chloride (CPVC) as an attractive and obvious alternative.

The maintenance team was already familiar with the benefits of CPVC because, nearly 10 years earlier, CPVC pipe and fittings were specified for the plant's polymer coagulant bulk unloading line. More than a decade later, that CPVC system was still operating reliably without any downtime or maintenance issues.

The CPVC Advantage

CPVC pipe and fittings have been successfully used in a wide array of industrial applications for more than 50 years. During that time, they have been installed in a number of applications characterized by extremely harsh environments. Industries successfully served by CPVC include chemical processing, metals finishing, water and wastewater treatment, chlor-alkali, pulp, and paper, to name just a few.

There are many reasons why companies such as these, including Lubrizol's Avon Lake Plant, choose to convert to CPVC pipe and fittings. They offer a combination of benefits unlike any other piping material currently on the market. Some of the product attributes that have the most relevance and appeal to water and wastewater treatment plants, as well as a long list of other chemical processors, include:

Resistance to chemical and microbial corrosion, pitting and scaling

The product's natural ability to resist corrosion without the need for additional coatings or protection is, perhaps, its greatest selling feature. No corrosion means less maintenance and downtime. As a result, productivity and profitability increase.

Superior mechanical strength

CPVC outperforms most other non-metallic piping materials when it comes to mechanical strength. However, it's important to note that not all CPVC pipe and fittings meet the same standards for mechanical strength. For added peace of mind, only pipe and fittings that meet the cell class of 24448 — the highest for any CPVC compound — should be specified.

High heat tolerance

Most CPVC pipe and fittings are pressure rated for up to 200°F. That's nearly 80° higher than PVC. Heat tolerance is, obviously, a consideration when transporting hot fluids. It is also a consideration for outdoor applications, where ambient temperatures may vary greatly as a result of the effects of the sun.

Ease of installation

Lightweight (approximately one-eighth the weight of steel) and easy-to-maneuver CPVC piping systems do not require large or expensive handling equipment for installation. They are typically installed via solvent cement, flanging or threading — none of which require time-consuming, risky soldering. The preferred method for installing CPVC — solvent cementing — results in a highly reliable chemical bond between the pipe and fittings that is stronger than either piece alone. With many other materials — especially metals — the joint is typically the weakest point of the system and most vulnerable to leaking.

Safety considerations

CPVC offers many advantages from a safety perspective. It is safer to install, because no soldering is required. It's safer to operate, because its lower thermal conductivity minimizes the transfer of heat from inside the pipe. With no corrosion to cause premature leaks, it also reduces concerns of worker injuries resulting from overhead leaking pipe. And, it exhibits outstanding fire performance characteristics both in terms of limited flame propagation and low smoke generation. This is due to the compound's low petroleum content. It stops burning when the ignition source is removed and when it does burn, its smoke is considered no more toxic than wood. In addition, CPVC has a high flash ignition temperature — typically around 900°F. This is the lowest temperature at which sufficient combustible gas is evolved to be ignited by a small external flame. In comparison, other ordinary combustibles, such as wood, ignite already at 500°F.

Lower total installed costs

Highly stable, competitive material costs, combined with lower maintenance requirements, fewer premature failures from corrosion, and lower labor costs

resulting from a fast and easy installation process all contribute to the cost benefits of a CPVC piping system.

Conclusions at the Avon Lake Plant

All of the above benefits were considerations at Avon Lake in order to help drive the decision to convert from stainless steel to CPVC. Without a doubt, however, the overriding factor was the reliability of the system. After nearly five years of 24/7 operation, the CPVC line installed in the pump room's polymer coagulant feed line is demonstrating the same reliable performance as the first CPVC line that was installed 10 years earlier. Maintenance team members report zero problems with the CPVC system, despite the fact that it regularly pumps thousands of gallons of polymer coagulant through its lines each month. Such an aggressive schedule is necessary to keep up with the production demands of the plant. Downtime resulting from piping repairs and maintenance was a cost that could no longer be afforded. Thanks to the newer high-performance CPVC system, that is no longer a problem._

___

For more information, visit www.corzancpvc.com *[1].*

Links:
[1] http://www.corzancpvc.com