Beyond Metal

No one would argue that corrosion is commonplace in water and wastewater treatment plants. Not only does chemical corrosion result from the strong acids and bases used for pH neutralization, but microbial corrosion resulting from sludge streams and chemical attack from clarification polymers has also minimized the long-term reliability of metallic systems.

By Domenic DeCaria

Implementing CPVC pipe to curtail corrosion in water treatment plants

Equally corrosive are the chlorine and chloramines added to neutralize and kill bacteria before discharging wastewater into a river or ocean. In addition, the release of dissolved gases, including hydrogen sulfide and other corrosive fumes, can cause external pipe corrosion.

To combat these problems, some plants have implemented what can best be termed standard corrosion control technology. These options most often include cathodic protection or upgrading the system to duplex-grade stainless steel piping—both of which are accompanied by a hefty price tag. Retrofitting a cathodic protection system for large-diameter steel piping systems can cost up to 25% of what a total replacement would cost. This percentage can climb even higher as the system size decreases. A new treatment facility would spend much more than necessary by going the way of this standard technology.

Considering CPVC

There are, however, reliable piping materials that possess the necessary chemical resistance and mechanical strength to stand up to even the harshest disinfection processes. Chlorinated polyvinyl chloride (CPVC) is one such material that has proven especially effective—both from a cost and reliability perspective—because it offers a balance of properties to help keep treatment plants in compliance, reduce installation, maintenance time and costs, and increase productivity. Although newer to the market than carbon steel and many high-end alloys, CPVC has a long-established track record in a wide

Disinfection technologies and chemical treatment processes have changed dramatically in the past few decades, creating the need to identify newer piping materials.

variety of industrial operations that require the use of corrosive chemicals, including metal finishing; chemical treatment; pulp and paper; and water and wastewater treatment plants. Within a typical water treatment operation, there are many applications for which CPVC has proven compatible and cost-effective. That is because CPVC is immune to the corrosive effects of many of the more commonly used chemicals and liquids in water or wastewater treatment, such as ferric chloride, sulfuric acid, an array of caustics, brine solutions and pressurized high-temperature water.

It is important to note, however, that even though CPVC is resistant to a broad range of corrosive environments, it is not compatible with all chemicals that may be used in a treatment operation. The designer should confirm chemical compatibility before selecting CPVC for a particular application.

Assuming chemical compatibility with the chemicals being used, CPVC offers a number of distinct advantages:

Immunity to chemical and microbial corrosion, pitting and scaling. CPVC piping is chemically inert to most mineral acids, bases and salts, as well as aliphatic hydrocarbons. As a result, it is not subject to corrosion, even when exposed to high concentrations of chlorine and chloramines. Because the material is nonconductive, it is also immune to galvanic corrosion.

CPVC piping can be buried in alkaline or acidic soils without requiring any paint or special coating. It has been used effectively in alkaline lime slurry systems that neutralize the acid generated during the nitrification of ammonia. CPVC is resistant to the corrosive effects of microbes such as sulfate-reducing bacteria or sulfur-oxidizing bacteria.

Ease of installation. Unlike metallic systems, CPVC piping systems do not require welding for installation. A simple solvent cement-joining system significantly reduces labor time and requires fewer, less expensive installation tools.

Low maintenance. A properly installed CPVC piping system requires little or no maintenance. It is completely immune to rust, pitting and scaling. Furthermore,

external pipe coatings are not necessary because CPVC is not affected by even the most aggressive soil and air conditions.

Lightweight. CPVC piping is approximately one-eighth the weight of metal. This translates into better maneuvering on site, easier installation within close quarters and the elimination of heavy equipment to lift and install the pipe.

Optimum flow rates. Because the interior wall of all CPVC pipe has a Hazen Williams C Factor of 150, smaller-diameter piping can often be specified, resulting in significant cost savings. In addition, less energy or horsepower is required to transfer fluids.

Superior mechanical strength. CPVC piping systems are pressure-rated for operation up to 200°F, which is nearly 80 degrees higher than what can be handled by standard PVC. In addition, the systems can be expected to maintain their pressure-bearing capabilities for 50 years and beyond.

Safety. Although CPVC piping can handle higher temperatures, it demonstrates low thermal conductivity. This reduces the potential for burn injuries from hot pipes and may diminish the need and expense of installing protective insulation.

Low flame and smoke characteristics. Third-party testing confirms that CPVC exhibits low flame and smoke characteristics. It will not support combustion, which means it cannot be the source of a fire or cause a fire to spread. Moreover, it will not contribute to flashover.

Long service life. With metal systems, it is possible to literally measure corrosion in inches per year as a result of aggressive water and corrosive chemicals. But CPVC is chemically inert to many of these same chemicals and has proven to be highly resistant to UV degradation.

Disinfection technologies and chemical treatment processes have changed dramatically in the past few decades, creating the need to identify newer piping materials. Whether for use in the construction of a new treatment plant, the expansion of an existing operation or the replacement of an outdated, corroded pipeline, CPVC has proven to be a viable alternative for today's water and wastewater treatment plants. WWD

Domenic DeCaria is product engineer for The Lubrizol Corp.'s Corzan Industrial Systems. DeCaria can be reached at 216.447.6126 or by e-mail at domenic.decaria@lubrizol.com.

For more information, write in 1112 on this issue's Reader Service Card

LEARN MORE
For additional articles on this topic, visit:
www.wwdmag.com/lm.cfm/wd070812