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How Advanced Feeder Technology Mitigates Disinfection Dangers

Metering pumps have been feeding the treatment chemicals used to disinfect water and wastewater for many decades. However, this traditional liquid dosing technology is brimming with potential problems. From the hazards caused by line breaks or pump failures, to the extensive maintenance and high total costs, metering pumps are often not a solution that allows water system operators to sleep well at night.

Metering pumps rely on positive pressure to push chemicals to the point of application. This requires a cavity to fill and expel chemicals, with a pulsating or "slugged" flow. The chemicals are constantly pressurized and prone to air locking and spills without triggering an alarm. Metering pumps have low turndown rates, so wide feed-rate swings require special arrangements, and they tend to consume a large amount of power.

By comparison, automatic liquid vacuum feeders have gained wider acceptance as an alternative method for delivering chemicals. The main component in these systems is an electronic flow sensor that measures the chemical feed rate. Vacuum conditions allow for a safer, more reliable way to feed, while helping to maintain stability, ensuring that over-feed or under-feed conditions are eliminated.

The advancements made in automatic liquid vacuum feeders also mean they are now more cost-effective for many new water and wastewater plants. The capital investment in a vacuum system for a typical 1,000 GPD water system can be less than half of that for a metering pump system. Operating expenses in those cases are about a third of the cost because of the relatively high cost of maintenance kits and energy needed for metering pumps. Larger-capacity plants that would require big pumps can install liquid vacuum feeders in much less space.

Behind The Technology

The big pitfall of metering pumps for liquid dosing is that when a line breaks, chemicals are still being pumped. Besides the waste, this creates a hazard that could harm workers, the public, and the environment. Pump failures also contribute to a hazardous condition. Wear components in the pump, such as the diaphragm in an air-operated pump or tubes on a peristaltic pump, won't trigger an alarm when they fail. This can leave chemicals pouring out of the head of the pump, causing damage to the pump and endangering workers.

Pumps also have extra potential for failure. For example, diaphragm pumps require compressor regulators and backflow pulsation dampeners. Automatic vacuum feeders don't have the same demands; therefore, they have fewer failure points.

In vacuum-based technology, chemicals are pulled in a continuous stream and not pressurized. This offers more accuracy in feeding chemical over a wider range than competing technology, while modular design provides a greater ease of installation and operation. Because of its benefits, an increasing number of new plants are being outfitted with the new technology.

Here's how it works: The sensor sends an analog signal representing the actual feed rate, which goes to the operator's SCADA system for verification and to the controller. A vacuum is generated to pull the chemical from the storage tank through the feeder and into the eductor. From the eductor, the chemical mixes with the water and is delivered to the process.

Advanced automatic liquid vacuum feeder units come SCADA-ready, which provides a benefit for users who choose to apply that feature for controllability. This offers flexibility and can be applied in many ways. For example, some facilities run in compound loop control, where they take into consideration both the flow of the plant and the residual, based on an analyzer. Additionally, the feeder can be used in residual-only mode, flow-rate-only mode, or set point-only mode.

Other benefits of the technology include: multiple control modes and alarm functions; materials of construction compatible with most aqueous water treatment chemicals; no requirement for a means of calibration verification (Calibration Chamber); and a standard turndown ratio of 100:1.

There are some limitations to these systems, but those are readily addressable. For example, high-pH chemicals react with calcium carbonate in carrier water and scaling can occur at the point where the two meet and mix. Several solutions to this issue are available, including the use of ion exchange (softeners) to reduce the pH of carrier water or to locate the injector at the point of application to limit scaling, then switch to a standby injector when fouling occurs.

Although metering pumps still dominate the treatment chemicals process, water and wastewater treatment plant operators are increasingly turning to automatic liquid vacuum feeders as a solution.