

Chemical Feed Control and Efficiency™

Vol. 1, No. 1

Reported independently by Catalytic Objective Synthesis™ *

May, 2016

Vacuum Dosing Chemical Feeder for Chlorination and Dechlorination Helps Minimize O&M Costs for City's CSO Screening and Disinfection Facility

As part of its Long Term Control Plan to reduce combined sewer overflows (CSOs) to the Merrimack River, the City of Nashua, NH constructed a new Screening and Disinfection facility (SDF), to reduce untreated discharges of CSOs to the Merrimack River.

Sewer system modeling was performed by the engineering firm Hazen and Sawyer, to evaluate baseline condition performance and develop alternatives to mitigate untreated CSOs. Various CSO disinfection strategies were evaluated, and Computational Fluid Dynamics (CFD) analysis was also performed to confirm flow routing/mixing and disinfection contact times.

The results of the modeling indicated that the recommended CSO control technologies would satisfy the requirements to screen and disinfect flows up to a 2-year "actual" design storm event, without any untreated discharges at either locations CSO 005 or CSO 006.

Facility Design and Operation

Treated flows in excess of the approximately 1 MGD contact/storage volume capacity are discharged to the Merrimack River, and the remainder is returned to the sewer system for eventual treatment at the facility downstream. Based on the anticipated frequency of operation, the facility

was designed utilizing equipment that minimized operation and maintenance (O&M) of the facility, based on frequency of use.

The control and operation of the facility is fully automated and remotely monitored, and the entire process is gravity-driven. This elimination of the pumping component significantly reduced the O&M costs and requirements associated with traditional pumped-tank systems.

Horizontally-installed CSO fine-slotted screens provide high operational reliability; automatic mechanical cleaning driven by a hydraulic power unit; low maintenance requirements; and discharge of the screenings back into the waste stream for ultimate removal at the City's wastewater treatment facility.

Chemical Storage and Feed

The facility also features optimized chemical storage and feed systems that dose based on flow rate. This setup offers simplicity of operation, reduced maintenance, higher turn down capability, and enhanced mixing. Automatic cleaning and flushing systems, comprised of a combination of tipping buckets and flush gate systems, are programmed to automatically operate post-event in sequence, so that the entire facility is cleaned within hours following a wet weather activation of the facility.

One key component of chemical storage and feed operation is using a vacuum chemical feeder system to deliver sodium hypochlorite (NaOCl) for chlorination and sodium bisulfite (NaHSO₃) for dechlorination of the CSO discharge.



Patented vacuum chemical feeder system delivers sodium hypochlorite (NaOCl) for dechlorination, providing for disinfection of untreated discharges of combined sewer overflows (CSOs).



Similar feeder system is also used to deliver sodium bisulfite (NaHSO₃) to provide for dechlorination of CSO discharge.

“This is an unmanned facility that only operates 6-12 times per year for up to several hours on each occasion,” explained Frank Ayotte, P.E., Senior Associate at Hazen and Sawyer, in Boston, MA. “By using a vacuum liquid dosing system, we have no moving parts and don’t have to have the chlorination/dechlorination chemicals sitting idle for long periods of time within a typical pump. This type of dosing system also has an excellent turndown range and is able to handle a wide range of influent flows up to the design capacity of 91 mgd for this facility.”

The entire facility is gravity driven. The chemical storage and feed systems are optimized to dose based on flow rate. The vacuum liquid doser, patented by manufacturer JCS Industries of Houston, TX, is controlled by multiple flow meters, which allow it to pace the chemical flow rate based on contact time (CT) setpoint and flow. Disinfection is based on a delivery of a 5% NaOCl solution, while dechlorination is achieved with NaHSO₃.

“This setup offers simplicity of operation, reduced maintenance,

higher turn-down capability, and enhanced mixing,” Ayotte said. “When an event begins, depth and velocity sensors at the influent weir activate the CSO screening equipment and the chemical dosing systems.”

Patented Chemical Feeders

The JCS Industries chemical feeders utilize real-time feed information, via electronic sensors that allow for continuous monitoring and control of the chemical feed rates. Each feeder automatically regulates in both fixed and variable control modes, including fixed feed rate, flow paced, residual control, and compound loop. The feeder system can dose a variety of aqueous chemicals commonly used in municipal and industrial water treatment systems.

The feeder system is comprised of a vacuum injector to safely introduce the liquid into the feed-water stream; a reversing servo motor coupled with a V-notch valve to regulate the chemical feed rate; an electronic flow sensor to monitor and regulate the feed rate; and a control module for complete electronic control and communications.

Chemical residual signals for both NaOCl and NaHSO₃ are used to adjust each chemical’s liquid flow rate by electronically positioning the servo motor driving the feed control valve. The ratio of input signal to liquid flow is adjustable over a range of 5% to 400% to enable increased liquid feed in response to additional chemical demand. US Patents have been received for the all-vacuum liquid feeder, which can dose up to 60,000 gal/day.

For further information, contact JCS Industries, 5055 FM 2920, Spring, TX 77388, Tel. 281-353-2100, Fax 281-353-0657, sales@jcsindustries.us.com, www.jcsindustries.us.com.

####

**Catalytic Objective Synthesis™ newsletters, reported independently by Cliff Lebowitz, are sponsored by equipment manufacturers who allow for objective reporting based on interviews of their customers and their engineering firms, who in turn provide review and approval for accuracy and completeness. Titles and headlines are created to help readers recognize solutions for problems and needs, typically related to issues such as quality, reliability, efficiency, and compliance. Circulation and distribution are customized for each newsletter.*