



# Sending H<sub>2</sub>S Packing

Technology prevents H<sub>2</sub>S formation in Pacific Coast force main

By Inken Mello



Laguna Beach installed its second ECO2 cone outside, painting the tip black so that it blends in with the surrounding landscape.

*The city of Laguna Beach, Calif., is a unique beach community with more than 7 miles of beautiful beaches. The city has 24,000 residents and receives 3 million-plus visitors each year. Odor emissions from several manholes near the discharge of a 3-mile-long force main on Pacific Coast Highway were unacceptable for the community.*

Hydrogen sulfide (H<sub>2</sub>S) levels reached peak concentrations of 800 ppm every morning. Treating the wastewater with calcium nitrate was a solution that reduced the concentrations, but it did not achieve the results for which the city had hoped.

City personnel were well aware of the fact that average H<sub>2</sub>S concentrations of 25 ppm were not sufficient for odor control—the odor threshold for H<sub>2</sub>S is less than 1 ppm—and would cause corrosion of their sewer lines. According to the American Society of Civil Engineers, concrete corrodes at a rate of 1 in. in five years at H<sub>2</sub>S concentrations of 20 ppm.

In 2005, the city started investigating alternative odor and corrosion control technologies. Because of physical constraints and the high cost of chemicals, scrubbers and chemical treatment were not deemed practical or cost-effective. Air scrubbers did not address H<sub>2</sub>S concentrations in the headspace of sewer lines and manholes, and corrosion prevention was an important goal for the city.

## A Preventative Solution

The ECO2 system offered several valuable advantages, including a return on investment of less than four years, a significant reduction of odor at the discharge manholes and an increased service life of the Northcoast Interceptor by preventing the formation of H<sub>2</sub>S and associated corrosion.

The system was custom-designed for Laguna Beach's Bluebird pump station. The 24-in. Bluebird force main is almost 17,000 ft long, with an average flow of 2.4 million gal per day (mgd) and a maximum flow of up to 5.4 mgd. The ECO2 system dissolves 1,000 lb per day of pure oxygen into a wastewater sidestream that is then blended back into the force main flow. This raises the dissolved oxygen (DO) level in the wastewater and creates aerobic conditions.

H<sub>2</sub>S only is formed in wastewater void of oxygen. Providing a sufficient amount of DO in the wastewater prevents the bacteria in the slime layer from converting sulfates to sulfides. With no dissolved sulfides in the water, there will be no release of H<sub>2</sub>S at discharge points or other points of turbulence.

H<sub>2</sub>S not only causes a rotten egg smell; it also is converted to sulfuric acid by bacteria residing along the pipe walls. The sulfuric acid accumulates as an acidic condensate along the pipe walls and causes crown corrosion in sewer lines. A U.S. Environmental Protection Agency study found that severe H<sub>2</sub>S corrosion may reduce the 50- to 100-year life expectancy of infrastructure to less than 10 years.

"Most of ECO2's installations to date have been driven by odor complaints," said Steve Hatchel, president of ECO2. "But as people become more aware of the disastrous effects corrosion has on our infrastructure, we are beginning to see a shift in the expectations our customers have of their odor control technologies. Corrosion protection is an important goal

that cannot be ignored. Protecting infrastructure from corrosion should be included as long-term savings in life-cycle cost analyses."

## Laguna Beach Sees Results

The city of Laguna Beach has been pleased with the results of its first ECO2 system. The maintenance is minimal and can be absorbed easily into the existing operating budget. The only item that requires regular maintenance is the system's sidestream pump, a standard industrial water pump. The operation of the system itself is automated. There are no mixers or moving parts, so it is not susceptible to plugging.

The city decided to generate oxygen itself with a small skid-mounted onsite oxygen generator. It generates pure oxygen on demand at a low cost (4 lb/kWh). Only a small amount of gaseous oxygen is stored on site under ambient pressure and temperature.

H<sub>2</sub>S levels at the discharge manhole have been monitored regularly since system startup and have been measured to be consistently below 2 ppm. City personnel and the residents of Laguna Beach have been especially pleased with this performance. Furthermore, the return on investment of the ECO2 equipment compared to the existing chemical treatment was less than four years, which was more than acceptable for the city.

In early 2009, the city installed a second ECO2 system in its collection system. This second system treats the 1-mgd force main upstream of the Bluebird force main and addresses odor and corrosion problems at the discharge into the Bluebird pump station. The first system fit entirely into the existing pump station building, and the city opted to install the second ECO2 cone outside on the existing concrete slab for the now obsolete chemical tank. Laguna Beach painted the tip of the 12-ft-high stainless steel cone black so that it blends in with the surrounding hills.

Several other municipalities throughout southern California currently are looking into using superoxygenation systems to eliminate odor and corrosion problems in long force mains or upstream of wastewater treatment plants (WWTPs).

Maintaining a positive DO in the influent of a WWTP prevents odor and corrosion problems at the headworks. In addition, the ECO2 system provides a pretreatment benefit: Every pound of DO added to the collection system satisfies 1 lb of biochemical oxygen demand that does not have to be removed at the WWTP. At higher oxygen feed rates, this results in significant energy savings for the receiving WWTP. **wwd**

**Inken Mello is director of sales and marketing for ECO Oxygen Technologies, LLC. Mello can be reached at 858.272.7102 or by e-mail at imello@eco2tech.com.**

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