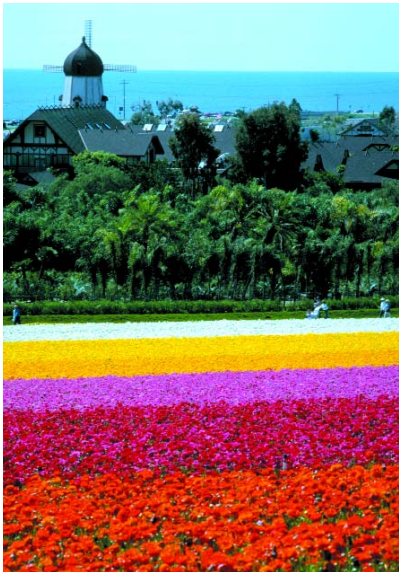
BioMagic
An Environmental Solutions Company

Case Study

CITY OF CARLSBAD

Industry: Municipal Wastewater
Problem: Pump station odor and hydrogen sulfide control

Variable Dosing Yields Economy and Results



Business Overview

The Carlsbad Municipal Water District is a subsidiary of the City of Carlsbad, located in San Diego County, California. The district's service area covers approximately 85% of the city, an area of about 32 square miles. The District provides wastewater collection services through 145 miles of collection pipelines, 40 miles of sewer laterals and 16 pump stations.

The Batiquitos Pump Station is located adjacent to the Batiquitos Lagoon Tidal Wetlands Area. The lagoon itself consists of 610 acres with a drainage basin of about 55,000 acres and is bordered on its north side by a popular walking/hiking trail. The pump station is located within a few yards of the walking trail.

Challenge

Wastewater from the local residential area and an upscale golf resort is collected at the Batiquitos Pump Station. The city was using other hydrogen sulfide control products at other stations, but agreed to a pilot program at Batiquitos with BioMagic to test the product's performance on a station with high sulfide levels. The challenge was to reduce the liquid sulfides in the force main discharge to less than 0.5 milligrams/liter (mg/L) consistently and cost-effectively. Initial readings taken from the force main discharge ranged from 1.5 to 3.4 mg/L depending on the time of day and where in the pump cycle the sample was taken. Initial hydrogen sulfide gas readings taken by an OdaLog hydrogen sulfide datalogger at the force main discharge averaged 19 parts per million (ppm) with daily concentration peaks of 150-250 ppm. See graph 1.

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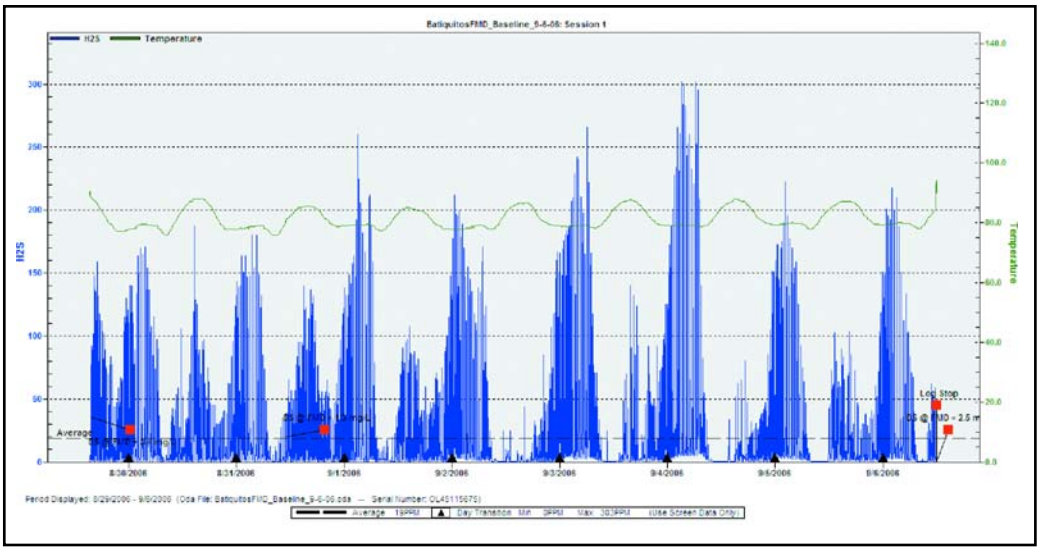

Graph 1: Hydrogen sulfide gas readings taken by a hydrogen sulfide datalogger at the force main discharge averaged 19 parts per million (ppm) with daily concentration peaks of 150-250 ppm.

Also, liquid sulfide levels of the incoming wastewater were measured in the wet well of the pump station. These measured an abnormally high 0.5-0.7 mg/L. adding an additional challenge for total sulfide removal at the force main discharge. Baseline data collection was complete after one week and a dosing scheme was devised. Results would be determined based on weekly sulfide samples taken from the force main discharge, combined with gaseous hydrogen sulfide data.

BioMagic Solution

Given the high incoming sulfides concentration, and the very high sulfide level at the force main discharge, dosing was planned at a very high concentration of three gpd BioMagic's M6 BioOdorStop. A tank and pump system was set up to inject additive directly into the influent to the wet well. This initial dosing was based on information that the station pumped 0.1 MGD, which turned out to be incorrect; daily flow was actually 0.8 MGD. M6 BioOdorStop dosing was adjusted to 25 gpd, which represented a high concentration of M6 BioOdorStop, but was in line with the actual flow rate of the pump station.

After only four days at the 25 gpd dosage rate, the force main discharge sulfide level was down to 0.6 mg/L, and the average H2S gas levels had dropped to 6 ppm with maximum peak concentrations of about 60 ppm. These results were in line with expectations. We decided to maintain this dosage rate for one more week before reducing the dosage to a more economical, maintenance level.

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Results

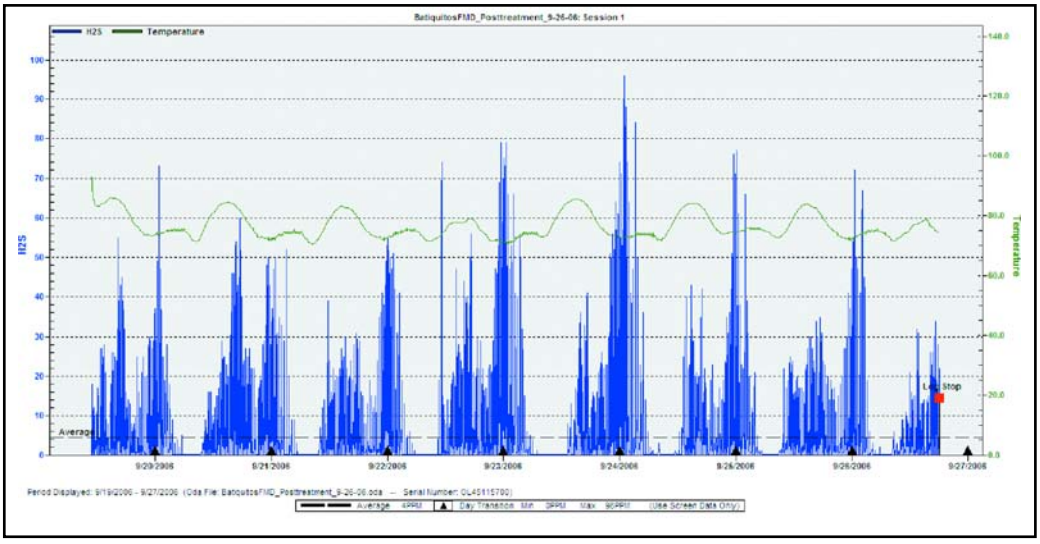
One week later, multiple liquid samples were taken from the force main discharge from mid-morning to dark. The results of the liquid sulfide readings are in chart 1.

Chart 1

Time	Dissolved Sulfides (mg/L)	pH	Comments
10:45	0.4	7.6	Sample taken 3 min after pump start
11:36	0.3	7.4	Sample taken 3 min after pump start
13:19	0.3	7.2	Sample taken 3 min after pump start
15:31	0.3	7.7	Sample taken 3 min after pump start
15:36	0.2	7.7	Sample taken 5 min after pump start
16:39	0.5	7.5	Sample taken 3 min after pump start
17:28	0.5	7.6	Sample taken approx 2 min after pump start
18:02	0.5	7.3	Sample taken approx 1 min after pump start

These dissolved sulfide concentrations compare very favorably to the baseline concentrations of 1.5 – 3.4 mg/L.

Gaseous hydrogen sulfide data corroborated the data. The average H_2S level had dropped to 4 ppm, with peak concentrations in the 60-70 ppm range. See graph 2.



Graph 2: The average H_2S level dropped to 4 ppm, with peak concentrations in the 60-70 ppm range

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While these results were certainly favorable, they were accomplished using an abnormally high concentration of M6 BioOdorStop, especially when compared to our experience at other pump stations. The dosage rate was reset to 12.5 gpd, representing approximately 15 ppm M6 BioOdorStop concentration on a daily flow basis. The readings taken one week later, produced excellent results. The liquid sulfide sample still contained only 0.3 mg/L, only 0.1 mg/L higher than the sample taken one week earlier at the high dosing level. The gaseous H_2S data was also quite good, averaging 7 ppm.

In order to further optimize M6 BioOdorStop usage for maximum cost effectiveness and performance, a variable dosing scheme was devised based on H_2S and liquid sulfide readings taken at different times of the day. By analyzing the data throughout the test period, the dosing was adjusted to match the worst levels of sulfides with a higher dosing rate. The dose rate was still to be a total 15 ppm concentration level (13 gpd) of M6 BioOdorStop. The dosing scheme was set as follows:

Chart 2

Time	**Pump 1 (52.5 GPD)** Set @ 8 gpd	**Pump 2 (95.1 GPD)** Set @ 11 gpd	**Total GPD Rate**	**Hourly Rate (gph)**
0000	ON	ON	8	0.33
0300	ON	OFF	8	0.33
0700	OFF	OFF	0	0
1000	ON	ON	19	0.8
1400	ON	OFF	8	0.33
1500	ON	ON	19	0.8
1900	ON	OFF	8	0.33
2100	ON	ON	19	0.8

During very high flow periods, the additive was completely shut off, and during high sulfide generation periods, the dosing was increased by 50%. Readings taken during the next few weeks had dissolved sulfide concentrations of 0.4 mg/L and 0.1 mg/L. Gaseous H_2S data over those two weeks had average levels of 6 and 5 ppm.

Final tests were taken twenty days after the variable dosing scheme had been implemented. The results were extremely favorable; the dissolved sulfide level in the sample taken from the force main discharge at noon was **zero mg/L**!

Most of the data taken for detailed analysis for this test was taken on a Tuesday, which had representative data for most of the other days of the week. Chart 4 shows the final H_2S data compared to the baseline H_2S data hour by hour.

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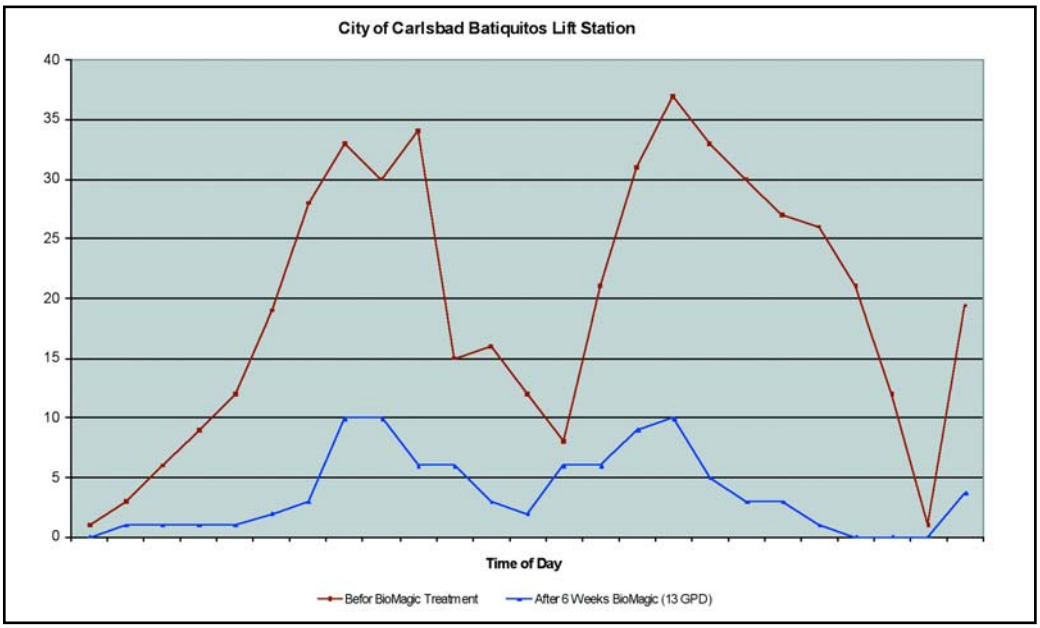

Graph 3: H_2S concentration was reduced from 19 ppm to 5 ppm, hour over hour, and the average never exceed 10 ppm as compared to the baseline hourly average of 30 ppm.

It is important to note that the average daily concentrations of the M6 BioOdorStop was kept to only 15 ppm, as desired. The goal of achieving less than 0.5 mg/L of dissolved sulfides was not only met but significantly exceeded. The creative dosing scheme provided an answer that was effective, but also economical.

About BioMagic

We develop and manufacture engineered solutions for the control and elimination of organic waste odor and the reduction of solid waste. Our products are primarily used to control odor and infrastructure damage caused by hydrogen sulfide gas and other odor-causing compounds.

Simple, effective and environmentally friendly, our solutions oxygenate the setting—accelerating the natural cycles of waste elimination. Our bio-stimulants are equally effective in liquid or solid waste conditions.

BioMagic is located in Costa Mesa, CA and can be reached at:

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