

CASE STUDY

Solids Storage Tank Odor Removal



Fogging eliminates hydrogen sulfide odors

Overview

Faced with a \$5,000 monthly cost to control odors, a 38,000-m³/d (10-mgd) trickling filter wastewater treatment plant decided to switch to a new odor-control process. The plant was handling odors from its covered solids-storage tank by injecting permanganate into the waste solids from its secondary clarifier and treating odors in the storage area headspace with chemical scrubbing. But the odors were only partially controlled.

The utility decided to replace the chemical injection and scrubber system with a carbon scrubber but needed a method to effectively treat odors during the changeover, reduce the odor load on the new carbon scrubber, and serve as a reliable backup.

CH2M Hill (Englewood, Colo.), the engineering firm that the utility hired

to find the stopgap system, tested OHxyPhogg™ odor-control technology at the plant for 6 weeks last fall. The OHxyPhogg™ system, manufactured by Parkson Corp. (Fort Lauderdale, Fla.), uses a patented air-atomizing, three-fluid nozzle, which combines ozone with a rapid application of micron-sized water particles. The result is a hydroxyl-radical fog that can be dispersed throughout the entire odorous air space, generating a large reaction surface area and oxidizing the odors. Minimum reaction time between the fog and the hydrogen sulfide is 7 to 10 seconds. The technology has been used successfully in lift stations, wet wells, covered solids thickeners and holding tanks, and other odorous spaces.

Before the test, the current practice was to inject permanganate into the solids before it entered the holding tank in order to reduce odorous compounds

inside the holding tank and an adjacent belt filter press room. Odors within the solids-storage tank were treated with caustic and hypochlorite in a concurrent low packed-media scrubber rated at 2360 L/s (5,000 ft³/min). Treated air was exhausted to the atmosphere.

In the solids tank, solids depth ranges from 3 to 5 m (10 to 15 ft), and the tank diameter is 18 m (58 ft). A 95-kW (125-hp) submersible aerator keeps the solids aerated and mixed. CH2M Hill conducted an odor analysis in 2008 and determined that the chemical scrubber was removing odors by about 66%.

During the 6-week trial of the fogging system, the permanganate dose was gradually reduced to zero in order to evaluate the system's effectiveness to eliminate odors inside the headspace.

The pilot test

The testing team determined two V150 OHxyPhogg™ units would be needed for this application and installed them outside the holding tank with six nozzles extending into the holding-tank headspace. The nozzles were positioned about 152 mm (6 in.) above the solids surface. The fogging units only have to connect to a potable water source and standard electrical outlet.

The pilot test was organized in three phases. In the first, the fogging system was activated while the existing odor-control system ran normally. In the second, the blower for the chemical scrubber was turned off while the fogging system remained in operation. In the third, permanganate injections were phased out gradually.

Hydrogen sulfide sensors were placed near the solids surface and one on the inside tank wall, where the tank and the dome cover come together. Hydrogen sulfide readings also were taken along the fence line of the plant.

Test results

The fogging system showed no effect in Phase 1, generally because the scrubber blower exhausted the hydroxyl fog from the headspace before it had time to react with the hydrogen sulfide.

But in Phase 2, the blower was turned off, allowing time for the fog to react with the hydrogen sulfide. Under these conditions, hydrogen sulfide readings

were recorded at 1.6 mg/L at the solids surface and were nondetectable at the top of the tank — normally, hydrogen sulfide levels peaked at about 2.7 mg/L inside the tank. Overall, the detection threshold for hydrogen sulfide was reduced by 81%.

In Phase 3, permanganate injection rates were reduced in stages: First, there was a 10% reduction, then 25%, then 50%, and finally the injections were completely eliminated. The scrubber blower remained off during this phase as well.

When the permanganate dose was reduced by 10%, there was no appreciable difference in performance compared to Phase 2. Odor levels remained about the same at the surface of the solids, and were nondetectable at the top of the inside tank wall.

When the permanganate dose was reduced by 25%, hydrogen sulfide concentrations increased slightly; the increases were noticeable at the solids surface but remained nondetectable at the top of the tank. Similar results were recorded when permanganate was reduced by 50% and eliminated completely.

In addition to the measurements in the solids-storage tank, hydrogen sulfide readings were collected every 2 hours for 12 hours a day at 16 different locations throughout the plant where operators normally collect data. The data showed that the odor



averages decreased significantly as the trial progressed. Furthermore, plant operators personally noticed the decrease in odors.

System performance exceeds expectations

The system demonstrated it could essentially eliminate the hydrogen sulfide odors, even when permanganate addition was suspended. The tests also showed that the fogging system would reduce the amount of odors going to the carbon scrubber and would provide an effective backup odor-control system should the carbon scrubber be taken out of service.

Odor reduction also was noted both qualitatively by odor panels and quantitatively by reduced sulfur concentrations in air samples collected and sent offsite for analyses. And with operating costs of only about \$2,000 a year — compared to \$5,000 per month for the chemical scrubbing system — the fogging system appears significantly more cost-effective than the chemical methods. ■



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