Demonstration of Ultra-S3 for the Treatment of Sulfides within Biosolids Entering a Belt Filter Press System

Abstract

Ultra-S3 was used to treat sulfides within biosolids being pumped from the anaerobic digester to a belt filter press at the Springville, Utah wastewater treatment plant. Prior to treatment hydrogen sulfide was present within the atmosphere of the belt filter press building at concentrations approaching 30 ppm without the ventilation system operating and from 5 to 10 ppm with the ventilation system in operation. This situation resulted in significant odors in addition to safety and equipment corrosion concerns. Ultra-S3 was able to lower sulfide levels within the belt filter press building to an average of <1 ppm in the air with the ventilation system off.

Introduction

Biosolids supplied to the belt filter press from anaerobic digesters at the Springville, Utah wastewater treatment plant (WWTP) contains sulfides at levels expected to exceed 30 ppm within the liquid sludge. When biosolids are pumped from the digester to the belt filter press building (BFPB) hydrogen sulfide gas escapes from the biosolids as the sludge is distributed over the belt press. This results in airborne hydrogen sulfide levels within the belt filter press building in excess of 20 ppm when the ventilation system is off and 5 to 10 ppm when ventilation is active. Additionally, the ventilation system removes the hydrogen sulfide from the building to the atmosphere immediately outside of the building that can cause odor problems in the vicinity of the plant.

A trial was conducted to control hydrogen sulfide in BFPB at Springville's WWTP by LA Chemical's Salt Lake City branch using Ultra-S3 that features a liquid catalyst to generate hydroxyl radicals when combined with an oxidant such as hydrogen peroxide. According to the EPA, hydroxyl radicals are considerably more potent than hydrogen peroxide alone or any other commercially available oxidants. The improved potency, results in very rapid and complete treatment of sulfides in wastewater and/or biosolids.

Procedure

Two chemical feed pumps were set up to inject Ultra-S3 and dilute hydrogen peroxide (7.5%) inline as biosolids were moved from the Sludge Pump Station (SPS) to the BFPB. The feed system was set up to feed the chemicals at ~ 2.5 ppm of combined oxidant to 1.0 ppm of anticipated total sulfides within the biosolids. The trial was conducted at three sludge pump rates to include 60 gpm, 70 gpm and 75 gpm. At these pumping rates, the treatment contact time between the chemical injection point and the exit to the belt filter press was 5.4, 4.7 and 4.3 minutes, respectively. The trial was conducted over a full day of treatment between the hours of 06:24 to 14:15.

Methods

Chemical injection was accomplished using two metering pumps designed to meter a range of volumes up to 10 gallons per hour each against 35 psig. The actual delivery rates for the trial approximated 5 gallons per hour of reagents. Injections were accomplished through two injection fittings installed inline on the discharge side of the sludge pumps within the Sludge Pump Station. Ultra-S3 was injected immediately up-line from the peroxide injection port.

Results were monitored using a Detection Instrument's Odalog Hydrogen Sulfide Gas Data Logger, which recorded hydrogen sulfide air sample data above the filter press every minute during the course of the trial.

In order to more completely judge the effect of Ultra-S3 on hydrogen sulfide levels in the BFPB, the ventilation sys-

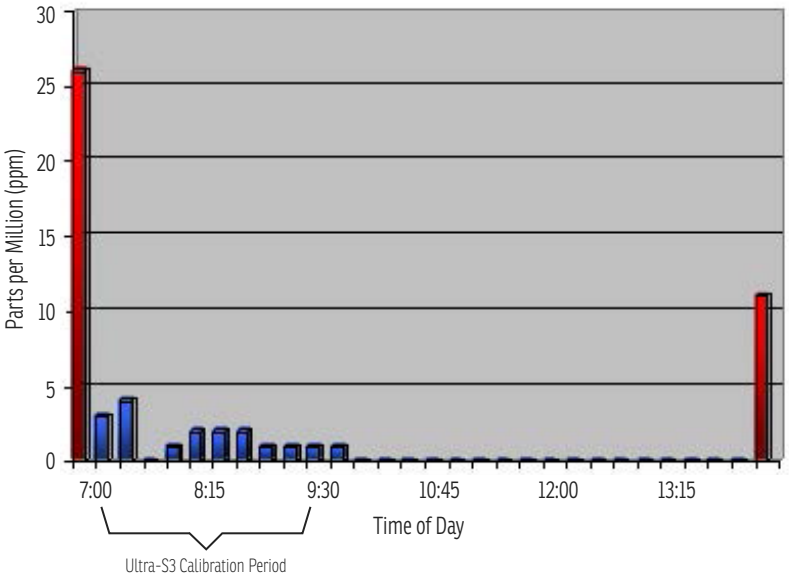
tem was left off during the course of the trial after initially ventilating the building to clear hydrogen sulfide at the start of treatment. Ventilation was turned back on after the study was complete and injection pumps shut down as hydrogen sulfide levels climbed.

Results & Discussion

The sludge system began processing on 06 December 2005 at 06:24. The initial pump rate was 60 gpm. The ventilation system in the BFPB was shut down just after initiation of solids pumping and hydrogen sulfide levels within the building rose to 26 ppm by 06:58. At this time the Ultra-S3 was turned on. The hydrogen sulfide levels slowly dropped over the next 30 minutes, leveling out at 5 ppm with lows dropping to 2 ppm. It was determined that back pressure on the metering pumps was resulting in diminished chemical feed volume to the sludge line. The pumps were recalibrated and the hydrogen sulfide levels continued to drop, reaching 0 ppm at 07:38.

Figure 1 below depicts the hydrogen sulfide levels recorded by the Odaloger at 15 minute intervals. The sludge feed rate was increased to 70 gpm at 07:52 resulting in a slight increase in hydrogen sulfide to around 2 ppm in the air. By 08:52 the levels dropped to 1 ppm and finally to 0 ppm by 10:00 where the hydrogen sulfide remained until 14:07 with the exception of a one minute interval when the sludge pump rate was increased to 75 gpm. During this minute interval the hydrogen sulfide levels only increased to 1 ppm. At 14:07 the Ultra-S3 was turned off in preparation for shut down of the sludge handling system. After the 5 minutes of time that it took for the lines to clear of treated biosolids, hydrogen sulfide levels began to climb. By 14:14 plant personnel were forced to turn the ventilation system back on as hydrogen sulfide levels climbed above the safety standard of 10 ppm.

Figure 1: Ultra-S3 Sludge Treatment Study
Springville, Utah Wastewater Treatment Plant



The blue bars indicate periods where Ultra-S3 was operating.

It was apparent that Ultra-S3 was very effective when properly adjusted and could actually eliminate hydrogen sulfide within the atmosphere of the BFPB. The process was particularly impressive when considering that 0 ppm of hydrogen sulfide within the air was accomplished with the ventilation system off.

Conclusions

This study resulted in the following conclusions.

1. The dosage rate of ~2.5 ppm of Ultra-S3 oxidant per 1.0 ppm sulfide was a correct dosage rate for treating sulfides within Springville WWTP biosolids.
2. Contact times for Ultra-S3 of 4.3 to 5.4 minutes were sufficient to accomplish effective treatment. No grease build-up was noted during the treatment.
3. It was possible to attain 0 ppm of hydrogen sulfide within the air of the BFPB during active biosolids processing while the ventilation system was off.
4. Proper use of Ultra-S3 can be an effective tool to allay concerns for safety within the BFPB.
5. It is reasonable to conclude that 0 ppm of sulfides within the atmosphere of the BFPB as a result of proper use of Ultra-S3 will significantly reduce corrosion to concrete, metal and electrical components.