Sample Successful WEFTEC "Technical-Type" Abstract

Title of Abstract

Author List

The Problem

In response to odor complaints received from residents, section of a municipality initiated a program to assess the nature of the problem. Significant amounts of hydrogen sulfide in the sewer gas were identified as the main cause of these complaints.

Goals and Objectives

The primary goal of this study was to determine how to minimize odor complaints and damage resulting from hydrogen sulfide gas buildup in the sewer. The objectives were to identify areas where hydrogen sulfide was formed and released; to determine the parameters responsible for sulfide generation and release; and to identify treatment and control approaches to minimize sulfide release and associated pipe corrosion.

The length of sewer system upstream of the study area is 8 km, including a pumping station and 5 km of force main. Pipe grades in the first section of trunk sewer in the study area vary between 0.09 % and 0.12 %. However, a section of trunk sewer where most of the odor complaints originated has an average slope of 2.9 %, with a maximum slope of 5.7 %. The average flow rate during the monitoring period was 218 L/s.

Identifying the Problem

A comprehensive sampling and flow monitoring program was conducted to determine sulfide concentrations in the sewage and sewer gas, and hydraulic conditions along the

trunk sewer. The sewer monitoring program included flow measurements, automated sampling of sewage and automated sulfide monitoring of sewer gas. Sewage samples were analyzed for total sulfide, sulfate, BOD, total sulfur and pH.

The measured data was not sufficient to identify parameters and operating conditions responsible for sulfide generation and release. Therefore, a computer model was prepared and calibrated to identify system zones of significant sulfide generation and/or release. The model was set up using industry standard equations and the physical dimensions of the sewer system obtained during the flow monitoring and sampling program. Sulfide release was estimated using the Pomeroy-Parkhurst method. Sulfide generation was estimated using Pomeroy's Z formula and the Flow/Slope relationships. The model was calibrated using the measured flow rates and contaminant loads. Based on an assessment of measured values and those obtained from the model, the following observations were made:

- Septage discharged at the pumping station increased the BOD load by approximately 100 mg/L resulting in increased sulfide generation and release downstream of the pumping station.
- Aeration of the sewage at the force main prevented sulfide formation in the force main, except during low flow conditions.
- Significant amounts of sulfide were generated upstream of Gordon Avenue due to low flow velocities, low slope and relatively long sewer section length (1.5 km)
- The largest sulfide release zone was in the residential area with the average sulfide concentration in the sewer gas being approximately 12 ppm.

Septage and industrial wastewater were identified as potentially significant factors in the generation and release of H_2S. A second monitoring and computer modeling program was performed to assess the impact of this load on H_2S generation and release. The effect of removing the septage load was assessed using the calibrated model. The results suggested that H_2S generation and release could be reduced by approximately 40 to 60 %. The utility is currently trying to identify the most effective way to manage septage and high strength industrial wastewater loads in the system.

The Solution

It is estimated that cleaning the sewer and improving the hydraulic conditions along the route could reduce H_2S generation and release by an additional 15 % to 40 %. These changes should be made, as severely corroded sections of the sewer are replaced. Monitoring should include continuous measurement of H_2S concentration in the sewer gas at key locations; composite sampling of BOD, TSS, total sulfide, pH and DO concentrations in the sewage at critical locations; and continuous monitoring of flow depth and temperature. A number of treatment options were considered. The immediate treatment approach was to increase ferrous chloride addition at the pumping station.

As a result of this study, a multi-pronged H_2S control strategy has been implemented. Action included septage and high strength industrial waste diversion, industrial load characterization and control, improved sewer design, continuous monitoring and chemical treatment.