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# Liquid $H_2S$ on-line measurement for better sewer systems insights

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**Abstract:** Hydrogen sulphide ($H_2S$) monitoring is crucial for wastewater management due to its corrosive and odorous properties. Traditional gas-phase $H_2S$ measurements have limitations, particularly in assessing downstream risks and providing accurate concentration data. This study introduces the GS1440 sensor, which measures $H_2S$ in both liquid and gas phases, offering a new standard for network and treatment plant operators. The liquid-phase measurement provides a more accurate representation of $H_2S$ concentrations, unaffected by ventilation and turbulence, thus enabling better risk assessment and mitigation strategies. This paper details the materials and methods used, followed by the results of field applications demonstrating the sensor's effectiveness.

**Keywords**: $H_2S$; Liquid-Phase Monitoring

## 1. Materials and methods

### 1.1 Sensor overview

The GSx440 sensor from Hach is designed for robust $H_2S$ monitoring in both water and air. It is suitable for hazardous locations and can be used in various applications, including sewage system, WWTP influent, sludge thickening, buffer tank management… The sensor features a corrosion-resistant stainless-steel body. It provides continuous, actionable $H_2S$ data via wireless or hard-wired connections, facilitating proactive control and optimization of $H_2S$ treatment processes.

### 1.2 Installation and set-up

The GS1440 sensor can be connected using three different methods, each suited to specific applications and environments:

- Field transmitter, operating on batteries for remote locations
- Hach sc transmitters (ex: SC4500), for advanced data management and SCADA integration
- 4-20 mA current Loop

The sensor can be mounted in a tank, pipe, or flow cell, depending on the application. Its stainless-steel body ensures durability and resistance to corrosive environments in wastewater applications.

### 1.3 Calibration and maintenance

Calibration is a critical aspect of maintaining the accuracy of the GS1440 sensor. The sensor must be calibrated before initial use and then at regular intervals to ensure consistent performance. Calibration is performed using a 1000ppm $H_2S$ gas.
Maintenance tasks include cleaning the sensor to remove any buildup of debris or biofilm that could interfere with the measurements.

### 1.4 The benefit of the $H_2S$ liquid phase measurement

Measuring hydrogen sulphide ($H_2S$) in the liquid phase offers numerous advantages over gas phase measurement:

- **Accuracy and reliability**: Liquid phase measurements provide actual $H_2S$ concentration in water, unaffected by sensor position, ventilation, or air flow. They offer consistent readings regardless of turbulence and flow, providing a more accurate $H_2S$ risk assessment.
- **Extended sensor lifetime**: Liquid phase sensors last longer in humid environments and require less maintenance than gas phase sensors, making them more durable over time.

## 2. Example of applications and results

Sensor has been applied on 3 different applications to determine benefits provided by the liquid phase measurements compare to gas phase measurements.

### 2.2 Site A

Site A, a sewer network at risk of sulfide production, uses ferrous sulfate dosing at a lift station's discharge well, with $H_2S$ produced upstream. To optimize dosing, a liquid phase $H_2S$ sensor was installed at the discharge point, controlling the dosing pump based on this measurement. A second sensor downstream verified effectiveness, testing different strategies.

Figure II.1 shows $H_2S$ measurements at the discharge point (blue curve) and downstream (red curve) under different dosing conditions. Constant dosing (middle graph) failed to neutralize $H_2S$ peaks above 1 mg/L, even with double the reagents compared to proportional dosing (right graph). Without dosing (left graph), most dissolved $H_2S$ detected at the discharge point was measured downstream 20 minutes later.

Sensor-controlled dosing (right graph) optimized chemical use and reduced downstream $H_2S$ issues. Constant dosing is ineffective due to variable $H_2S$ production. Sensor-controlled dosing improved $H_2S$ neutralization, reducing corrosion and odour while using 50% less chemicals (see Figure II.2).

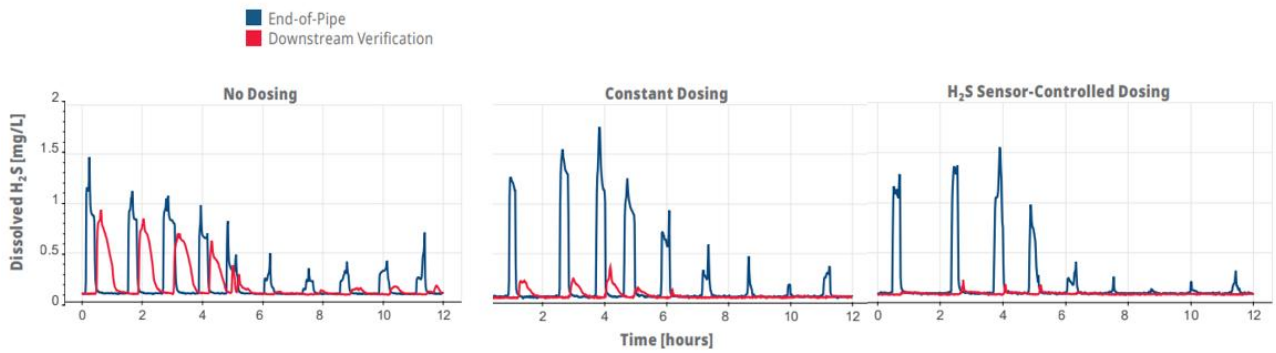


**Figure 2.1** $H_2S$ concentrations upstream and downstream dosing point

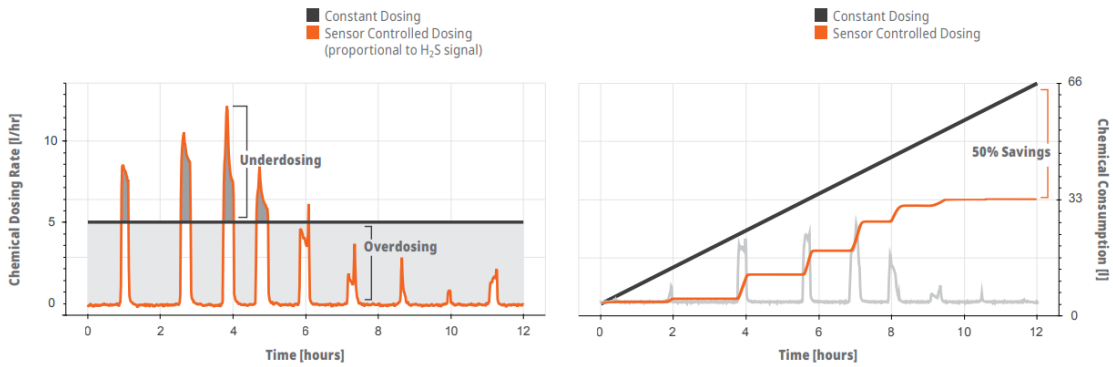


**Figure 2.2** Ferrous consumption with the different dosing strategies

### 2.2 Site B

Site B monitored incoming $H_2S$ concentrations at a municipal wastewater treatment plant with significant $H_2S$ issues. The plant receives municipal and industrial wastewater. Sensors were installed in the liquid phase of each line, providing a dynamic overview of $H_2S$ loads and insights into each line's $H_2S$ influence. Continuous pH measurements on both lines allow total sulphide

concentration calculations. Figure II.3 shows significant $H_2S$ variations, especially from the industrial effluent, which contributed up to six times more $H_2S$ during this period.

Liquid phase sensors distinguish between industrial and municipal $H_2S$ sources. This data prompted further investigations and discussions with the industrial contributor to define acceptable $H_2S$ thresholds, improving $H_2S$ management and reducing the impact on the WWTP.

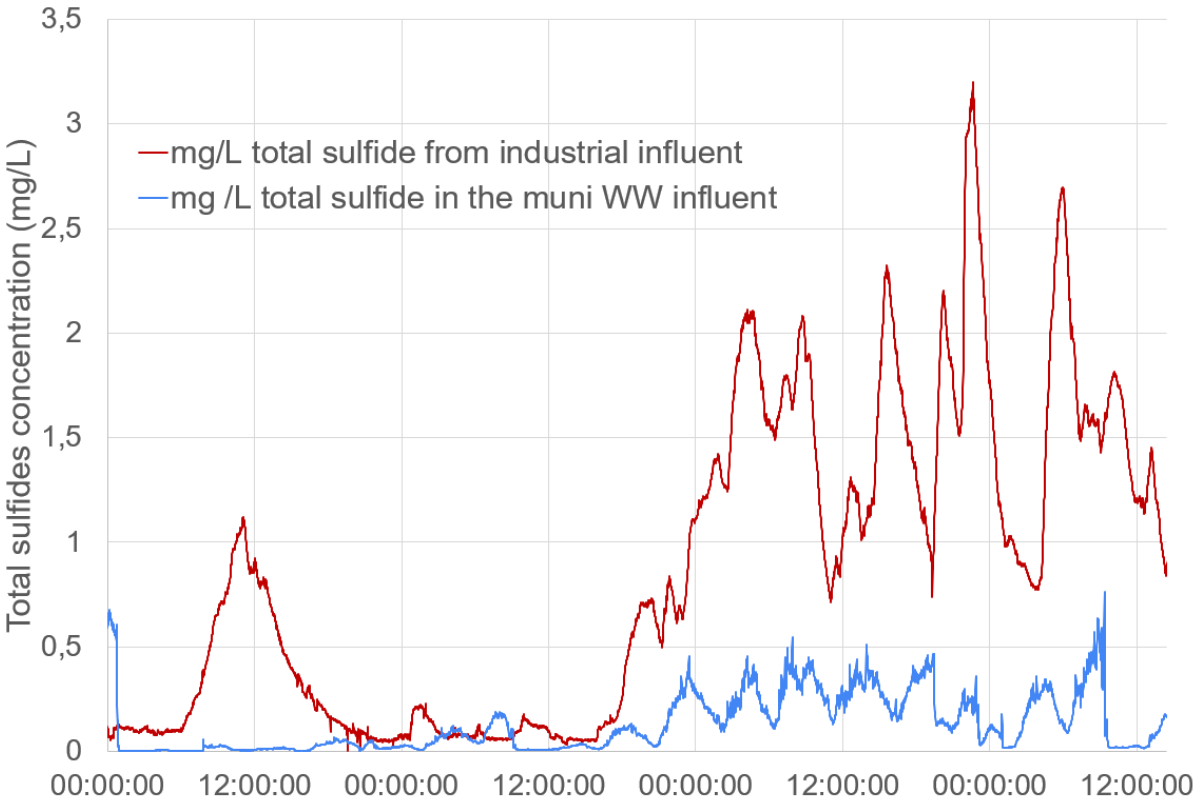


**Figure 2.3** Total sulfide concentrations in WWTP influents

### 2.3 Site C

Site C compared $H_2S$ measurements in liquid and gas phases. Two sensors were installed: one in the liquid phase and one in the gas phase at a pressurized line's discharge point. The liquid sensor was immersed in water, while the gas sensor was above the water surface.

Observations:

- Temporal occurrence: $H_2S$ peaks occurred simultaneously in both phases
- Lack of quantitative correlation: despite simultaneous peaks, no quantitative correlation was observed due to variable turbulence
- Variability in gas phase: at a constant aqueous sulphide concentration of 1.2mg$H_2S$/L, gas phase $H_2S$ levels varied from 150 to 829 ppm.

Figure II.4 illustrates $H_2S$ concentrations in both phases, highlighting gas phase variability due to turbulence.

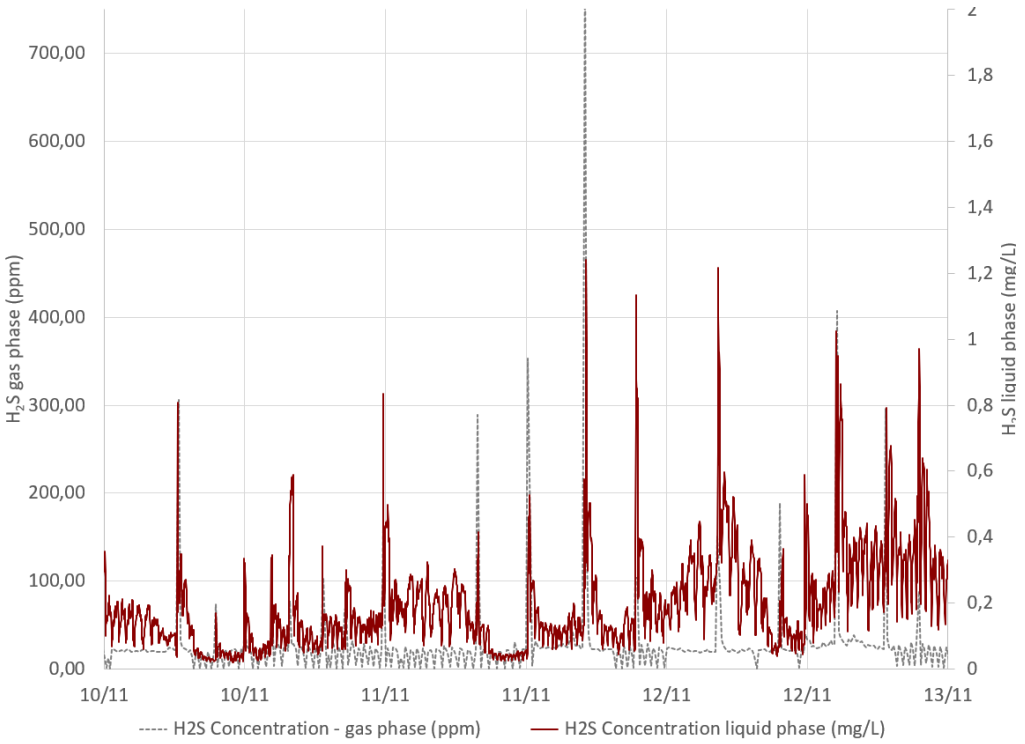


**Figure 2.4** Comparison of side-by-side liquid and gas phase measurements

## Conclusion

Measuring $H_2S$ in the liquid phase provides a robust and reliable solution for wastewater management, offering better understanding of $H_2S$ formation processes, optimizing treatments, and reducing environmental and health risks. Concrete examples and graphical data from studies clearly demonstrate the advantages of this approach over gas phase measurements.