Gas vs. Liquid H_2S Measurement

New sensor provides better H_2S insights in sewer networks

Problem

In order to properly manage their assets and operations, water utilities need to fully understand how H_2S impacts their sewer network. This requires a precise understanding of how H_2S behaves across different locations for extended periods of time.

Solution

By continuously measuring H_2S directly in or just above untreated wastewater with Hach H_2S sensors, operators can make decisions on the basis of real-time data throughout the collection system.

Benefits

- Complete and dynamic overview of H_2S challenge.
- Proactive and data-driven approach to H_2S management.
- Real-time data in SCADA & cloud.
- Reliable monitoring unaffected by external factors.
- Uninterrupted measurements.

Background

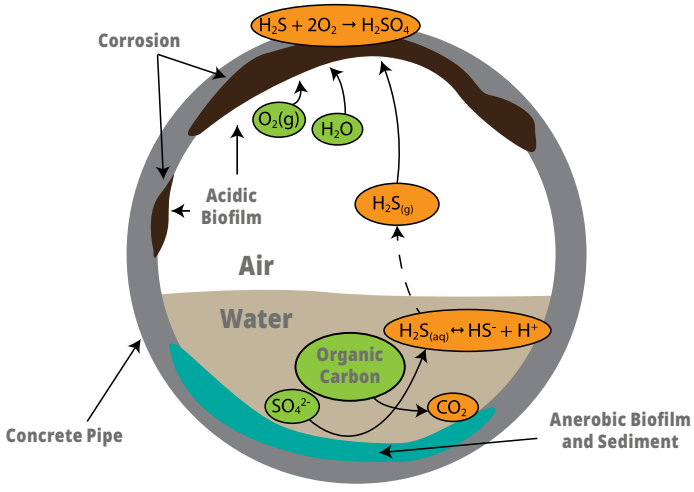
The toxic, foul-smelling, and highly corrosive gas hydrogen sulfide (H_2S) poses a major challenge to wastewater utilities. H_2S is formed when wastewater is pumped through force mains, and H_2S induced odour and corrosion issues are commonly found in hotspots right after the discharge into the gravitational sewer system. Here, part of the dissolved H_2S is released into the air, while another part remains in the sewage, where it is transported further downstream in the network if left untreated.

Challenge

Wastewater utilities typically use gas loggers to monitor H_2S concentration changes in the diluted air below manhole covers. However, seeing as H_2S is produced and transported in the wastewater and not in the air, wouldn't it make more sense to measure it in liquid?

This case study investigates if continuous, liquid-phase measurements provide a better approach to H_2S monitoring than gas-phase measurements and thereby deliver better insights into how H_2S impacts sewer hotspots.





H_2S is formed in the sewage by the reduction of sulfate. Part of the dissolved H_2S may be released to the air where it can cause corrosion after being transformed into sulfuric acid.*

** Model adapted from Hvitved-Jacobsen, Vollertsen, and Nielsen (2013) – Sewer Processes: Microbial and Chemical Process Engineering of Sewer Networks & Li, Kappler, Jiang, and Bond (2017) - The Ecology of Acidophilic Microorganisms in the Corroding Concrete Sewer Environment.*



The Hach H_2S sensor measures H_2S directly in wastewater and in the air above.

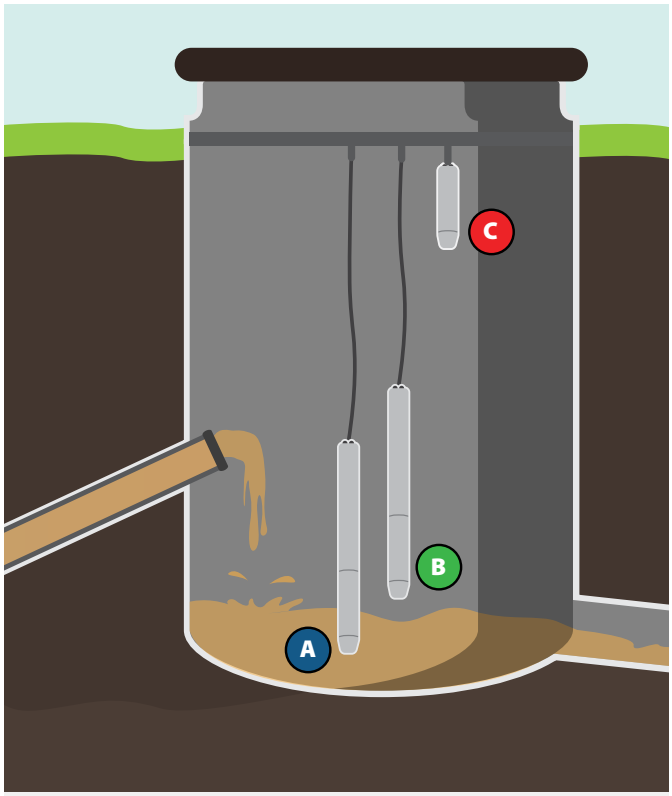
Setup

To analyse the benefits of measuring H_2S directly in wastewater, 3 Hach H_2S sensors were installed in the same 3-meter deep force main discharge well at a Danish wastewater utility. Capable of continuously measuring H_2S in both gas and liquid phase, the Hach H_2S sensors were installed in the raw wastewater (A), in the headspace just above the wastewater (B), and in the headspace just below the manhole cover (C).

Results

As seen on the graph, the liquid-phase measurements (A) provide a full overview of how H_2S impacts the sewer hotspot. The gas-phase measurements in the air above the sewage (B) were correlated with the liquid-phase measurements, while the gas-phase measurements in the diluted air just below the manhole cover (C) were unable to reveal the severity of the H_2S challenge.

The major deviation in the gas-phase data (C) suggests these measurements were heavily affected by external factors such as turbulence, ventilation, and pumping rhythms.

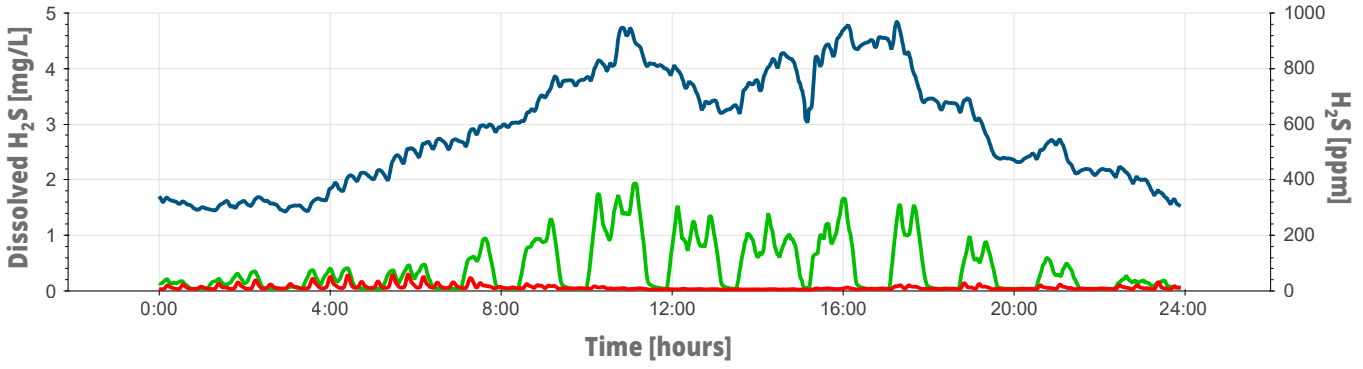


Measurement Locations

A In the wastewater (liquid)

B Above the wastewater

C Below the manhole cover



A data-driven approach to H_2S management

The Hach H_2S sensor's liquid-phase measurements reveal the true scope of a utility's H_2S challenge. This knowledge enables a data-driven approach to H_2S management for greatly improved corrosion control, optimised chemical dosing, effective root cause analysis, and optimised planning of new infrastructure projects. Finally, the Hach H_2S sensor's unique ability to measure both in and above wastewater makes it a flexible tool suitable for odour detection campaigns as well.

Liquid-phase H_2S measurements provide better insights that enable you to...

- **Make data-driven decisions** when prioritising H_2S management activities.
- **Minimise H_2S odours** by focusing odour control activities on confirmed hotspots.
- **Extend the lifespan of assets** and prevent critical infrastructure collapse
- **Optimise chemical dosing stations** using direct H_2S sensor-controlled dosing–or by verifying the effect of your dosing efforts with downstream control measurements.
- **Solve H_2S problems at the source** by mapping individual sewer lines.
- **Prevent planning errors** caused by a lack of knowledge or underestimation of the H_2S challenge.

