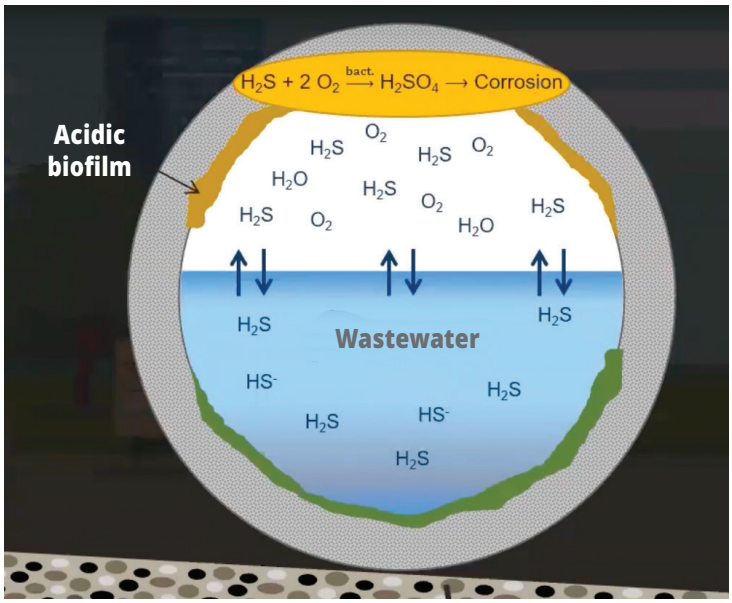
Gas vs. Liquid Measurement: A New Phase Of H_2S Management



Summary

For many aspects of wastewater collection and treatment, there can be multiple routes to achieving desired results. In the case of hydrogen-sulfide (H_2S) measurement, an exclusive sensor that is equally accurate in liquid-phase and gas-phase measurements has created entirely new ways to assess hydrogen-sulfide concerns. Here is how that offers wastewater professionals more cost-effective opportunities for measuring and managing their H_2S issues.

The Value Of Liquid-Phase Measurement

Wastewater professionals concerned about worker safety, odor control, and corrosion issues related to H_2S typically have experience with gas-phase sensors. But the attributes and functionality of liquid-phase sensors are now causing them to reassess current gas-phase-sensor limitations in the pursuit of reliable readings for more productive hydrogen-sulfide control.

- **More Consistent, Comprehensive Readings.** Unlike gas-phase sensors that can provide highly variable representations of the H_2S load in wastewater—depending on where they are mounted and how H_2S gas diffuses from the water into the headspace above it (Figure 1)—liquid-phase sensors provide a consistently more reliable overview. That means always knowing the H_2S load in the wastewater at any sampling location, at any point in time—even as concentrations continue to change with new influent.
- **Continuous Monitoring And Control, Anywhere.** The ability to identify the concentration of dissolved H_2S in any wastewater environment on a continuous basis—via hard-wired or cloud-based connections—provides the insight to empower smarter decisions. That includes addressing worker-safety concerns in potentially hazardous environments, identifying the potential for emerging odor problems before they become a public nuisance, protecting infrastructure from corrosive effects, and meeting regulatory mandates.

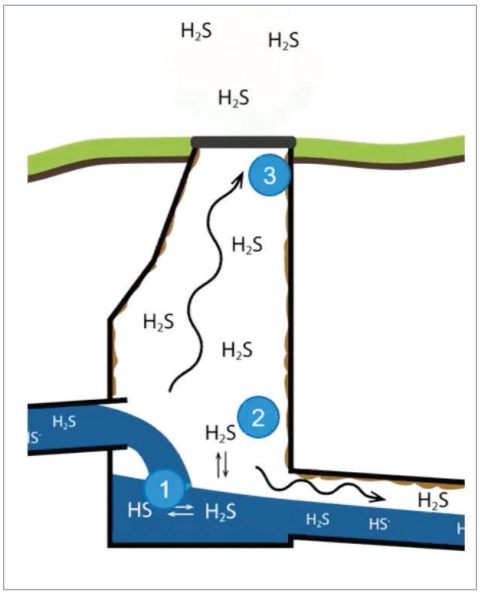


Figure 1. Liquid-phase measurement directly in the wastewater (1) is naturally more reliable as an indicator of the total hydrogen-sulfide presence at a sampling location than gas-phase sensors mounted in the headspace between the water's surface (2) or the top of an enclosure (3). Also, having that accurate measurement farther upstream in a collection system enables wastewater administrators to remediate problems sooner and protect downstream equipment and personnel.

- **Greater Flexibility.** A rugged, portable sensor (Figure 2) located directly in the wastewater can fulfill a variety of needs for permanent installations or periodic spot-checking of collection-system and wastewater treatment plant conditions. Some of the more desirable locations to monitor include:
  - ***Lift Stations And Manholes.*** Measuring individual lateral lines coming into a collection-system manhole or pumping stations can help to pinpoint the origins of the H_2S and enable cost-effective preventive or remedial steps to be taken closer to the source, and only when needed. Also, because water turbulence tends to release more of that H_2S into the airspace, being able to adjust chemical dosing according to the precise hydrogen-sulfide concentration helps to limit the risk of odor or worker-safety problems there and farther downstream.
  - ***Force-Main Discharge Points.*** This is a common problem area because longer hydraulic retention times (HRTs) tend to increase hydrogen-sulfide concentrations. Being able to pinpoint those concentrations despite changes in HRT or seasonal temperatures can help to optimize control in this turbulent-water environment.
  - ***WWTP Headworks.*** Just like lift stations with multiple inflows, headworks locations with multiple incoming lines can benefit from measuring hydrogen-sulfide concentrations in each to pinpoint sources and optimize control.
  - ***WWTP Hotspots.*** Other WWTP locations to benefit from more accurate liquid-phase detection include primary clarifiers, aeration tanks, and anaerobic digesters. High-reliability readings there can be used to prevent odor problems, scaling, or concerns over chemical dosing disrupting treatment processes such as chemical phosphorus removal or chemically enhanced primary treatment (CEPT).
- **Lower Maintenance.** Unlike competitive gas-phase sensors that demand backup inventories and scheduled maintenance activities for rotating them in and out of service at high-exposure applications, a liquid-phase sensor provides continuous, reliable readings without intervention. That is true even in challenging operating environments with anaerobic conditions and 100-percent humidity. Robust construction and simple field-calibration steps ensure years of accuracy with minimal maintenance attention.



Figure 2. This compact, low-maintenance, electrochemical sensor—with stainless-steel housing, anti-fouling design, and sealed industry-standard connections (shown in callout)—provides robust performance for submerged wastewater as well as gas-phase applications. It delivers ± 5-percent accuracy with a detection limit of 1 percent of full range. The same sensor can report in milligrams per liter (mg/L) for liquid measurements and parts per million (ppm) for gas/air measurements. Standard bracket assemblies (inset) provide for quick and convenient mounting in typical manhole locations.

Building Stronger Hydrogen-Sulfide Management Strategies

With the versatility, accuracy, and reliability of liquid-phase hydrogen-sulfide sensors, entirely new strategic options for protecting worker safety, minimizing odor complaints, and protecting wastewater infrastructure from corrosion are now available to collection-system administrators and WWTP operators.

- **Create More Practical Insight.** Because concentrations vary from the liquid phase to the gas phase at the top of a manhole or WWTP basin, having the ability to monitor the highest concentrations in the water—automatically and continuously—maximizes a utility's ability to manage all related aspects of collection-system and WWTP operation. Low-maintenance sensors permanently installed in the wastewater flow and seamlessly integrated into existing SCADA or PLC systems—or enabled by battery-powered remote-monitoring devices connected to the cloud—can extend that control to remote locations wherever hydrogen-sulfide problems exist (Figure 3).
- **Adjust Chemical Dosing Automatically.** Continuous liquid-phase monitoring for H_2S at known problematic locations enables finely tuned control over chemical feed systems to dispense only the volume needed to neutralize the specific problem at that specific point in time.
- **Cut Operating Costs.** Overdosing with ferric chloride or other chemicals can drive operating costs up without any added benefit. Matching dosing to the hydrogen-sulfide concentrations in specific water streams provides optimum control at the minimal necessary cost. Equally important, low maintenance requirements and long-term installation life relieve pressures regarding staffing costs or scheduling concerns.
- **Protect Biological Processes.** Continuously monitoring incoming wastewater to automatically adjust chemical-control treatments according to fluctuating hydrogen-sulfide concentrations will protect downstream biological functions against disruptions caused by high residual concentrations.
- **Identify And Track Problematic Sources.** By simplifying continuous monitoring closer to the source of H_2S problems—force-main discharges, WWTP headworks, spikes from industrial customer discharges, etc.—remote-sensor, liquid-phase measurement makes it easier to identify and establish more finite control. Also documenting problematic customer discharges into the collection system can establish a basis for mandating pretreatment of problematic discharges or justifying surcharges for exceeding allowable limits of H_2S-inducing content such as high sulfate content or biochemical oxygen demand (BOD).

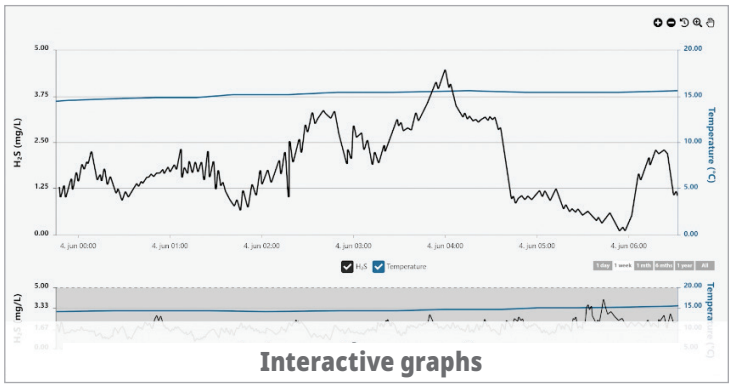


Figure 3. Remote-access options for continuous liquid-phase monitoring can provide operators with minute-by-minute, drill-down visibility into highly accurate H_2S status by time and temperature including color-coded dashboard views for easy identification of emerging problematic hotspots.

World Headquarters: Loveland, Colorado USA | hach.com

United States **800-227-4224** fax: 970-669-2932 email: orders@hach.com
Outside United States **970-669-3050** fax: 970-461-3939 email: int@hach.com

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