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H2S hazard lethal and unpredictable

By Stephanie Leonard

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Signage is part of risk communication. Using gas monitors are among best practices for safe manure handling.

Photo by Stephanie Leonard



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If storing, hauling or applying liquid manure is on your list this fall, protecting personnel and livestock must be top priority.

The hazard is hydrogen sulfide (H₂S) — a heavy, colorless gas with no warning properties at unsafe concentrations. H₂S is produced by bacteria that digest manure and organic matter.

In undisturbed slurry, H₂S remains dissolved in the liquid, with concentrations in the surrounding air typically undetectable or a few parts per million (ppm). It has a characteristic rotten-egg odor at low concentrations.

But when manure is disturbed or transferred, H₂S breaks through the slurry surface into the air (like when you shake a bottle of your carbonated beverage before opening it). During agitation and pumping, H₂S is released in bursts. In a matter of seconds, airborne concentrations can increase a hundred- to a thousand-fold, with deadly consequences.

Safe manure handling

- Plan pumping when there's a cross wind, 7-10 mph minimum.

- Remove animals if possible; if not possible, observe animals for distress.

- Open the building for maximum ventilation. Use intrinsically safe portable fans if available.

- Work with a partner.

- Cover or barricade pit opening to prevent falls.

- Wear personal H₂S gas monitors; leave area when alarms indicate concentrations rising!

- Use a H₂S monitor near pump to inform agitation speed and warn of high concentration.

- Don't agitate until manure level is 1.5-2 feet below slats; this allows headroom for H₂S below the slats.

- Agitate slowly to avoid rapid high bursts; H₂S is often highest at onset of agitation and when pump nozzles are above the manure surface.

- Keep nozzles below manure surface. Don't agitate with upper jet at or above surface.

- Shut off agitator when H₂S levels rise over alarm set-points; let H₂S disperse.

- Stop agitation when manure level is within 6 inches of bottom nozzle.

- Don't get on top of or inside a tank to inspect levels or fix problems.

- Don't get down to floor or slat level to inspect problems.

‘Knock-down’ effect

H₂S concentrations over 5 ppm cause increasingly severe health symptoms and outcomes: from headache and eye irritation, to disorientation, to collapse, loss of consciousness, and death. At 100 ppm, the concentration deemed Immediate Danger to Life and Health, H₂S is not detectable by smell.

At 500 to 2000 ppm — levels that have been documented during agitation and pumping — the effects can be lethal to people and livestock nearby.

H₂S is heavier than air, accumulating in low areas like pits and along floors. Over the past 40 years, many H₂S-related human and livestock deaths involved deep pits in swine or dairy buildings.

Common scenarios have included entering pits to perform maintenance work or retrieve objects that fell through slats. Scores of incidents have involved multiple fatalities of unprotected, would-be rescuers — often family members — who didn’t recognize the hazard and were also overcome.

More recently, H₂S-caused deaths and close calls have occurred during stirring and pumping at open lagoons, and in or atop liquid manure tanks used in field application.

What do these calamities have in common? The imminent risk was unrecognized, and individuals were unprotected.

Risk factors

Poor-quality well water and high-sulfur-containing dietary ingredients — e.g., distiller’s grains, gluten and syrup — can increase sulfur excreted from animals, resulting in greater H₂S content in manure.

Environmental factors, including agitation and stirring practices, ambient temperature, wind currents and supplemental ventilation, affect the release rate and dispersion of H₂S.

Despite these known contributing factors, there is no formula to accurately predict risk vs. no-risk. And building configuration or past experience do not predict future safety.

In fact, most accounts of animals down or lost and human fatalities occurred after many successfully uneventful experiences. “Never had a problem before” may be a reason people mistakenly presume that risk doesn’t exist at their own operation.

Gas monitors

The only way to confirm dangerous conditions is to use direct-reading gas monitors specific for H₂S. Options range from low-cost, single-gas personal monitors that clip to the collar to multi-gas data-logging monitors that read H₂S, oxygen, explosive gases and carbon monoxide. Monitors provide continuous detection with audible, vibrating and visual alarms that alert the wearer to leave the area.

The easiest-to-use single-gas H₂S models have a 2-year sensor life and are virtually maintenance-free. They display “service life remaining” (in months) but lack real-time concentration readouts.

For manure handling activities, a better option are monitors with visual and audible alarms that display real-time H₂S ppm concentrations when gas is present. Real-time ppm display is important because concentrations change rapidly during pumping and with distance from the source. Users can observe display readings and factor them into their decision-making. When no H₂S is present, the monitors display service life remaining.

Two examples are GasClip Technologies' Single Gas Clip Plus Hydrogen Sulfide (SGC-P-H) and Honeywell BW Clip Real Time H₂S. They alarm at preset levels, display concentration up to 100 ppm, have 2-3-year service life, and can be "hibernated" off-season. Costs are under \$200.

Will the monitor respond when you need it?

Most manufacturers advise "bump testing" before each use; this involves applying gas with a known H₂S concentration to the monitor to confirm that alarms function and the sensor readout is accurate. Doing a bump test is like switching on your flashlight to make sure the bulb and batteries work before taking it into the dark basement during an outage!

H₂S monitors and accessories for bump testing are available through local and online safety supply stores and some local manure handling equipment dealers.

Safe manure handling starts with recognizing and respecting this hazard. It follows with best practices accounting for environmental conditions, agitation techniques, communication, gas-detecting monitors and knowing that the only respiratory protection for H₂S is an atmosphere-supplying (SCBA) respirator.

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