

## Hydrogen Sulphide Emissions and Safety

Hydrogen sulphide ( $H_2S$ ) is produced when manure undergoes anaerobic (absence of oxygen) fermentation. Hydrogen sulphide is produced continuously in all un-aerated manure storage systems, including shallow barn gutters, underground storage tanks or outside manure storages.

Hydrogen sulphide is considered both an odour nuisance and a health hazard. Hydrogen sulphide is a deadly gas if people are exposed to a high concentration. It is also a corrosive gas, which can cause corrosion and deterioration of concrete structures of livestock buildings and equipment.

The concentration of hydrogen sulphide is usually very low in livestock buildings compared with other gases like ammonia, but when manure stored inside livestock buildings is agitated, large amounts of  $H_2S$  can be released in a short time.

### Characteristics

Hydrogen sulphide is heavier than air, soluble in water, and can accumulate in underground pits and unventilated areas of livestock buildings. It has a rotten-egg odour and can be easily detected at low concentrations (well below one part per million in air).

**Table 1. Hydrogen sulphide and health hazards**

Concentration (ppm)	Health Response
0.01 - 0.7	least detectable odour
3 - 5	offensive odour
10	eye irritation
20	irritation to mucous membranes and lungs
50 - 100	irritation of respiratory tract
150	nose nerve paralysis
200	headache, dizziness
500 - 600	nausea, excitement, unconsciousness
700 - 2,000	fatal

### Occupational contamination limits

The American Conference of Governmental Industrial Hygienists (ACGIH) defined Threshold Limit Value (TLV) as an estimate of the average safe airborne concentration of a substance, which represents conditions under which it is believed that nearly all workers may be repeatedly exposed to day after day without adverse effect.

Threshold Limit Value (TLV) for hydrogen sulphide in Alberta:

- long-term exposure (8 hours): 5 ppm
- short-term exposure (15 minutes): 10 ppm

### Hydrogen sulphide detection

Hydrogen sulphide is an extremely poisonous gas, so appropriate detection equipment should be available in livestock buildings, specifically during manure agitation and pumping.

A variety of detection equipment is available such as gas detector tubes, continuous monitors, personal monitors and portable monitors. Some of these monitors are simple to use while producers may need some training to calibrate and use others.

Monitoring should be conducted from outside the buildings by using a gas detector tube with an extension hose to avoid the possibility of breathing highly toxic hydrogen sulphide. The detector tube must be specific for the gas to be measured (hydrogen sulphide). While reaching through a window or other opening, place the detector tube near floor level and use the vacuum pump to draw air into the tube. Remove the detector tube and read the gas concentration (NASD).

## Options to reduce emissions from livestock buildings

1. Modifying livestock diets to balance rations reduces hydrogen sulphide emissions.
2. Frequent removal of manure from static pits significantly reduces hydrogen sulphide.
3. Physical (aeration), chemical (manure additives and oil sprinkling) and biological (biofiltration) treatment of stored manure reduces emissions.

## How to protect yourself from exposure

1. Provide strong ventilation during agitation and pumping. The building interior should be off limits to people. If possible, livestock should be removed from the facilities (Farm Safety Association).
2. Keep the agitator below the liquid surface. Gas will be released in greater volumes if vigorous surface agitation occurs.
3. If possible, lower the level of liquid manure in the storage facility before commencing agitation. This step will further reduce the possibility of gas being forced above floor level.
4. Never allow the manure pit to fill completely. Allow one to two feet of air space to accommodate concentrations of gas.
5. Do not enter a manure storage pit without respiratory protection, especially when high concentrations exist, such as during agitation and pumping of manure.

## Summary

Producers need to be aware and informed of the dangers of being exposed to hydrogen sulphide for long periods. Use all necessary measures to protect yourself against exposure, and seek medical help if you experience any symptoms or illness related to exposure to noxious gases.

### For more information, consult the following:

Standard Safety and Consulting, Edmonton.  
<http://www.ssafety.com/training.htm>

Farm Safety Association and Saskatchewan Department of Labour

National Agricultural Safety Database (NASD)

Nordstron, G.A.: J.B. McQuilty: "Manure Gases in the Animal Environment." University of Alberta – 1976

### Prepared by:

Atta Atia, PhD. – Manure Management Specialist