

# Work safely around liquid manure

Kelley J. Donham MS, DVM, professor of Occupational and Environmental Health and director of Iowa's Center for Agricultural Health and Safety, the University of Iowa

**Question: What do a bottle of Champagne and a pit of liquid manure have in common?**

**Answer: When they are agitated, they off-gas rapidly.**

## Why is that?

There is gas stored in liquid. In champagne, it is harmless carbon dioxide. In liquid manure, it is highly toxic hydrogen sulfide (H<sub>2</sub>S). When champagne (or other carbonated beverage) or liquid manure is exposed to the air, a small amount of gas in the liquid phase diffuses into the air – slowly.

**Figure 1**

### How are a bottle of champagne and liquid manure alike?

- Agitation results in rapid release of gas from the liquid.
- Harmless carbon dioxide comes from champagne (or beer or pop).
- Hazardous hydrogen sulfide comes from liquid manure



However, agitation dramatically increases the surface area of the liquid allowing the gas to escape rapidly. Agitating liquid manure in a confined space increases the risk of H<sub>2</sub>S rising to acute toxic levels. This fundamental event has produced more than 20 human fatalities in Iowa and numerous swine fatalities over the past two decades.

## Why is H<sub>2</sub>S so hazardous?

At high concentrations (above 500 ppm), H<sub>2</sub>S is a general toxic to all body cells, but especially brain cells. One breath can cause a person to fall unconscious and stop breathing. H<sub>2</sub>S also is an irritant and can cause the lungs to fill up with fluid.

Most buildings never reach these sudden toxic levels unless manure is agitated. Although H<sub>2</sub>S has a characteristic “rotten egg” smell, one cannot rely on this as a warning as it paralyzes the sense of smell.

## I-CASH Research on H<sub>2</sub>S poisoning

In 1980, I investigated a case in eastern Iowa where three members of a farm family died while trying to pump out an underground manure storage tank. Two sons succumbed while trying to rescue their father, who went into the tank to investigate a pump malfunction.

I was on the scene the next day to investigate. This event challenged us to research these situations so they can be prevented in the future.

The following is a synopsis of our research:

1. Fatal toxic events in pork producers have occurred under the following situations:
  - Entering a building with a deep pit (4–8 feet) while agitating or just after agitating
  - While power washing a building, water ran into the pit causing agitation resulting in a toxic event
  - Entering a manure pit or other above- or below-ground storage following agitation
  - Entering a sump pit or junction box to repair a pump or blockage
  - Entering a liquid manure wagon (honey wagon) for a repair or to retrieve an object
  - Pulling the plug to drain a pit into an adjacent holding tank, H<sub>2</sub>S flowed back into the building through the drain
2. Acute toxic events are caused by H<sub>2</sub>S. Other gases may accompany H<sub>2</sub>S, but are not the primary toxin.

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3. Nearly half of deep pits have the possibility to cause an acute toxic event when agitated, even with the ventilation fans running.
4. The following factors increase the risk for a toxic event:
  - The more agitation – the more gas comes off
  - High sulfates in your well water (greater than 250 ppm) may cause high levels of hydrogen sulfide in your manure
  - If the manure has an acid pH (below 7), there will be more potential for gas to come out of the manure
  - Deep pits (4–8 feet) are more potentially hazardous as it takes anaerobic (no oxygen) conditions for the bacteria in the pit to make hydrogen sulfide
  - Pits are most hazardous in the spring and early summer as more H<sub>2</sub>S is produced at warm temperatures
  - Never trust past history. If a toxic situation has not happened for the past 10 years in a given pit, it might happen the next time

## How do you prevent these acute toxic conditions from happening on your farm?

When agitating liquid manure in a confined space, be aware that a lethal situation may develop anytime. Never go inside a building with a deep pit underneath when agitation is ongoing, or for an hour afterwards. The usual respirators (dust mask or chemical cartridge mask) will not protect you from high levels of H<sub>2</sub>S. The more the manure is agitated, the greater the potential hazard. **Agitate as little as possible to empty the pit.** Observe the pigs from outside the building. Stop agitating immediately if the pigs become restless and agitated.

If the pit cannot be emptied without causing harm to the pigs, you can check the acidity of the pit (use pH paper on the end of a pole). pH paper can be obtained from pH ion Co. <http://www.ph-ion.com> or Micro Essential Laboratory <http://www.microessentiallab.com>.

If the pit is acid (below 7), you can add slacked (hydrated) lime (available from most lumber yards) at 500 lbs. to an average-sized (800-sq. ft.) pit. Start agitating slowly once more.

Figure 2

### Agitation of liquid manure + confined space = big risk

- These are examples of confined spaces where fatal situations have developed.



Do have the ventilation on at full level when pumping.

Check the level of sulfates in your well water. If they are above 250 ppm and you have trouble, you may have to find another water source (e.g., rural water or a new well).

If possible, empty the pit three to four times annually. Empty the pit during cool weather if possible.

Always avoid any situation where you may be in a confined space when liquid manure may be agitated.

Fortunately, we hear less frequently today about cases of hydrogen sulfide poisoning in swine producers. We think it is because producers are much better educated about this hazard. However, these preventable tragic events still do happen.

Handling liquid manure is like handling a loaded gun. If you respect the gun and always operate like the gun is loaded, then you, your family and workers should be safe also.

## Questions??

Contact Dr. Donham at (319) 335-4190 or at [kelly-donham@uiowa.edu](mailto:kelly-donham@uiowa.edu).

