



Manure Storage Hazards

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Storage of animal manure is a common practice on Pennsylvania farms. Dairy, beef, swine, and veal producers use manure storage systems when wet or cold weather, and/or a lack of time for field application, prohibits spreading.

Of the two types of manure storage systems, below-ground storage is more hazardous than above-ground storage. Storage that is covered by slotted floors, or has a storage lid or cap, is more hazardous than those without a cover. Examples of storages that are potentially the most dangerous include those under buildings or directly beneath livestock, and pump-out pits. Tragically, when accidents do occur, they likely involve multiple fatalities. There have also been instances where livestock have perished due to manure gas.

Manure storage hazards include toxic and oxygen displacing gases such as hydrogen sulfide, ammonia, carbon dioxide, and methane. Toxic manure gas hazards exist with covered pit storages and are most severe when the manure is being agitated, pumped, or following emptying if the pit is still covered. At other times, toxic gas production is low and ventilating fans or natural air movement prevent hazardous gas

levels from developing. This is because of adequate oxygen levels and the dispersion of the toxic gases through air movement.

Hydrogen sulfide is the most dangerous manure gas. It is colorless, heavier than air, and can cause death within seconds at high concentrations. Hydrogen sulfide has a rotten egg odor, often detectable at lower levels. However, the human sense of smell is deadened from concentrations at less than lethal levels. Additionally, the smell of hydrogen sulfide is often masked by other smells common to livestock facilities. Hydrogen sulfide levels may increase a thousand-fold during

agitation and emptying and it is found around most manure storage, both human and animal.

Carbon dioxide is a nontoxic gas, but it replaces oxygen and therefore causes asphyxiation. Because it is colorless and odorless, carbon dioxide is only detectable by gas detection equipment. Being heavier than air, it usually accumulates near the bottom of a manure storage. Carbon dioxide is not usually found at lethal levels unless all ventilation into and around a pit has been eliminated for several hours.



Figure 1. Warning signs such as this example should be placed at all entrances to manure storage pits.

Ammonia may cause severe burns to the eyes, throat and lungs when it combines with mucous membrane moisture and forms an alkaline base. Ammonia is lighter than air and has a strong bleach smell. Because it is an irritant, victims usually leave the area quickly. While it is not suspected of causing death, continuous low-level ammonia exposure can cause irritation to the respiratory system and difficulty with vision.

Methane is highly flammable and explosive. It is odorless and colorless and impossible to measure without gas detectors. Methane is lighter than air and rises readily from storage areas. It can collect under hoods, roof ridges and corners and usually accumulates during hot weather in poorly ventilated storages or buildings. Methane explosions may result from lighted torches and electrical wires shorting out.

To minimize manure gas hazards, farmers should:

- ☐ keep people and animals out of confinement buildings during storage agitation and emptying
- ☐ ventilate for several hours following pumping activities
- ☐ equip ventilation systems with alarms to warn of a failure
- ☐ provide auxiliary ventilation should power fail
- ☐ allow one to two feet of air space to accommodate toxic gases
- ☐ keep manure agitators below the liquid's surface
- ☐ use gas traps for emptying pipelines and keeping gas from back-flowing into buildings
- ☐ eliminate smoking, open flames or electric sparks near manure storage areas.

Emergency rescues from manure pits are a no-win situation. When a person collapses into a pit, toxic gas levels may be extremely dangerous for entrance without a self-contained breathing

apparatus (SCBA). The only safe procedure is to ventilate the manure storage and wait for rescuers who have the proper equipment. Barn fans or silo blowers can be used for ventilation, however, do not lower them into the pit because methane gas may explode due to an electric spark.

The only potential hazard normally associated with open systems such as lagoons and above-ground tanks is drowning (See Fig. 2). Uncovered ground level storage should be fenced to protect people and animals. A hardened surface may develop during extended dry or cold periods. When the crust

softens, people or animals may suddenly fall through. Never leave ladders leaning against manure storage walls since a person could accidentally fall off the ladder into the tank and drown.

Guidelines developed by NIOSH suggest the following before you enter this type of confined space (NIOSH Pub. No. 90-103):

- ☐ all manure pits should be ventilated
- ☐ the atmosphere within the manure pit should be tested before entry
- ☐ a standby person should be in constant contact and ready to lift the worker to safety with mechanical lifting equipment, including a winch, hoist or pulley
- ☐ anyone entering a manure pit should wear a safety belt or harness with a lifeline tied to the mechanical lifting equipment

Remember: Warn visitors and guests about manure storage hazards. You are legally responsible for their health and safety while on your farm.



Figure 2.