

NB 210-15-9 ENG – Safety Risk From Manure Storages of Dairy Cows Bedded with Gypsum

National Bulletin: 210-15-9

Date: July 14,
2015

Subject: ENG - Safety Risk From Manure Storages of Dairy Cows
Bedded with Gypsum

Purpose. To provide a fact sheet on the safety risk from manure storages of dairy cows bedded with gypsum.

Expiration Date. September 30, 2015

Background. Safety must be a primary consideration in managing animal waste. It must be considered during planning, siting, and designing of agricultural waste management system (AWMS) components, as well as during the actual operation of handling wastes. The operator must be made aware of safety aspects of any waste management system and the AWMS components under consideration. The potential for an accident with waste management components is always present.

On September 17, 2012, two young boys temporally lost consciousness while riding their tricycles near an open manure storage tank that was being agitated for pump out. The investigation pointed to the likelihood that the event was caused by increased production of hydrogen sulfide as the result of the use of gypsum for bedding. Gypsum is a very soft sulfate mineral composed of calcium sulfate dihydrate. Following the incident in 2012, NRCS worked with Penn State University on the investigation of the incident.

Explanation. A variety of gases can be generated in the operation of an AWMS that can cause asphyxiation, poisoning, and explosions. Manure gases can accumulate when manure is stored in environments that do not have adequate ventilation, such as underground covered waste storage tanks. Waste storage facilities and lagoons placed in open environments also store and release gases, especially during agitation. These gases can reach toxic concentrations and displace oxygen. The four main gases are ammonia (NH₃), carbon dioxide (CO₂), hydrogen sulfide (H₂S), and methane (CH₄).

Hydrogen sulfide is a deadly gas. Hydrogen sulfide is the most dangerous of the manure gases and can cause discomfort, headaches, nausea, and dizziness. At levels above 200 ppm, collapse, coma, and death due to respiratory failure can occur within seconds after only a few inhalations (http://www.safetydirectory.com/hazardous_substances/hydrogen_sulfide/fact_sheet.htm). Humans and farm animals have been killed by this gas after falling into or entering a manure tank or being in close proximity of a manure storage facility during agitation. Although only small amounts of H₂S are produced in a manure tank compared to the other major gases, this gas is heavier than air and becomes more concentrated in the tank space over time.

Hydrogen sulfide is produced by anaerobic decomposition of organic wastes. It has the distinct odor of rotten eggs at low concentrations but cannot be detected at higher concentrations because it overpowers the sense of smell. Hydrogen sulfide deadens the olfactory nerves (the sense of smell); therefore, if the smell of rotten eggs appears to have disappeared, this does not indicate that the area is not still contaminated with this highly poisonous gas.

Agitation of liquid wastes to facilitate transfer and other waste management functions is a common practice in an AWMS. When liquid waste storage facilities are agitated in preparation for pump out, high concentrations of H₂S can be released. As H₂S is heavier than air, it will build up in the area overhead of the mixing activities and may drift downward adjacent to the storage tank. This activity may release large quantities of noxious gases and create dangerous and possible lethal conditions even with maximum open air ventilation.

The attached Penn State Extension brochure provides background and findings from on-farm monitoring of dairies using gypsum as stall bedding where a link has been found to highly toxic levels of hydrogen sulfide gas during manure movement and agitation. Penn State University also sponsored a webinar on the topic that can be viewed at <https://meeting.psu.edu/p65jlt7o1df/?launcher=false&fcsContent=true&pbMode=normal>

Everyone working around or near manure storage facilities must understand the health hazards that exist, including symptoms and effects from the gases produced. NRCS staff should avoid, where possible, manure storage facilities during pump-out operations and never enter confined spaces where manure gases can accumulate. When working with producers who use gypsum as bedding material, NRCS staff should make producers aware of the risk and recommended precautions outlined in the attached

brochure. Also attached is another Penn State Extension publication, "Manure Storage Design and Safety Considerations with Gypsum Bedding."

Contact. For additional information, contact, please contact Bill Reck, National Environmental Engineer, Conservation Engineering Division, at (202) 720-4485.

/s/

C. Wayne Honeycutt, Ph.D.
Deputy Chief for Science and Technology

[Attachment A](#)

[Attachment B](#)