Penn State **Extension**

Open Air Manure Storage Safety Tips

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Injuries and fatalities occur in confined space manure storages that are enclosed, such as beneath animal quarters, or below-ground reception and pump out pits, and in non-enclosed storages, such as earthen, lined and concrete manure pits and ponds. Non-enclosed manure storages are open to the atmosphere but still meet the definition of a confined space in terms of occupational safety and health.

In the case of open air manure storage pits and ponds, some hazards can include:

- A thick liquid and floating crust that make swimming, buoyancy or even moving around very difficult.
- Steep and slippery slopes that can make getting out of manure storages difficult or impossible.
- Localized layers of hazardous gases existing above manure surfaces, especially on hot, humid days with little to no breeze.
- A speeding up of manure gas release from movement, agitation, removal, or addition of manure to a storage pond.
- Not having sufficient oxygen to breathe if a person is 'treading' in manure because of an inability to get out.
- Not being able to see into depths of manure like you can with clear water.
- A slow response time for adequate emergency actions because of site isolation and remoteness.

Safety guidelines to follow:

1. Make sure everyone that needs to be near manure storage structures understand the hazards that exist, including the effects that the various gases have on them.
2. Make sure the open air manure storage has a fence installed around the perimeter and access gates are locked to keep unauthorized personnel from entering the area.
3. The open air storage should have manure drowning hazard signs and no trespassing signs on all sides of the storage.
4. If you must go into the fenced area of the open manure storage, wearing a safety harness with life line attached to a safely located solid object or anchor will enhance your chances of rescue.
5. Never work alone. The second person's role is to summon help in an emergency and assist with rescue without entering the storage.
6. Rescue equipment, such as a flotation devices and lifelines, should be attached to every manure pump.
7. Move slowly around manure storages as the ground can sometimes be uneven and may cause a person to trip or stumble.
8. Bystanders and non essential workers should stay away from pump out or other accessible areas.
9. There should be no horseplay near the open manure pit or pumping equipment.
10. Explosive gas may be lurking near where agitation or pumping is occurring. No smoking, open flames or sparks should be allowed. If equipment malfunctions during agitating or pumping of the manure, shut all equipment off and remove it from the storage before servicing or repairing.
11. If you feel unsure or uncomfortable with what you are getting ready to do near the open manure pit, step back, contact someone and review the situation before proceeding.
12. Be prepared to call 911 if an emergency happens. Being prepared means accurately describing the incident, number of victims, and giving specific directions to the site of the emergency.

Manure Storage Safety
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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 into this event is ongoing. Additional research needs to be conducted on the use of gypsum for bedding. Gypsum is a very soft sulfate mineral composed of calcium sulfate di-hydrate. The additional sulfur may have increased the production of hydrogen sulfide in this environment. Extra caution and awareness is necessary to dairy operations that are using this type of bedding material.

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 (NH_3), carbon dioxide (CO_2), hydrogen sulfide (H_2S), and methane (CH_4).

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 H_2S 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 H_2S can be released. As H_2S 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.

Because of the potential danger of gases around manure storage facilities, ponds, or lagoons; first aid equipment should be supplied nearby. An identified, easily accessible area should be provided for storing safety

equipment. The area should be inspected periodically to ensure that all equipment is available and in proper working condition. An emergency action plan, including telephone numbers of the local fire department and/or rescue squad should be posted near the safety equipment and near all telephones.

Safely hazards are inherent to an AWMS. Several actions and precautions to be taken when dealing with manure storage facilities include but are not limited to:

- Safety equipment can include air packs and face masks, nylon line with snap buckles, safety harness, first-aid kits, flotation devices, safety signs, and hazardous atmosphere testing kits or monitors. All family member and employees should be trained in first-aid, CPR techniques, ad safety procedures and policies.
- Do not enter a manure pit unless absolutely necessary and only then if the pit is first ventilated, air is supplied to a mask or a self-contained breathing apparatus, a safety harness and attached rope is put on, an there are two people standing by.
- Do not attempt without assistance to rescue humans or livestock that have fallen into a manure storage structure or reception pit.
- For open storage facilities, put a fence around it and post "Keep Out" signs.
- Signs should be prominently posted and maintained that warn of the hazard. Children and those that cannot read must be given special instruction to assure that they are aware of the hazard.
- To minimize hazards, agitation of manure is best done on windy days.
- Impoundment type facilities present a drowning hazard. Crusts that are formed on the surface and slime formation make waste impoundments more hazardous. Crusts have the appearance that they would support a person's weight; however, they often will not.
- Everyone working around or near manure storage facilities must understand the health hazards that exist, including symptoms and effects from the gases produced.
- During pump out operations, ensure non-essential workers or bystanders are away from the manure storage facility.

Additional information regarding AWMS safety issues can be found in the following references:

Agricultural Waste Management Field Handbook Chapter 3, section 651.0303 *Effects of animal waste on the air resource*. http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31441.wba

Agricultural Waste Management Field Handbook Chapter 10, section 651.1008 *Safety*. http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31529.wba

Agricultural Waste Management Field Handbook Chapter 13, section 651.1303 *Safety*. http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31482.wba

(This document can be found at NRCS's Website http://nitcnrcsbase-www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1048954.pdf)