A Countdown of 10 Educational Topics of Manure Gas Safety

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This audience largely extension, agency, industry support.
Provide talking points for you.

Producer audiences
Provide some science
Discuss items that increase risk
Preach awareness and avoidance

10) Most incidents go unreported
• Loss of consciousness
• Loss of livestock

Can you ever accumulate accurate data on this subject?
9) Repair & Maintenance and Rescue are High Risk Activities

<table>
<thead>
<tr>
<th>% of Victims in Study</th>
<th>Repair &amp; Maintenance</th>
<th>Attempting Rescue without Proper Equipment</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field &amp; Beaver (2007)</td>
<td>33</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>Park et al. (2016)</td>
<td>27</td>
<td>40</td>
<td>67</td>
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</tbody>
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8) All manures produce gas

- All manures are organic material in a state of microbial degradation.
- Gases are a by-product of microbial processes.
  - H₂S – Hydrogen Sulfide
  - NH₃ – Ammonia
  - CH₄ – Methane
  - Lack of Oxygen
  - CO₂ – Carbon Dioxide

7) Open-air storages are confined spaces!

Confined Space

- Large enough to enter
- Has limited or restricted means of entry and exit
- Not designed for continuous normal worker occupancy

- Field & Beaver (2007)
  - 16% of victims were not in confined spaces

The presentation is archived at:
http://articles.extension.org/pages/21819/chronological-webcast-archive
6) Different Gases = Different Behavior

- Some are odorless
- Most are colorless
- Some are explosive
- Some sink
- Some rise

5) Characteristics that Increase Risk

- **Liquid > Solid**
  - All manures need respect
  - Remember all manures produce gas
  - Unclear whether swine or dairy present higher risk
- **Anaerobic > Aerobic**
  - Anaerobic microbes more likely to produce H₂S
  - Deep storages have had time to create gases
- **Movement Increases Gas Release**
  - Agitation an especially risky time
  - Important consideration for solid manures too

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**Agitation has 2 important effects...**

1. Increases Effective Surface Area
2. Changes surface concentration
Flux – the action of flowing
- \( \text{NH}_3 \) - Aerobic & Anaerobic environments

Ebullition – the action of bubbling or boiling
- Some gases release through ebullition
  - \( \text{H}_2\text{S}, \text{CH}_4, \text{CO}_2 \) - Anaerobic environments

How does Ebullition occur?
- Concentrations of the gas exceed their solubility in solution
- May or may not create foam
- Soda can analogy

4) Warm Weather Increases Risk
- Field & Beaver (2007)
  - 60% of instances May-August
  - 26% in August
    - Long storage times through summer yield deep, warm, anaerobic, microbiably active manure
    - When disturbed a lot of gas can release
- However...
  - This means 40% occurred in cold months
  - Never get complacent!

3) Complacency Kills
- Meinen’s gerbil story

  • Not uncommon to hear comments like:
    - “They’ve gone in there to repair that item many times.”

  • The Agricultural Work Ethic:
    - You can work yourself to death.

  • If complacency kills, then:
    - SOP’s and good habits can provide some level of protection against risk
Tips for Operators

- Use a monitor!
- Observe agitation from a distance.
- The first hour of agitation is probably the worst, but never let your guard down.
- Remember health of nearby livestock.
- Observed gas behavior
  - Gases ‘throw’ in the direction of manure agitation

Operator Position – up and away

Position operator work area so that a person...
- Does not reach over or adjust/maintain machinery near storage edge
- Is not in a low-lying area. (Remember H₂S is a heavy, ground-hugging gas)

Choose up-wind position

Change in wind direction increased H₂S concentrations – beware of areas that trap gas

Max H₂S concentration > 500 ppm

Max H₂S concentration = 64 ppm

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2) Make Choices for Children

- **What is your responsibility?**
  - Everyone has an obligation to design, supply, buy, operate, and maintain manure storage and handling systems that are safe for workers, visitors, livestock, and children.

- Field & Beaver (2007)
  - 21% of fatalities were under 16
  - 11% of victims listed as “playing and discovered missing”
  - All were children

1) Another Type of Monitoring

A Reality of our target audience is....

*Only a low % of workers or visitors wear monitors.*

In an effort to plant seeds in a person’s mind....

*I have created a list of ‘Body Alarms’.*

- The list contains symptoms of gas exposure.
- It is not all-inclusive, but contains signs of danger from a number of the common dangerous agricultural gasses.
What will you do if your smoke alarm goes off while you sleep tonight?

Body Alarms!!!

- Dizziness
- Wobbly knees
- Feeling hot and clammy
- Lack of attention to details
- Loss of motor skills/fatigue
- Anxiety/Excitement
- Severe eye irritation/decrease in sight

Pay attention to your body. Take action if there are signs of gas exposure. Get to fresh air!

Summary

- Gases are produced from all manures
- Open-air storages need respect
- Repairs & Rescues > 50% deaths
  - *Manure movement* increases gas release
- Safety First! Complacency kills!
- Remember Body Alarms!
- Ventilation is so important!