

OSC | 11
Ohio Safety Congress & Expo



#114 – Confined spaces in agriculture

Dee Jepsen, Ph.D.

Wednesday, March 30, 2011

1 to 2 p.m.

Ohio | Bureau of Workers' Compensation

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Confined Spaces in Agriculture

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Objectives of this session:

- Understand the Environmental Conditions that exist in a Confined Space
- Recognize Confined Spaces on the Farm
- Identify Air Sampling Techniques
- Understand Engulfment Hazards
- List Confined Space Entry Procedures



Definition: Industry Confined Space

- Limited opening for entry and exit
- Unfavorable ventilation
- Contains or produces dangerous air contaminants
- Not intended for continuous occupancy

Hazardous Atmospheres

Asphyxiating

Flammable

Toxic

Confined Spaces on the Farm

- Manure Pits
- Silos
- Grain Bins
- Bulk tanks (milk tanks)



The most immediate and severe hazard associated with a Confined Space is air quality, but in agriculture...

Engulfment

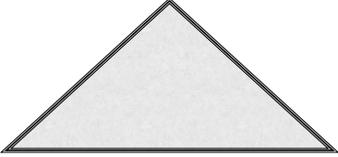
Confined Space Fatality Factors

- Failure to recognize the hazard
- Failure to follow safe work procedures
- Failure to follow emergency response procedures



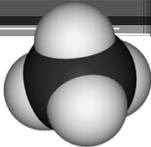
Flammable Atmosphere

Fuel Supply



Oxygen in Air **Source of Ignition**

Methane



- Non-toxic and lighter than air
 - Odorless, colorless
 - When ventilation is inadequate can displace oxygen and cause asphyxiation
 - Forms explosive concentrations in air

0% 10% 20% 50% 100%

LEL UEL

Explosive Range: 5-15%

Asphyxiating Atmosphere

- Oxygen deprivation through:

Consumption	Displacement
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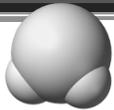



Asphyxiating Atmospheres . . .

- Simple Asphyxiating
 - No ill effects on the body
 - Carbon dioxide
 - Nitrogen
- Chemical Asphyxiating
 - Produces ill effects on the body
 - Carbon monoxide
 - Hydrogen sulfide
 - Nitrogen oxide

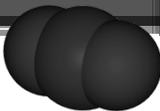
Can be Toxic Atmospheres

Hydrogen Sulfide



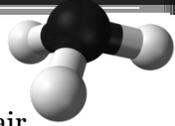
- Highly toxic and heavier than air
 - Rotten egg smell but higher concentrations deaden the sense of smell
 - Concentrations in the air can soar during agitation
 - A few breaths of 600 ppm H₂S laden air can readily cause loss of consciousness and death

Carbon Dioxide

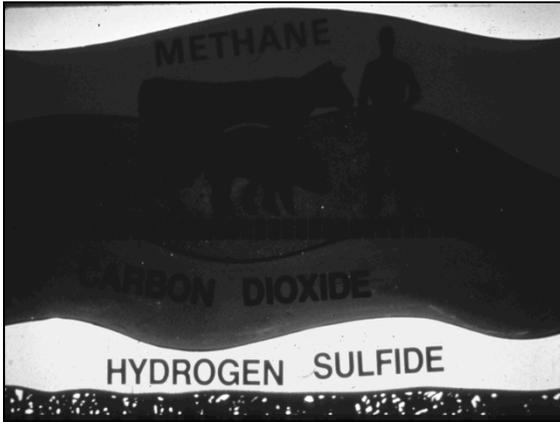


- Non-toxic and heavier than air
 - Odorless, colorless
 - Normal product of decomposition and animal respiration
 - When ventilation is inadequate can displace oxygen and cause asphyxiation

Ammonia



- Non-toxic and lighter than air
 - Characteristic urine smell
 - Lighter than air
 - Can irritate the eyes and throat
 - Higher concentrations can cause wheezing and shortness of breath
 - Less of an immediate concern because the strong persistent odor discourages long contact



Swine Operations

Dangers with Manure Pits

- Between 1975 and 2004, there were 75 fatalities associated with manure storage and handling
- Most of these fatalities resulted from asphyxiation

Manure Holding Facilities

Above Ground Manure Tanks

Manure Lagoons

Dangers with Manure Pits

- Rescuers account for over 60% of confined space fatalities

BREAKING NEWS

Gas From Manure Pit Kills 5 On Dairy Farm

HARRISONBURG, Va., July 3, 2007

Farmer, Wife, 2 Daughters And Farmhand In Virginia Were Overcome By Methane

By Lloyd de Vries

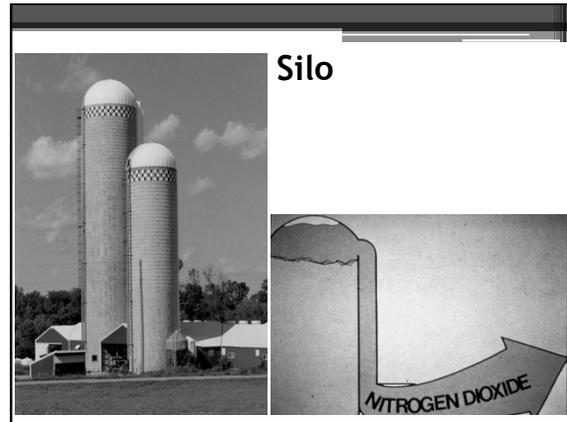
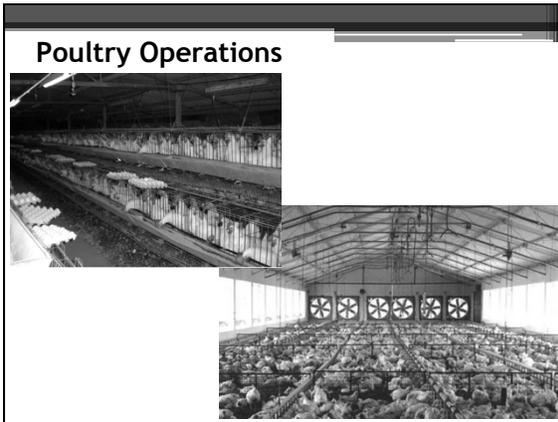
(CBS/AP) Deadly methane gas emanating from a dairy farm's manure pit killed five people, including four members of a Memoselle family, authorities said.

Emergency workers speculate that after the first victim was overcome Monday, the others climbed into the pit in a frantic rescue attempt. "It was a domino effect with one person going in, the second person going after them," Rockingham County Sheriff Don Farley said.

Characteristics of Manure Gases

- ! Temperature, humidity, atmospheric pressure, wind speed and direction as well as the changing conditions of the manure stored make for a constantly changing situation
- ! Never assume that the storage unit is constant and static
- ! Just because you have entered it safely in the past does not mean that you will always be able to enter safely

! WARNING !



Confined Spaces and OSHA

- You must be able to manage **ALL** potential hazards within a confined space
- You must have a confined space entry process
- It must be written and employees must be trained
- The air must be tested and monitored
- Rescue procedures must be in place

Gas & Vapor Sampling

- Diffusion Tubes
- Detector Tubes
- Electronic Reading Instruments

Diffusion Tubes

- Direct reading measure
 - Takes hours to get reading
- Do not use in IDLH



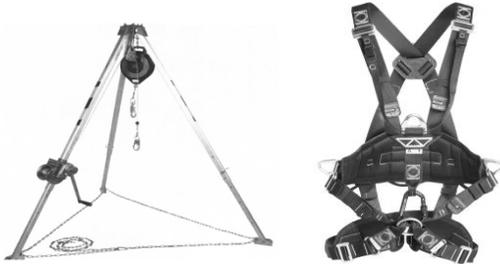
Detector Tubes

- Shows results in a minute
- “Grab Sample”
 - High concentrations that need immediate readings
 - H₂S or NH₃ in manure pits
 - CO poisoning

Electronic Reading Instruments

- Instantaneous readings
- Accurate to the concentration
- Expensive

Retrieval tripod and body harness

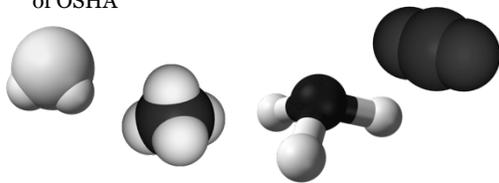


Emergency Services and Rescue Procedures



Summary of Gases

- Confined spaces often contain potentially fatal hazards
- Make no entries into CS unless you have equipment and training that meets the guidelines of OSHA



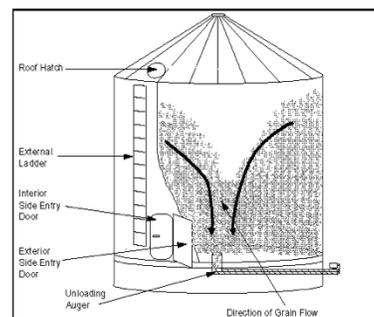
Engulfment Atmospheres



Different Types of Bins



Anatomy of a Grain Bin



Engulfment: Flowing Grain

From the time the auger starts, you have 2-3 seconds to react.

In 4-5 seconds you are trapped!

After 22 seconds, you are completely covered.

Figure 1. Flowing grain can bury a worker in seconds.

Engulfment: Bridged Grain

A dangerous situation created by a previous partial unloading of the bin.

As unloading begins, bridged grain falls into the air space and the worker is instantly trapped.

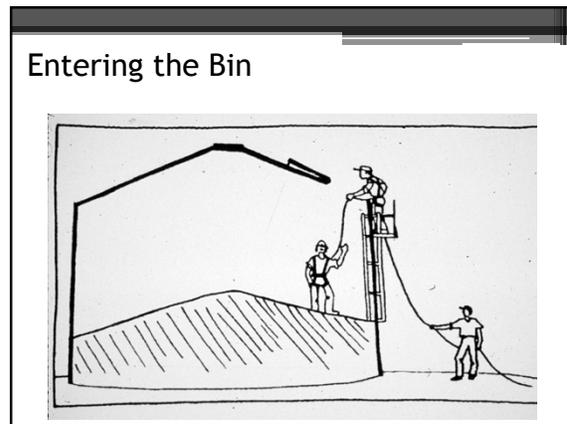
Before the grain flow can be stopped, the worker is covered. In seconds, suffocation occurs.

Figure 2. "Bridging" condition that results in engulfment.

Engulfment: Avalanche Grain

Beware of a steep pile of grain... because it may tumble down... and result in suffocation.

Figure 3. Accumulation on bin side that results in engulfment.



Permit Requirements for Confine Space Entry

The Employer Must: 1910.272(g):

- Issue a permit – 1910.272(g)(1)(i)
- De-energize all equipment - 1910.272(g)(1)(ii)

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What is OSHA requirement for tie-off strength?



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- Have an Observer - 1910.272(g)(3)
- Train Observer in Rescue - 1910.272(g)(5)
- Provide Rescue Equipment - 1910.272(g)(4)





Engulfment fatalities steadily increasing



Session Summary

- Wide range of **confined spaces** on Ohio farms
- Additional **training** to identify and understand the environmental conditions that exist
- Assistance with **monitoring equipment**
- **Engulfment hazards** are a known confined space hazard
- **Family farms** are not required, but recommended, to follow safe entry procedures
- Additional training is needed for **rural rescuers**

Questions about Confined Spaces in Agriculture

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