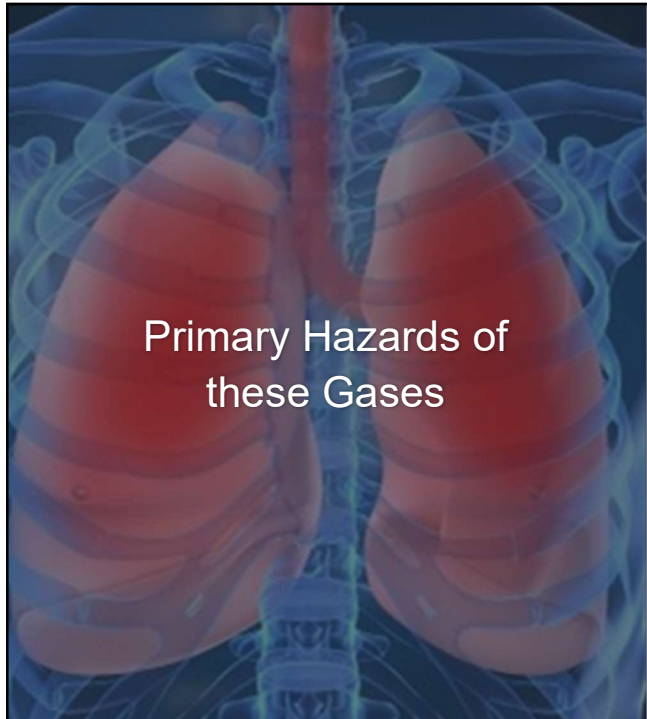





Objectives

Review	Dangerous gases first responders may encounter
Discuss	Characteristics of these gases
Explain	Medical care for patients Safety for Responders



Primary Hazards of these Gases

- Toxic or poisonous reactions in people or animals
- Oxygen depletion which can result in asphyxiation
- Explosions that can occur when oxygen mixes with the gases (primarily a problem with methane)



Manure Pit & Silos



Gases

- Hydrogen Sulfide
- Ammonia
- Carbon Dioxide
- Methane
- Nitrogen Dioxide

Characteristics of Hydrogen Sulfide

- Most dangerous gas associated with waste decomposition
- Distinct rotten egg smell
- Heavier than air
- After breathing this gas a short time, sense of smell becomes fatigued and you can no longer detect an odor
- At low concentrations H_2S irritates the eyes and respiratory tract; at moderate levels exposure causes headache, nausea, and dizziness; at high concentrations H_2S causes death



EFFECTS OF HYDROGEN SULFIDE

Effects of hydrogen sulfide (H_2S) on health

Hydrogen sulfide concentration
(expressed in ppm)

Effects on human health

1,000 to 2,000

▶ Sudden loss of consciousness with early respiration cessation within minutes. Death might occur even if the injured person is being moved to fresh air

500 to 700

▶ Loss of consciousness, cessation of the respiration then death

200 to 300

▶ Severe conjunctivitis (eye inflammation) and irritation to the breathing tracts after 1 hour exposure

100

▶ Coughing, eye irritation, anosmia (loss of smell) within 2 to 5 minutes

27

▶ Strong and unpleasant smell

10

▶ Irritation to the eyes begins

4.6

▶ Easily detectable, moderate smell

0.13

▶ Minimal perceptible smell

Characteristics of Ammonia

- Distinct, sharp, penetrating odor detectable at very low concentrations
- Heavier than air
- At moderate levels of concentration, can irritate eyes and respiratory tract; at high concentrations can cause ulceration to the eyes and severe irritation to the respiratory tract.

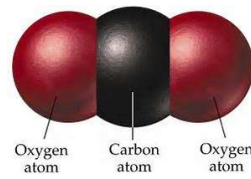


Toxic Effects:-

- Laryngeal Spasm:-** This is peculiar in Ammonia. Laryngeal Spasm & **Spasm of Glottis** are frequent. This can produce Asphyxia & Death, but spasm will relief if the person becomes **Unconscious**.
- 4) **Effect on Eyes:-** Ophthalmic complications like - a) **Corneal Opacity**, b) **Cataract** Formation, c) **Glaucoma**.
- 5) **Effect on the Skin:-** A jet of the Anhydrous Ammonia on the moist Skin can cause second degree **burns**.
- 6) **Gastritis:-** It continues several months after a gasing exposure.
- 7) The person who survives as acute gasing attack may develop permanent **Respiratory Disabilities** like a) Progressive Airway Obstruction b) Decreased Diffusion Capacity c) Bronchiolitis Oblitance d) Bronchiactasis e) Continuous Cough & Sputum.

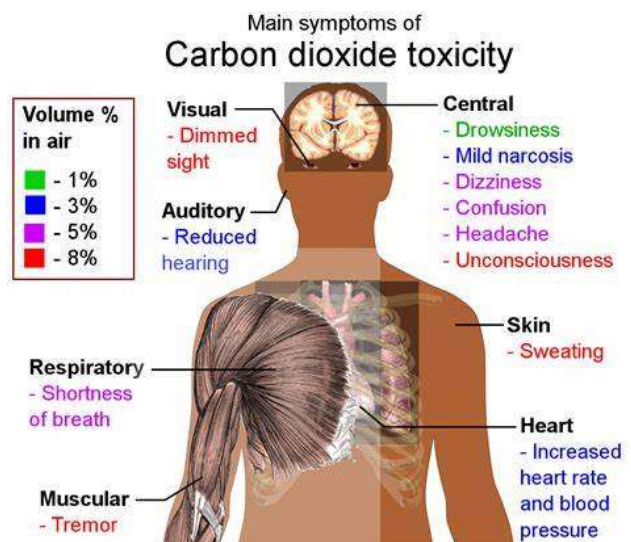
EFFECTS OF AMMONIA

Characteristics of Carbon Dioxide



- Odorless, heavier than air, difficult to detect
- Replaces oxygen in air and acts as an asphyxiant
- At moderate concentrations causes shortness of breath and dizziness
- A major contributing factor to animal deaths by asphyxiation in confinement buildings with faulty ventilation

EFFECTS OF CARBON DIOXIDE



Characteristics of Methane



- Odorless and lighter than air, so it tends to accumulate at the top of manure pits
- Considered an asphyxiant at extremely high concentrations.
- Main hazard is its flammable, explosive nature



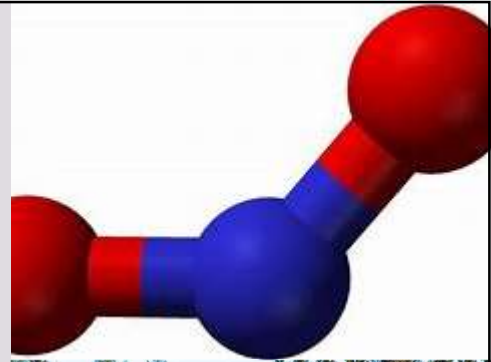
EFFECTS OF METHANE



Characteristics of Nitrogen Dioxide



- Pungent, sweetish odor, even at low concentrations. Has reddish-brown color, visible only in extremely high concentrations
- Heavier than air and can settle at the bottom of enclosed spaces
- One of the most hazardous lung irritants, however, the effect is so subtle that the victim may not realize the serious nature of the exposure until it is too late.
- Can cause bronchitis, chemical pneumonia, a severe fibrosis-type of pneumonia, severe lung damage that can be fatal in two to 10 days; or acute pulmonary edema that can be fatal in less than 48 hours.



EFFECTS OF NITROGEN DIOXIDE



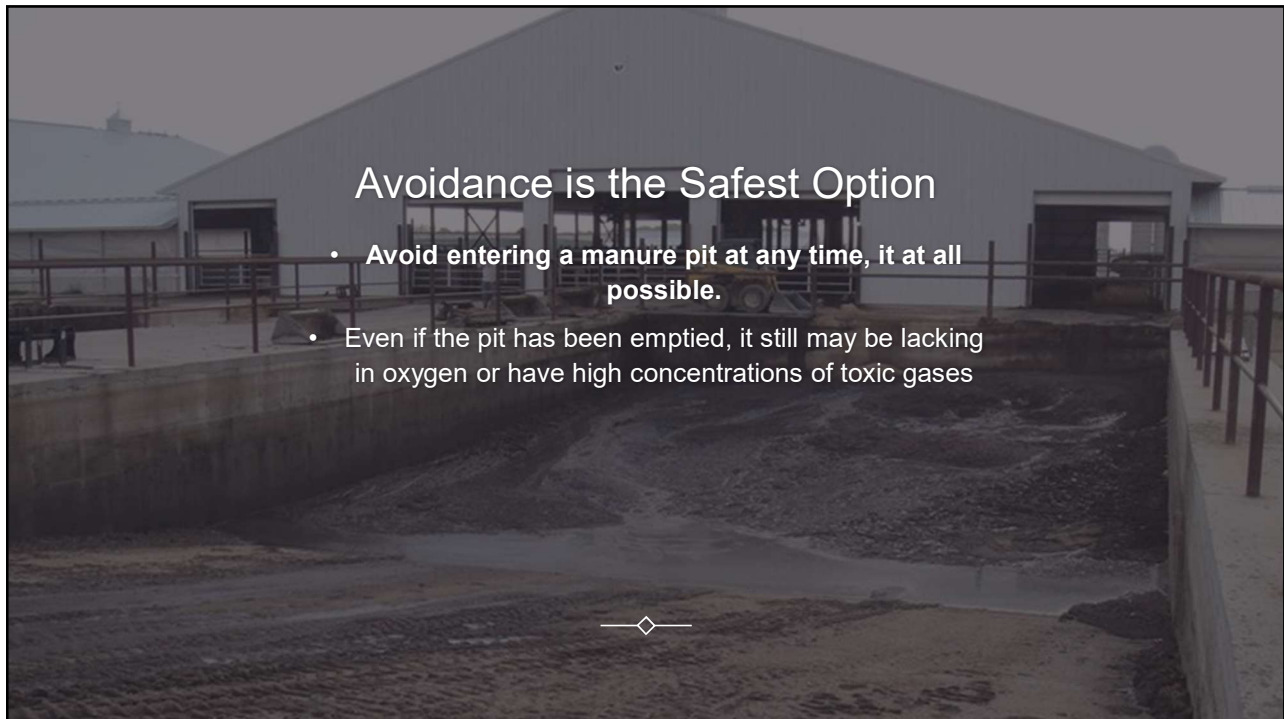
Effect of nitrogen oxides on Humans

- NO₂ is four times toxic than NO
- Odor threshold: **1-3** ppmv
- Mucos irritation: **10** ppmv
- **200 ppmv 1 minute inhaling → death!**
- Origin of death: wet lung
 - Nitric acid formation in the alveoli
 - Alveoli have semi permeable membrane (only gas exchange is possible)
 - Nitric acid : destroys the protein structure of the membrane → the alveoli is filled up by liquid
 - No more free surface for the gas exchange → death



Ventilation

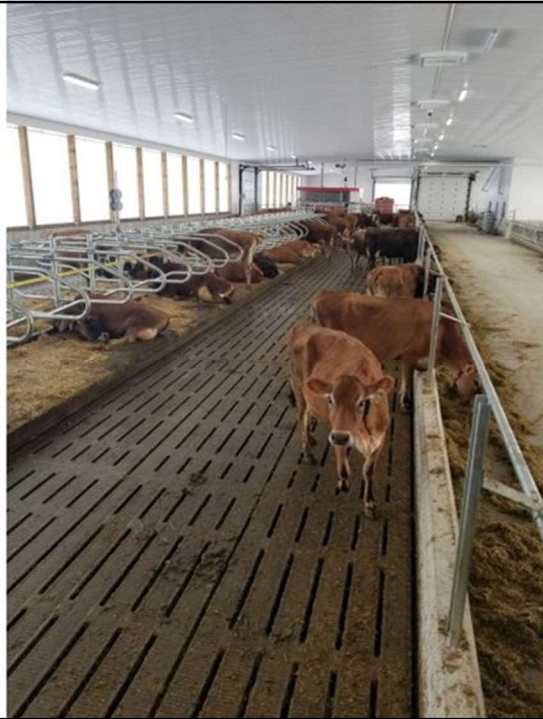
- **When working in agricultural buildings provide as much ventilation as possible, especially around manure pits during the agitation of waste.**
- No workers should be near a manure pit or in the building during the agitation process.
- If possible, remove all animals from the building.



Avoidance is the Safest Option

- **Avoid entering a manure pit at any time, it at all possible.**
- Even if the pit has been emptied, it still may be lacking in oxygen or have high concentrations of toxic gases





Animals Need Air Too

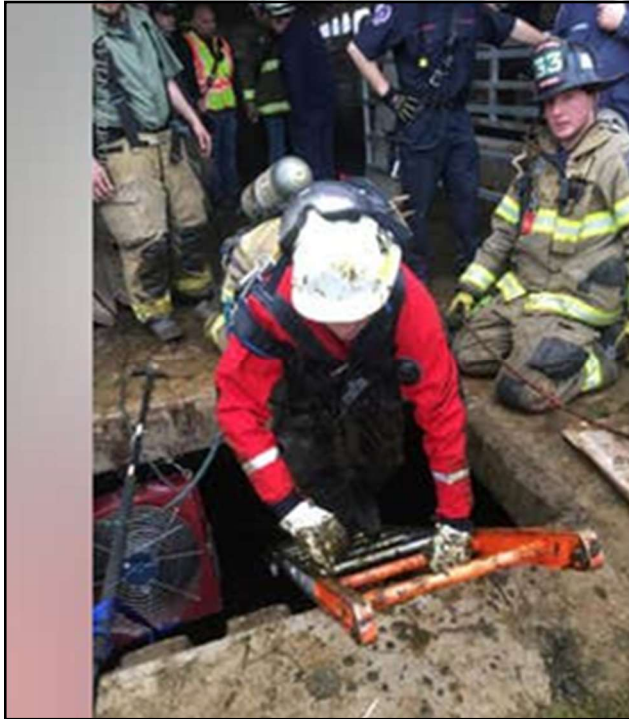
- **Always keep at least one foot of space between the highest manure level and the slats.**
- This protects animals who lie on the slats and inhale the gases that accumulate at the surface of the pit.



Silo Hazards

- Do not allow anyone to enter a silo during the tilling process until the blower has run for at least 30 minutes.
- Never enter a silo or manure pit area without someone on the outside monitoring your activity.
- Do not allow anyone to enter a silo for seven to 10 days after the filling process is complete because the fermentation process produces toxic gases.





DO NOT RUSH IN

Slow is Safe

We all come home



What type of Respirator is needed?

- Air Purifying
- Supplied Air
- SCBA



First Responder Management of Asphyxiation

- Airway
- Breathing
- Circulation



Rehabilitation of Responders

- The purpose of rehabilitation is to allow first responders to recover to a condition of preparedness that will allow them to work safely during an emergency situation or disaster.
- After the Incident has been contained, members will need to undergo significant rehabilitation
- Overexertion is the leading cause of mortality among firefighters while on duty.



Critical Incident Stress Debriefing



The CISD program has three goals:

- Lessen the impact of a trauma
- Help those involved recover
- Find people who might need extra help



QUESTION AND ANSWER SESSION

