



Breaking the Plane of Confined Spaces

29 CFR 1926 Subpart AA

Confined Spaces in Construction



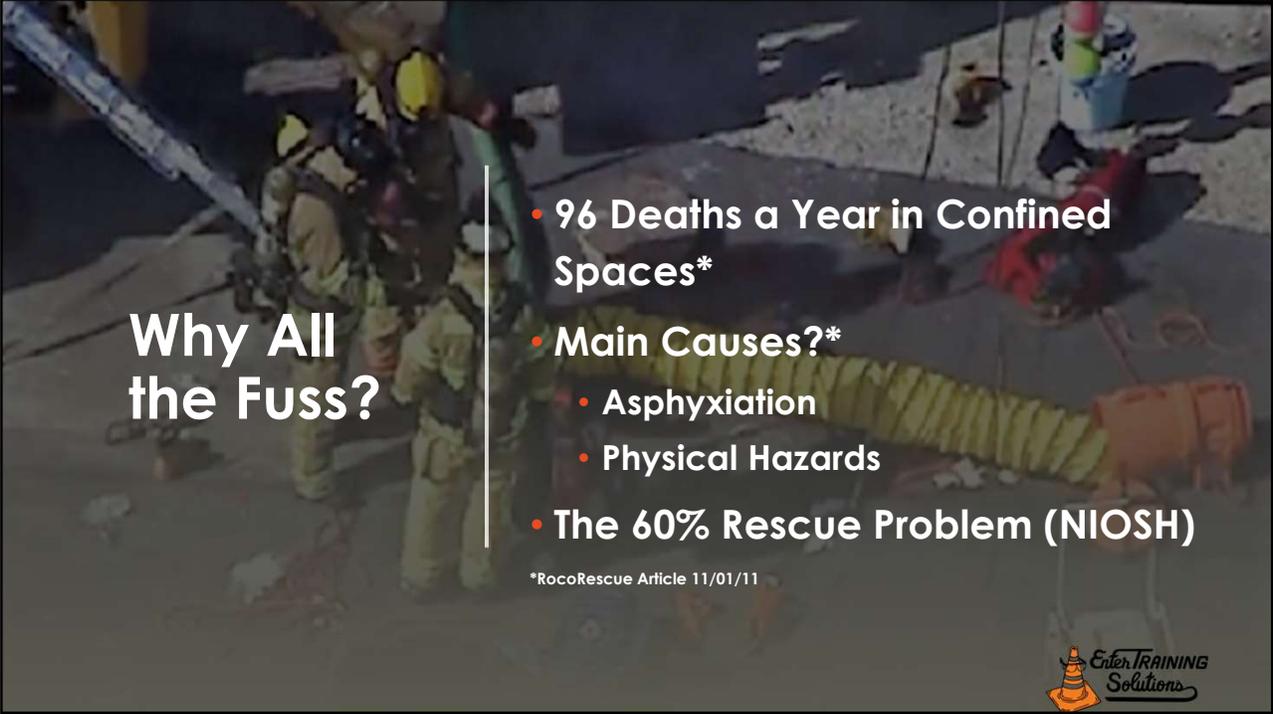
AGENDA

- Justification
- Definitions
- Permit vs. Alternate
- SCIENCE (aka Monica's Magic Time)
- Case Study

Today's Agenda:

- 1) Fun
- 2) More Fun
- 3) Did I Mention Fun?





Why All the Fuss?

- 96 Deaths a Year in Confined Spaces*
- Main Causes?*

 - Asphyxiation
 - Physical Hazards

- The 60% Rescue Problem (NIOSH)

*RocoRescue Article 11/01/11



3 Workers Dead in FL Confined Space Accident

Martechical.com

Key Largo, FL –

Three workers assigned to fix a roadway in the Florida Keys **lost their lives** this week after entering a **confined space** filled with **hydrogen sulfide** and **methane gas** created from years of rotted vegetation. The men descended a hole just wide enough to fit a body and about **15 feet deep** that was so poisonous that a **firefighter attempting rescue was knocked unconscious within seconds**.

The Sheriff's office reported that the workers went to investigate complaints from residents about what they thought was a sewage back up. The workers found a slight dip in the ground near the manhole cover at the end of the street. The first worker removed a manhole cover, went underground, and was uncommunicative. The second worker climbed down in search of his coworker and he, too, lost consciousness. The third man desperately climbed into the same hole to assist and was immediately overcome by fumes.

The deceased are Elway Gray, 34, of Fort Lauderdale, Louis O'Keefe, 49, of Little Torch Key and Robert Wilson, 24, of Summerland Key. All three worked for a private Michigan-based roadwork contractor named Douglas N. Higgins.

The firefighter who attempted rescue was revived with CPR and is believed to be in a coma after the accident. The local sheriff's office reports that the firefighter decided to enter the hole without his air pack because the hole was not wide enough to fit the man and his equipment.

Federal OSHA inspectors will investigate the deadly incident. The neighborhood was ordered evacuated until determined safe.





DEFINITIONS



Confined Space

- What is a Confined Space?
- Large Enough to Bodily Enter
- Limited Access & Egress
- Not Designed for Continuous Human Occupancy





Permit Required Confined Space

- **H**azardous
- **A**tmospheres
- **C**onverging Walls
- **E**ngulfment Potential



Permit Entry VS Alternate Entry



Permit Space Vs. Alternate Entry



- What's the difference?
 - Isolated from physical hazards
 - Actual or potential for atmospheric hazards
 - Forced air ventilation
 - Monitoring data
 - Written Documentation



Why Alternate Entry?

- "...need not comply with §§ 1926.1204 through 1206 and §§ 1926.1208 through 1211..."
- Huh?
 - No Permit Required Confined Space Program
 - No Permitting Process
 - No Entry Permit
 - No Duties of Entrant, Attendant & Supervisor
 - No Rescue & Emergency Services (No tripod)





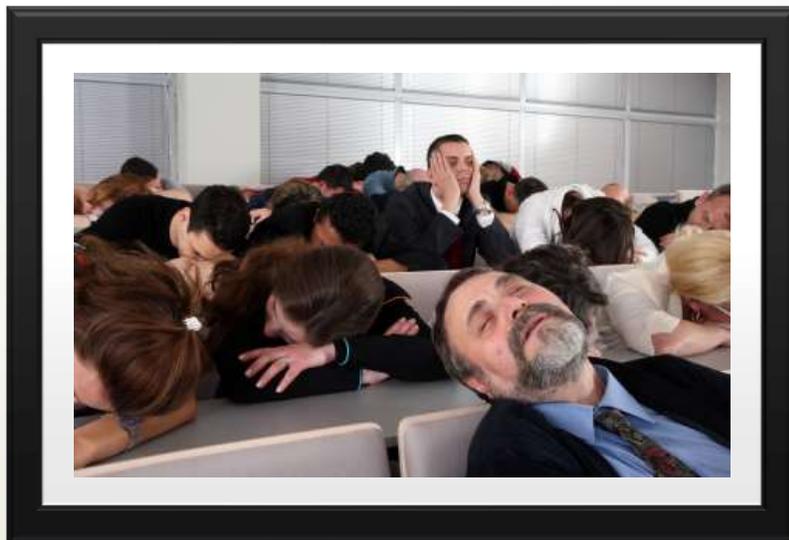
Additional Alternate Entry Rules

- Eliminate hazards that make it unsafe to open a cover
- Guard opening
- Test atmosphere before entry
- No hazardous atmospheres during entry
- Continuous forced air ventilation
 - Clean
- Continuous Air Monitoring



SCIENCE & MAGIC

But Mostly Science....





What Just Happened?

- Baking soda (sodium bicarbonate) is a base (8.3) and vinegar (acetic acid) is a weak acid (2.4).
- Combination creates carbonic acid, which is unstable and quickly decomposes into carbon dioxide (CO_2) and water (H_2O).
- CO_2 is heavier than air (1.53)
- As you tilt the container, you literally pour the CO_2 onto the flame. That means air can't get to the flame and it goes out for lack of oxygen.

Steve Spangler Science

EnterTRAINING Solutions



A Case Study

Here's Where it All Makes Sense

Hopefully.....



A Story From OSHA

- Construction site fatality on August 4, 2004
- Reported that the employee was found at the bottom of a manhole
- New sewer system under construction
- Small company (approx. 20 employees)

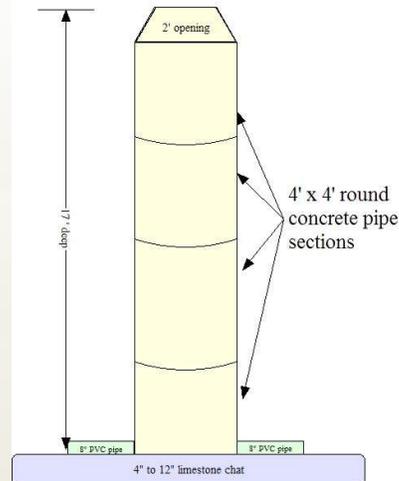




Confined Space Information

- 2 foot opening
- 4 foot wide internal diameter
- Riser was constructed of 4' X 4' concrete pipe sections
- 17 feet deep outside 16.5 feet inside
- Two 8" PVC Pipes in the bottom
- Built on a 4" to 12" bed of limestone chat

The Confined Space



What Happened...

- City code requires vacuum testing of space. If it fails, the space must be regrouted.
- After vacuum test failure, employee reportedly was assigned the grouting task
- Grouting is done by hand and takes about 1 hour
- The employee was working alone
- The employee was found at the bottom of the manhole unconscious



Initial Sampling

- After recovery, the medical examiner requested sampling of manhole
- Fire Department – Haz Mat Division took some multi-gas readings about 3 hours after recovery
- Results were 16.3 to 17% for oxygen and 0.0 to 4.5 % LEL
- Zero readings for carbon monoxide and hydrogen sulfide
- No readings taken for carbon dioxide



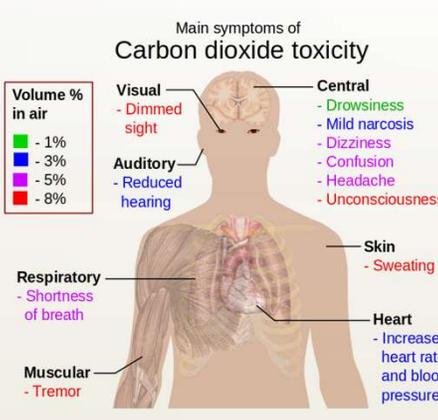
Inspection Results

- The employer did not have a confined space entry program (or any equipment)
- Direct Reading Instruments results 9 days later revealed:
 - Oxygen – 16.0 to 18.2 %
 - CO2 – 1.8 to 3.5 % or 18,000 to 35,000 PPM
 - LEL – 5 to 8 %
- Bulk Air Samples:
 - Oxygen – 12.5 to 14.1 %
 - CO2 – 16,845 to 23,968 PPM
 - Methane – 776 to 1372 PPM



So What Went Wrong?

Main symptoms of
Carbon dioxide toxicity



Volume % in air

- - 1%
- - 3%
- - 5%
- - 8%

Visual
- Dimmed sight

Auditory
- Reduced hearing

Central
- Drowsiness
- Mild narcosis
- Dizziness
- Confusion
- Headache
- Unconsciousness

Skin
- Sweating

Heart
- Increased heart rate and blood pressure

Respiratory
- Shortness of breath

Muscular
- Tremor

- Carbon Dioxide - Colorless odorless gas
 - Displaces oxygen leading to oxygen deficiency
- Special problem in Midwest area
 - Limestone Rock
 - Calcium Carbonate
 - Acidic topsoil
 - Acid leaches from soil, which then contacts the limestone producing Carbon Dioxide
- Numerous fatalities
 - Especially in new sewer/vault leak testing using a vacuum
 - Pulls carbon dioxide into the space
 - Oxygen measured at less than 3% on other similar fatalities
 - **5 similar cases known Nation-wide since 2000; 2 cases with 4 fatalities in the Kansas City area**



In Conclusion

- Any confined space can be deadly
 - Even if you've been in it before.
- Make sure your crews are trained on confined spaces and the hazards
- **ALWAYS** test a space before entering
- Document, Document, Document
- Be Safe!





Questions?

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