Confined Space

Recognition and controls for safe entry

Terry W. Krug, MS, CIH, CSP

President, EXOSHA

961 Sandalwood Ct

Bartlett, IL 60103

(630) 863-5359

www.EXOSHA.com

exosha.inc@gmail.com

2012- Italy Safety & Health Congress with ASSE - U.S.A.

Per ANSI Z117.1

Z117.1 Scope

- Provides minimum safety requirements to be followed while entering, working, and exiting confined spaces at normal atmospheric pressures.

Z117.1 Definitions

"Confined space" Enclosed area large enough and configured to allow a person to bodily enter and has the following characteristics:

- Its primary function is other than human occupancy
- Has restricted entry and

exit. (Restricted entry and exit is a physical configuration, which requires the use of the hands for support or contortion of the body to enter into or exit from a CS.)

Z117.1 Definitions (Cont.)

- **Permit Required Confined Space (PRCS)**. A confined space, which after evaluation, is found to **contain actual or potential serious hazards**. Because of the severity of the hazards, the confined space requires written authorization for entry.
- The following may be a serious hazard characteristic:
  - Contains or has a potential

  to contain a hazardous

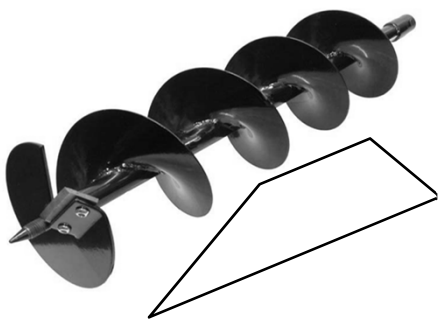
  atmosphere;

Oxygen deficiency
Toxic
Explosive

Z117.1 Definitions (Cont.)

- PRCS (Continued hazard characteristics):
  - Contains a material with the potential for engulfing an entrant; or having sloped walls crushing or trapping an entrant.

  - Contains any other recognized serious safety or health hazard (i.e. Heat stress, Electrical, Rotating parts like Augers, Fan blades



Hazardous Atmosphere

- An atmosphere that may be, or is injurious to occupants by reason of: oxygen deficiency or enrichment; flammability or explosivity; or toxicity.

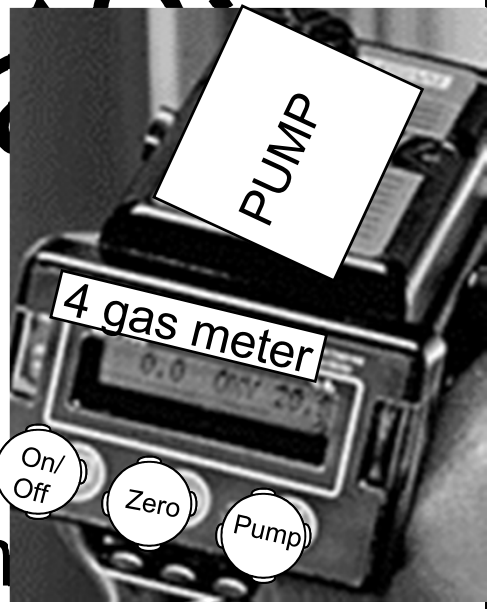
Hazardous Atmosphere

Consider the following list as possibly creating a hazardous atmosphere (taken from OSHA 1910.146 and/or Section 6 of Z117.1)

- Flammable substances in excess of 10 % of its lower flammable limit (LFL);
- Airborne combustible dust at its LFL;
- Oxygen concentration below 19.5 percent or above 23.5 percent by volume;
- Atmos. Conc. Exceeding its dose or PEL*
- Any other atmospheric condition that is immediately dangerous to life or health (IDLH)

Testing*

- The process by which atmospheric hazards that may confront entrants in a confined space are identified and evaluated
- Testing includes specifying the that are to be performed in th space where entrants may be present



***NOTE: Testing enables employers both to:**
•Devise and implement adequate control measures for the protection of authorized entrants
•Determine if acceptable entry conditions are present immediately prior to, and during, entry.

Test Instrument Calibration

- ***Section 6 of Z117.1 states to calibrate instrument (per mfr), before site visit. You may have to adjust sensor settings to match calibration (span) gas.***
- ***Upon return, check instrument's calibration with <u>same span gas</u> to verify instrument's accuracy. Do not adjust, but record instrument readings.***
- ***Reason: If you actuate the meter's "autocal" function at end of day, you won't be able to document sensor drift.***

Functional “Bump” Test

- ***Section 6.1.6 states a function check or bump test be done prior to each days use. A bump test is applying cal gas to sensors and observing the readings and alarm function***
- ***Many manufacturers recommend full field calibration if readings are off by more than 10% of expected values***
- ***Functional “bump” test only provides verification of sensor performance***

Considerations in Selection and Use of Gas Detectors

- *Sample-Draw Cautions*
  - *Sample lag time*
  - *Stabilization time*
  - *Potential for leakage in the system*
  - *Potential for pump malfunction*
  - *Foreign material in sampling line*

Detector Tube Sampling

- ***Proper selection of tube and appropriate range and accuracy of readings***
- ***Shelf life / storage conditions***
- ***Fading of stain***
- ***Cross sensitivity (interferences)***
- ***Correction factors***
  - ***Number of pump strokes***
  - ***Humidity and temperature differences***
- ***Pump Maintenance-follow mnfctrs guidelines***
  - ***Check for leakage***

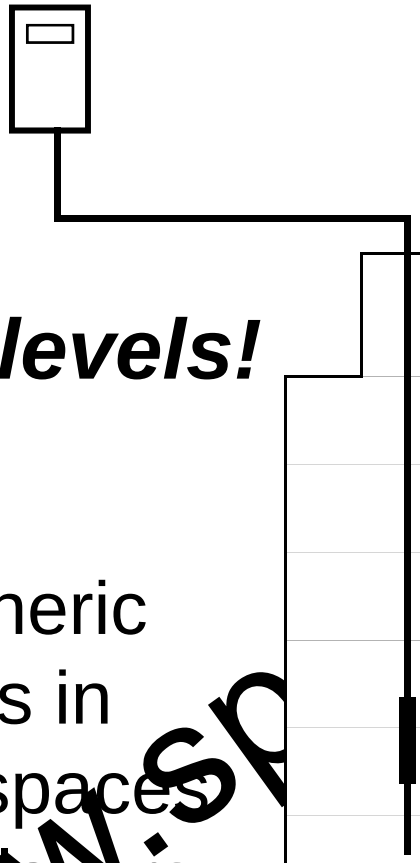
Test Instrument Summary

- Understand the operation and limitations of the test instruments you are using.
- Read the manufacture's instructions and practice calibrating, using and interpreting the results attained.
- If possible, back up your display readings with another type of instrument that has different interferences and limitations. i.e. detector tube sampling or gas bag analysis.
- Continually test all entrant's work areas.

Vapor or gas density

- *Measure of a vapor's or gas's weight compared to air. Why is this important?*
- *Gases lighter than air tend to rise; gases heavier than air tend to sink*
- *Molecular weight of air is 29*
- *Compare propane. 3 carbon atoms @ 12 each = 36 plus 8 hydrogen atoms @ 1 each = 8 plus 36 = total 44 MW Propane is 1.5 times heavier than air*

Stratification



Check all levels!

Atmospheric hazards in confined spaces can form layers

Acetylene

LIGHTER

Ammonia

Hydrogen cyanide

Methane

Hydrogen

Hydrogen sulfide

Gasoline

HEAVIER

Solvents (MEK, toluene, etc.)

Propane, carbon dioxide, chlorine

Three basic kinds of atmospheric hazards

- *Oxygen (deficiency and enrichment)*
- *Flammable gases and vapors*
- *Toxic contaminants*

They all can be controlled with proper ventilation techniques

VENTILATION AS A CONTROL

- Z117.1 Section 9 addresses ventilation. “When ventilation is used to control atmospheric contaminants in the confined space, the space shall be ventilated until the atmosphere is within the acceptable limits. Atmospheric testing shall be done in accordance with Section 6.”

VENTILATION PRINCIPLES

- Ventilation is the single best control (other than thorough cleaning) to prevent atmospheric hazards from causing problems.
- Atmospheric hazards are the leading cause of death in confined spaces.
- Use powerful enough air movers and continually ventilate throughout the confined space in areas where entrants are working.
- Insure air is drawn from a clean source.

ISOLATION & LOCKOUT/TAGOUT CONTROLS

- Section 8 of Z117.1 states ”All energy sources which are potentially hazardous to confined space entrants shall be secured, relieved, disconnected and/or restrained before personnel are permitted to enter the confined space”

LOCKOUT/TAGOUT

- Prior to entry, ensure all energy sources going to the space, that are not used in the entry task i.e. lights, ventilation, tools etc., are locked out preventing uncontrolled start-up of equipment.
- If it is considered to be servicing, outside of production, and the employee is exposed to a point of operation or an associated danger zone, the provisions of the Lockout/Tagout standard would apply. (1910.147)

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Section 11 addresses PPE and states the following:

“General. A qualified person shall determine personal protective equipment needed by all personnel entering the confined space including rescue teams.”

The PPE selected and used shall meet the following criteria:

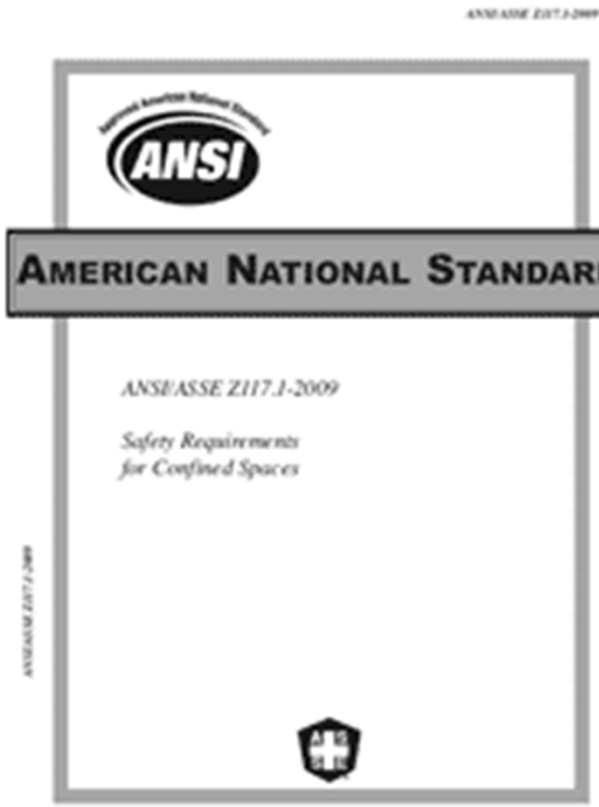
PPE Criteria

- Selected to protect against the hazard confronted in the confined space.
- The PPE selected fits the employee and does not cause other safety or health issues.
- The employee is trained in the proper donning, doffing and care & feeding of PPE.
- Use PPE that has been approved for use by a recognized authority, i.e. ANSI, NIOSH, ASSE, ISEA, NFPA etc.

CONCLUSION

- Nothing is absolute & everything can change in a confined space. By properly classifying confined spaces & understanding the hazards confronting entrants, recommendations can be made to control the hazards. This hazard control is accomplished through proper LOTO applications, well thought out ventilation practices, and the use of the correct PPE.
- Follow Z117.1 recommendations to minimize the dangers of entering & working in confined spaces.

More Information About the Standard



https://www.asse.org/shoponline/products/Z117_1_2009.php

Questions?

Confined Space

Recognition and controls for safe entry

Terry W. Krug, MS, CIH, CSP

President, EXOSHA

961 Sandalwood Ct

Bartlett, IL 60103

(630) 863-5359

www.EXOSHA.com

exosha.inc@gmail.com

2012- Italy Safety & Health Congress with ASSE - U.S.A.

Per ANSI Z117.1