CONFINED SPACE ENTRY, Supervisor, Attendant Entrant 8HR

Topics for today's Class

Regulatory requirements	Attendant & Entrant Communication
Confined space accident facts	Case Study #2
What is a confined space	Common Confined Space hazards
OSHA Permit required confined spaces	Re-classification of PRCS
DOSH Permit required confined spaces	Atmospheric hazards
Bumble Bee tuna Case Study	Atmospheric monitoring & testing
Employer requirements	Ventilation
Confined space Equipment	Respiratory protection
Host & contractor	LOTO
Confined space entry permit	Non-Entry Rescue & Emergency Procedures
Confined space entry rolls & responsibilities	Confined Space Summary

We use the following equipment and tools

- Miller Fall Protection
- Honeywell Analytics Air monitoring Equipment
- Bullard SAR or PAPR systems
- North Head, Eye, Face Protection

Rotating modules:

Written Test	Videos	ENTRY
Permit Prep	Classroom Scenario (Group)	INSPECTION

Regulatory Requirements

OSHA 1910.146	"PERMIT REQUIRED CONFINED SPACES"
WAC 296-809	"PERMIT REQUIRED CONFINED SPACES"
OAR 437-002-0146	"PERMIT REQUIRED CONFINED SPACES"

SCOPE of our training:

Permit required confined spaces as it relates to **general industry** requirements and best practices to protect employees from the hazards of entry.

Separate standards exist for the industries below, but differences are minor:

- Agriculture (296-307-642)
- Construction

OSHA 29CFR 1910.146

Contains several appendices that apply to the standard

- Appendix A- PRCS decision flow chart
- Appendix B- Procedures for atmospheric testing
- Appendix C- Examples of PRCS programs
- Appendix D- Confined space pre-entry check list
- Appendix E- Sewer system entry
- Appendix F- Rescue team or rescue service evaluation criteria (non-Mandatory)

Appendix E Sewer System Entry:

Special Considerations:

Difficulty due to completely isolating the space
Potential for the atmosphere to become unpredictably hazardous
Sewer workers make multiple regular entries, increasing risk.

Regulatory Requirements

PRCS Standard can be difficult to understand due to the required adherence to multiple safety standards including but not limited to the following standards:

Respiratory Protection	OSHA CFR 1910.134 / WAC 296-842
Lock-out Tag-out	OSHA CFR 1910.147 / WAC 296-803
Hearing Conservation	OSHA CFR 1910.95 / WAC 296-817
Fall Protection	OSHA CFR 1910 & 1926 / WAC 296-880
Personal Protective Equipment	OSHA CFR 1910.132 / WAC 296-24 & 800

Confined space Accident Facts

Of fatal confined space accidents, **93%** of the spaces did not have signs indicating that they were confined spaces
80% of confined spaces where fatalities occurred had been entered before without any problems by the same person who died.
40% of fatal atmosphere related accidents, the hazard was not present at the time of initial entry
89% of confined space fatalities were jobs authorized by supervisors
35% of the fatalities were the supervisors

As discussed the confined space standard is complicated and has various standards that apply to confined spaces. As you can see not adhering to these **minimum standards** can result in injury or death. **Complacency & Shortcuts are 2 severe hazards faced on a daily basis which are not identified or addressed by any State or Federal standard yet play a huge role in confined spaces.**

Behavioral Based Safety proves that humans have a tendency to get complacent and try to speed up processes or tasks by taking shortcuts. It's proven that the **more experience you have the more likely you are to get complacent or attempt shortcuts**. Based on your experience or repetition you gain a **false sense of safety** or security. A False sense of safety can **lead to injuries or even death**.

Common complacent and shortcut statements may include:

"We've always done it that way"
"We've never had a problem in the space before"
"It takes too long to get everything together, we're only going in for a couple minutes"
"The equipment is to expensive"
"We have never needed it before"

MOST CONFINED SPACE ACCIDENTS ARE CAUSED BY A FAILURE TO RECOGNIZE AND UNDERSTAND KNOWN OR POTENTIAL HAZARDS

What is a confined space?

Confined Space is:

1. ***Large enough for a worker to enter fully***
2. ***Not designed for continuous worker occupancy***
3. ***Limited or restricted openings for entry and exit***

What is meant by "limited or restricted entry & exit"?

If escape during an emergency is impeded by such obstacles as:

Manhole
Small door or opening
Ladder
Long tunnel
Baffles
Equipment or other obstacles

OSHA/AG CS Classifications

1. Permit Required
2. Alternate Entry
3. Non-Permit Required

DOSH CS Classifications

1. Permit Required
2. Alternate Entry

Common Confined Spaces

Storage tanks
Ship compartments
Process vessels
Boilers
Sewers
Tunnels
Underground Utility Vaults
Pipelines
Storm drains
Attics
Crawlspaces

OSHA/AG Permit Required Confined Spaces

Permit required confined Spaces Include

1 or more of the following

Hazardous atmosphere (known or potential to develop)
Inward sloping walls or dangerously sloping floors
Contains any other serious safety hazard (known or potential to develop)

What do they mean any other serious safety hazards?

Includes but not limited to the following:

Explosion
Mechanical devices
Electrical energy or devices
Hydraulic energy or devices
Pneumatic energy or devices
Radiation
Temperature extremes
Noise

Chemicals (present or applied that can cause serious physical harm or death)

What do they mean any other serious safety hazard?

Anything:

That could impair the ability to self-rescue

Result in a situation that presents an immediate danger to life or health (**IDLH**)

ALL CONFINED SPACES ARE PERMIT REQUIRED UNTIL PROVEN OTHERWISE

DOSH Permit Required Confined Spaces

Permit required confined Spaces Include

1 or more of the following

Contains or has potential to contain a hazardous atmosphere

Contains material with potential for engulfing someone who enters

Internal configuration could allow someone entering to be trapped or asphyxiated by inwardly converging walls or by a floor, which slops downward and tapers to a smaller cross section

Contains any other physical hazard (known or potential)

What do they mean any other serious safety hazard?

Includes but not limited to the following:

Any recognized health or safety hazards including engulfment in solid or liquid material, electrical shock or moving parts..

Any serious safety or health hazard that could either

Impair the ability to self-rescue or

Result in a situation that presents an immediate danger to life or health (**IDLH**)

ALL CONFINED SPACES ARE PERMIT REQUIRED UNTIL PROVEN OTHERWISE

General Employer Requirements

Employers Must:

Identify Confined Spaces by conducting site evaluations and job hazard assessments

Identify Known & Potential Hazards Associated with EACH confined space

Inform employees by posting signs where FEASIBLE

Prevent entry by unauthorized persons not only employees, but anyone who could possibly gain access

Establish a written program and written permit system

Train employees

Before 1st CSE assignment

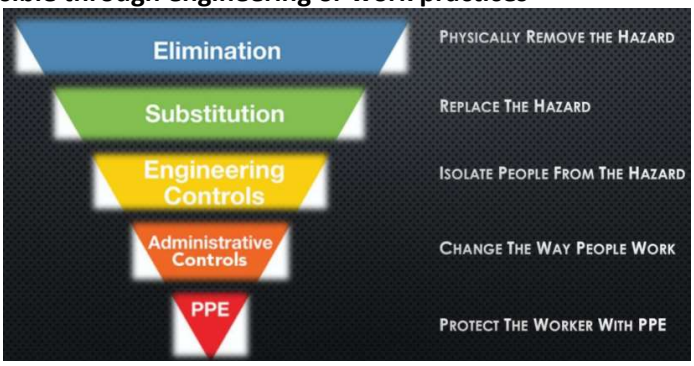
Changes in assigned duties

New hazard exposure

And when the employee shows deficiencies in knowledge or trainings

Provide required equipment, including testing and monitoring equipment with associated equipment training

Control hazards where possible through engineering or work practices



Protect entrants from external hazards

Enforce established procedures

General Confined Space Equipment & Employers responsibility to provide equipment and equipment training.

Testing and Monitoring Equipment

MOST IMPORTANT

Ventilation

MOST IMPORTANT

Communication

Equipment and process varies by entry and departments

Personal Protective Equipment

Host Employers & Contractors

Host employer arranges for contractor to perform work involving confined space entry

Host Employer Informs Contractor of:

1. PRCS in the workplace
2. PRCS hazards and history with each CS
3. Precautions or procedures they will be required to follow while working
4. Coordinate entry operations
5. Debrief contractor at end of entry

Contractor shall:

1. Obtain info on permit required by host
2. Coordinate entry operations with host
3. Inform host of entry procedures the contractor will follow during entry
4. Debrief host at end of entry

Confined Space Entry Permit

Entry permit: Our planning tool to help determine what types of PPE, other safety equipment and procedures are needed for a specific entry. CSE Permit is the **most essential tool** for assuring safety during entry in confined spaces with known hazards or with unknown or potentially hazardous atmospheres. It must be **completed prior to entry** and **posted at the entry site.**

CSE permit must contain a minimum 15 pieces of specific information:

Identify the space to be entered
Date and authorized duration of the permit
Acceptable entry conditions
Appropriate measures used before entry
Signature or initials of authorizing person
Equipment for safe entry
Other information needed for safe entry
Purpose of the entry
Hazards of the space to be entered
Results of initial and periodic tests
Names of Entrant, attendant, Supervisor
Communication procedures
Rescue/emergency services/ contact info
Additional permits (example: hot work)

PERMIT NEXT PAGE

Site location: _____ Date: _____

Purpose of entry: _____ Type of work: _____

Competent Person Evaluating: _____ Phone # : _____

Competent Person Remaining On Site During Work? _____

A competent person must evaluate the space using the Hazard Analysis below, If only Potential Hazardous Atmosphere is checked or all other hazards are eliminated by corresponding methods you may determine this Space to be an Alternate Method Confined Space and Sign the box on this page. If all hazards can not be eliminated or hazards in the grey box are checked, the space is Permit Required and the back of the form must be filled out. Continuous air monitoring and sufficient ventilation is required to be documented for all Alternate Method and Permit required Confined Spaces.

PERMIT DURATION:	PERMIT START TIME & DATE	SUSPEND PERIOD	PERMIT CLOSED TIME & DATE

COMMUNICATION PROCEDURES (INCLUDING EQUIPMENT) _____

ATTENDANTS AND ENTRANTS

LEAD ATTENDANT:	LEAD ENTRANT:	TIME IN	TIME OUT

ADDITIONAL ATTENDANT(s)	ADDITIONAL ENTRANT(s)	TIME IN	TIME OUT

HAZARD ANALYSIS

- ☐ 1) Potential Hazardous Atmosphere
- ☐ 2) Potential explosive Hazard
- ☐ 3) Electrical Hazard(s)
- ☐ 4) Excessive Heat/Cold
- ☐ 5) High Noise (>85dBA)
- ☐ 6) Fall hazard within space
- ☐ 7) Fire hazard
- ☐ 8) Chemical hazard
- ☐ 9) Birds/ Animals/ Insects/ Plants
- ☐ 10) Heavy equipment operating
- ☐ 11) Vehicle traffic near opening
- ☐ 12) Water or engulfment hazard
- ☐ 13) Moving mechanical equipment
- ☐ 14) Inadequate Lighting

PERMIT REQUIRED HAZARDS

- ☐ 15) Known hazardous/ Explosive atmosphere
- ☐ 16) Welding/ Fire hazard (Hot Work Permit)
- ☐ 17) Raw Sewage/ Decaying Material
- ☐ 18) Entanglement/ Difficult Rescue
- ☐ 19) Electrical Work without LOTO
- ☐ 20) Work on Energized/ Pressurized systems
- ☐ 21) Vertical drop >5ft at entrance

CORRESPONDING METHODS TO CONTROL HAZARDS ABOVE

- ☐ 1) Air Monitoring/ Ventilation
- ☐ 2) Air Monitoring/ Ventilation
- ☐ 3) Lockout/ Tagout of Electrical
- ☐ 4) Heaters/ Air Conditioners
- ☐ 5) Hearing Protection
- ☐ 6) Fall Protection
- ☐ 7) Fire Extinguisher
- ☐ 8) Chemical control per SDS
- ☐ 9) Removal of natural hazard
- ☐ 10) Equipment Control
- ☐ 11) Traffic Control
- ☐ 12) Water removal/ disconnect/LOTO
- ☐ 13) Lockout/ Tagout
- ☐ 14) Lighting

- ☐ 15) Monitoring/Ventilation ☐ Respirator(s)
- ☐ 16) Fire Extinguisher(s)
- ☐ 17) PPE for Sewage
- ☐ 18) Rescue plan/ Retrieval equipment
- ☐ 19) Qualified person/Arc Flash protection
- ☐ 20) Qualified person and work policy
- ☐ 21) Retrieval equipment required to be setup — **Tripod** **Davit** **Other**

MARK ALL PPE BELOW THAT APPLIES

ENTRANT PPE

- ☐ Hardhat
- ☐ Helmet
- ☐ Gloves
- ☐ Goggles
- ☐ Safety Glasses
- ☐ Face Shield
- ☐ Protective Clothing
- ☐ Welding Hood
- ☐ Full Body harness w D ring
- ☐ 1/2 mask respirator
- ☐ Full Face respirator
- ☐ SAR/SCBA
- ☐ SAR/ESCBA

OTHER:

MARK ALL PPE BELOW THAT APPLIES

ATTENDANT PPE

- ☐ Hardhat
- ☐ Helmet
- ☐ Gloves
- ☐ Goggles
- ☐ Safety Glasses
- ☐ Face Shield
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- ☐ Welding Hood
- ☐ Full Body harness w D ring
- ☐ 1/2 mask respirator
- ☐ Full Face respirator
- ☐ SAR/SCBA
- ☐ SAR/ESCBA

OTHER:

PERMIT CONTINUED ON NEXT PAGE

☐ AIR MONITORING FOR ALTERNATE ENTRY ☐ AIR MONITORING FOR PERMIT REQUIRED

GAS MONITOR MODEL: _____ BUMP TEST BEFORE USE ☐ CALIBRATION DUE: _____ DAYS

ALL MONITORED LEVELS MUST BE BELOW THE PEL OR WITHIN LIMITS FOR SAFETY ENTRY CONDITIONS TO BE SATISFIED

SUBSTANCE	PERMISSIBLE EXPOSURE LEVELS	PRE ENTRY	1	2	3	4	5	6	7	8
		CONTINUOUS AIR MONITORING RECORD RESULTS (REGULAR INTERVALS):								
O2 (Oxygen)	Range: 19.5% to 23.5%									
LEL/LFL	UNDER 10%									
H2S (Hydrogen Sulfide)	PEL= 10 STEL= 15									
CO (Carbon Monoxide)	PEL= 35 STEL= 200									
CO2 (Carbon Dioxide)	PEL= .005 STEL= .03									
	TIME(S):									

RESCUE PLAN FOR PERMIT REQUIRED CONFINED SPACE

☐ **NON- ENTRY RESCUE BY ATTENANT** (ENTRANT DOES NOT DISCONNECT FROM SYSTEM OR HAVE ANY SIGNIFICANT ENTANGLEMENT HAZARD

☐ **CONTRACTED PREVIOUSLY QUALIFIED THIRD PARTY RESCUE TEAM** OR FIRE DEPARTMENT W/ CONFINED SPACE TECHNICAL RESCUE TEAM WITH REASONABLE RESPONSE TIME AND WHO AGREES TO NOTIFY SUPERVISOR IF UNAVAILABLE.

☐ **EMPLOYER RESCUE TEAM** NOTIFIED AND AVAILABLE WITHIN REASONABLE RESPONSE TIME ☐ CHECK HERE IF REQUIED AT ENTRANCE

☐ **RESCUE TEAM ON SITE** WITH SUPPLIED AIR RESPIRATORS FOR KNOWN HAZARDOUS ATMOSPHERE ENTRY

RESCUE TEAM CONTACT # _____ RESCUE TEAM CONTACT NAME: _____

RESCUE TEAM CONTACT DATE & TIME _____

RESCUE TEAM NAMES: _____

SPECIAL HAZARDS, INFORMATION PROCEDURES, OR CONDITIONS FOR RESCUE:

PRE-ENTRY REQUIRMENTS TO BE COMPLETED IN ORDER

SECURE AREA (POST CS SIGN & BARRIERS AT ENTRANCE)	☐	Completed	ENTRANT DONS PPE/RESPIRATOR/CLOTHING	☐	Completed
	☐	N/A		☐	N/A
ENERGY CONTROL PROGRAM (LOTO)/ DEENERGIZED/ TRY-OUT FOR ALL ENERGY SOURCES	☐	Completed	EMERGENCY ESCAPE RETRIEVAL EQUIPMENT SETUP (TRIPOD, DAVIT, WINCH)	☐	Completed
	☐	N/A		☐	N/A
ENGULFMENT LINE(S) DISCONNECTED- LOTO-WATER REMOVED OR CONTROLLED W/ PUMPS	☐	Completed	**COMMUNICATIONS**		
	☐	N/A	VISUAL: ☐ VERBAL: ☐ RADIO: ☐	☐	Completed
GAS LINES- PURGE, FLUSH OR VENT (LIST):	☐	Completed	OTHER:	☐	N/A
	☐	N/A	**HOT WORK PERMIT IN CONFINED SPACE**		
INITIAL AIR MONITORING (RECORD ON PAGE 1)	☐	Completed	THIS DOCUMENT ALSO SERVING AS HWP FOR HOT WORK W/ FLAMMABLES WITHIN 35' OF WORK		
	☐	N/A			
VENTILATION OF SPACE BEFORE AND THROUGH DURATION OF THE ENTRY (UNTIL THE LAST ENTRANT IS OUT)	☐	Completed	FIRE EXTINGUISHER LOCATION(s)		
	☐	N/A			
CHEMICAL SDS REVIEWED	☐	Completed	NAME OF FIRE WATCH:		
	☐	N/A			
			TIME OF FIRE WATCH COMPLETION:		

ENTRANTS MUST EXIT SPACE IMMEDIATELY IF THERE IS A FAILUREOF A DIRECT READING INSTRUMENT, FAILURE OF VENTILATION SYSTEM, DETECTION OF A HAZARDOUS ATMOSPHERE, INTRODUCTION OF A NEW HAZARD, A HAZARD DEVELOPS, ENTRANT SHOWS SIGNS OF EXPOSURE, ANY ALARM OCCUCRES OR CONDITIONS CHANGE

SUPERVISOR

ENTRY SUPERVISOR SIGNATURE SIGNIFIES ALL CONDITIONS HAVE BEEN SATISFIED FOR ENTRY. ACCEPTABLE ENTRY CONDITIONS FOR PERMIT REQUIRED SPACE HAZARDS ARE BEING CONTROLED, CONTINUOUS MONITORING AND VENTILATION IS BEING PREFORMED AND EMERGENCY RESCUE HAS BEEN PLANNED

SUPERVISOR NAME _____ SUPERVISOR PHONE: _____

SUPERVISOR SIGNATURE: DATE & TIME:

END PERMIT

Confined Space Roles & Responsibilities

Confined Space Program Administrator:

The person who has overall responsibility for your program and has sufficient training or experience with PRCS entry to oversee program development, coordinate implementation and conduct program effectiveness evaluations.

Empowered to specify controls and protective actions.

Confined Space Entry Supervisor

A qualified and trained person responsible for identifying PRCS and performing responsibilities and job duties.
The CSE Supervisor may also be the attendant or entrant meaning that the **minimum amount of people needed for an entry is 2.**
Supervisor responsibility may be passed to another supervisor.

Job duties and Responsibilities:

Authorizes the entry into PRCS by signing the entry permit

Oversees entry operations
Knows hazards and hazard effects (symptoms) and consequences
Verifies rescue services are available, means of contact are in place
Removes unauthorized individuals
Verifies and check the following:
1. Permit is filled out
2. All test specified by permit have been conducted
3. All procedures and equipment per permit are in place

Terminates the entry and cancels the permit when assigned job is completed or a condition in the space is not covered in the permit

And determines entry operations remain consistent and acceptable entry conditions are maintained.

Confined Space Entry Attendant (outside the PRCS)

IMPORTANT

The number of attendants assigned should be tailored to requirements of the space and work being performed.
You need to assess if it is appropriate, or possible, to have multiple spaces monitored by a single attendant, or have an attendant stationed at each space.
May be stationed at any location outside the PRCS, if the duties described below can effectively be performed for each space.

Job Duties:

Must remain outside the PRCS during entry
Understands the hazards including recognition of exposure symptoms
Aware of behavioral effects of exposure to hazards
Maintains accurate record of who is in the PRCS
Continuously maintains accurate count of entrants in space
Maintains communication with entrants to monitor their status

Orders evacuation immediately for the following **(NOT LIMITED TO)**

1. **A prohibited condition is identified**
2. **Behavioral effects of hazard exposure are identified in the entrant**
3. **A situation outside the space that could endanger entrant**
4. **Attendant cannot effectively perform all duties required**

Job Duties

Confined Space Entry Attendant (outside the PRCS)

Performs non-entry rescue as specified on permit
Has ability to respond to an emergency without preventing performance of attendant's duties to monitor other spaces
Carries out no duties that might interfere with primary duty to monitor and protect entrants
Calls rescue services when entrant may need assistance to escape from space
Monitors space until entry operations are relieved or all entrants are out of the space

Confined Space Entry Entrant

Job duties:

Knows hazards, including symptoms of exposure
Uses equipment properly
Maintains communication with the attendant
Alerts attendant of conditions in the space
Exit from PRCS when (not limited to)
Attendant/Supervisor give evacuation order
Entrant recognizes hazard exposure warning signs or symptoms
Entrant detects a prohibited condition
Alarm is activated

Attendant & Entrant communication

Why is continuous communication between attendant and entrant(s) so important?

Attendant needs to advise the entrant of conditions external to the space
Observe entrant behavior
Notifies the entrant(s) in the event of an emergency, changing conditions, or termination of the entry

Effective CSE communication options

Voice
Hand signals
"Tap" signals
Rope line
Radios
Hard-line
Pass Device (Personal Alert Safety System)

Common Confined Space Hazards

Prior to entry into a PRCS, a thorough hazard assessment must be completed, including known and potential hazards.

WARNING!

Hazards may vary depending on the space
Hazards may change over time
Changes happen quickly

This list is not comprehensive

Engulfment hazards- Surrounding, Suffocating, Drowning

Water	Corn syrup
Chocolate	Wine
Beer	Plastic
Sewage	Grain
Sawdust	Dirt
	Any others…..

2-3" would not be considered a hazard, unless it covers a WWS hazard

This list is not comprehensive

Physical Hazards

- Hazardous energy
  - Electrical
  - Hydraulic
  - Pneumatic
  - Steam
  - Chemical reactions
  - Flowing energy (steam, gas)
  - Energy under pressure
- Heat and temperature extremes
- Combustible dust and particulates
  - Grain
  - Walnut shells
  - Plastic
  - Sugar
  - Metals
  - Pressurized lines
  - Chemical, hydraulic, pneumatic,
  - Steam, water
- Mechanical hazards may also have associated electrical hazards
- Moving or rotating parts
  - Augers, agitators, tumblers, mixers, rakes
  - Crushers
  - Conveyors
- Falls from height
- Ignition sources from non-intrinsically safe equipment
  - Light bulbs
  - Switches and ventilation system motors
- Spark producing equipment and processes like welding, cutting, burning, torching, grinding, space heaters
- Static discharge
- Transferring liquids without bonding or grounding

Psychological Hazards

Claustrophobia, Panic Disorders, Autophobia, Nyctophobia, Arachnophobia

Water hazards

Water, in a sufficient quantity to either endanger the entrant or to interfere with escape from the space

Water combined with other hazards (concealing trip and fall hazards)

Water may promote hazardous atmosphere formation like fermentation or rotting vegetation

Biological hazards

Disease causing organisms

Poisonous spiders and snakes

Hazards specific to the type of work you're doing are not only physical hazards, but atmospheric as well:

Welding - source of ignition, **oxygen consumption**

Painting - introduction of chemical toxins, **oxygen displacement**

De-greasing - introduction of chemical toxins, **oxygen displacement**

Sandblasting - introduction of particulates, **oxygen displacement**

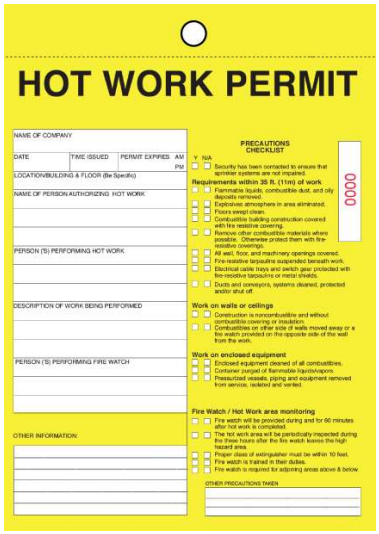
Mucking - release of organic vapors or toxins

Inerting - **oxygen displacement**

HOT WORK- Deliberate introduction of a source of ignition

Includes but not limited to:

Cutting	Welding
Riveting	Burning
Heating	Grinding


HOT WORK PERMIT

NAME OF COMPANY

DATE | TIME ISSUED | PERMIT EXPIRES AM PM

LOCATION/BUILDING & FLOOR (Be Specific)

NAME OF PERSON AUTHORIZING HOT WORK

PERSON (S) PERFORMING HOT WORK

DESCRIPTION OF WORK BEING PERFORMED

PERSON (S) PERFORMING FIRE WATCH

OTHER INFORMATION

PRECAUTIONS CHECKLIST

Y N/A

Security has been contacted to ensure that sprinkler systems are not impaired.

Requirements within 35 ft. (11m) of work

Flammable liquids, combustible dust, and oily deposits removed.

Explosive atmosphere in area eliminated.

Floors swept clean.

Combustible building construction covered with fire resistive covering.

Remove other combustible materials where possible. Otherwise protect them with fire-resistive coverings.

All wall, floor, and machinery openings covered.

Fire-resistive tarpaulins suspended beneath work.

Electrical cable trays and switch gear protected with fire-resistive tarpaulins or metal shields.

Ducts and conveyors, systems cleaned, protected and/or shut off.

Work on walls or ceilings

Construction is noncombustible and without combustible covering or insulation.

Combustibles on other side of walls moved away or a fire watch provided on the opposite side of the wall from the work.

Work on enclosed equipment

Enclosed equipment cleaned of all combustibles.

Container purged of flammable liquids/vapors.

Pressurized vessels, piping and equipment removed from service, isolated and vented.

Fire Watch / Hot Work area monitoring

Fire watch will be provided during and for 60 minutes after hot work is completed.

The hot work area will be periodically inspected during the three hours after the fire watch leaves the high hazard area.

Proper class of extinguisher must be within 10 feet.

Fire watch is trained in their duties.

Fire watch is required for adjoining areas above & below.

OTHER PRECAUTIONS TAKEN

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HOT WORK- **Special considerations to confined spaces**

Written authorization (PERMIT)

Continuous Monitoring

Continuous Ventilation

Zero Tolerance LEL reading

Re-Classification of Permit required Confined spaces

It is permissible to reclassify a PRCS to use other entry methods:

DOSH & OSHA

Alternate Entry procedures

OSHA/AG ONLY

Non- Permit Confined Space

Alternate Entry

The only hazard is atmospheric:

This atmospheric hazard must be mitigated with continuous forced air ventilation alone, and must maintain the space safe for entry

Documentation/ Certification Required

Location of space	Specific measures to eliminate hazards
Date of entry	Ventilation system used, Air monitoring
Duration of entry	Conditions of evacuation
Hazards of the space and work	Name, signature of Supervisor

Entrance cover may not be removed until conditions are safe

Barriers are erected immediately

Atmospheric testing prior to entry in this specific order

Must be tested for **Oxygen**
Must be tested for **Flammable gases & Vapors**
Must be tested for **Toxic contaminants**

No entry until hazardous atmosphere is eliminated
Continuous atmospheric monitoring verifying conditions remain safe
Continuous ventilation until last entrant leaves the space

Non-Permit Required: (OSHA) (AG 296-307-654)

No actual or potential atmospheric hazards capable of causing death or serious physical harm
All hazards can be eliminated without entry
Reclassification is allowed, only as long as hazards remain eliminated
Documentation is required to support re-classification

Atmospheric Hazards

Composition of fresh air

78% Nitrogen
20.9% Oxygen
1.1% All other gases, Water Vapor, CO2, Argon, Other trace gases

Sources of Atmospheric Hazards

There are any number of potential sources of atmospheric hazards in Confined Spaces, may include:

Previously stored chemicals/ materials
Unexpected leaks/ spills
Manufacturing processes
Drying of paints
Cleaning with acids/ solvents
Rotting, decomposition, fermentation
Welding, sandblasting, mucking

Some causes of oxygen deficiency

Leaking materials from storage tanks
Natural gas lines
Process valves
Decomposing organic matter
Corrosion
Fermentation
Combustion

Vapor density is the density of a gas or vapor in relation to air or hydrogen.
Air is considered to have a vapor density of 1.0
If a particular gas or vapor has a vapor density of **less than 1.0 it is considered lighter**
If a particular gas or vapor has a vapor density of **more than 1.0 it is considered heavier**
< 1 Lighter causes the gas or vapors to rise
> 1 Heavier causes the gas or vapors to sink

(Vapor Density)

Ammonia NH3 (0.597)	Raises
Carbon Monoxide CO (0.97)	Raises (within breathing zone)
Hydrogen sulfide H2S (1.189)	Sinks
Methane CH4 (0.554)	Raises
Carbon Dioxide CO2 (1.53)	Sinks
Chlorine CL2 (2.47)	Sinks

Primary Atmospheric Hazards in Confined Spaces

- Oxygen Deficiency
- Oxygen Enrichment
- Combustible Atmospheres
- Toxic Atmospheres
- High or Low temperatures

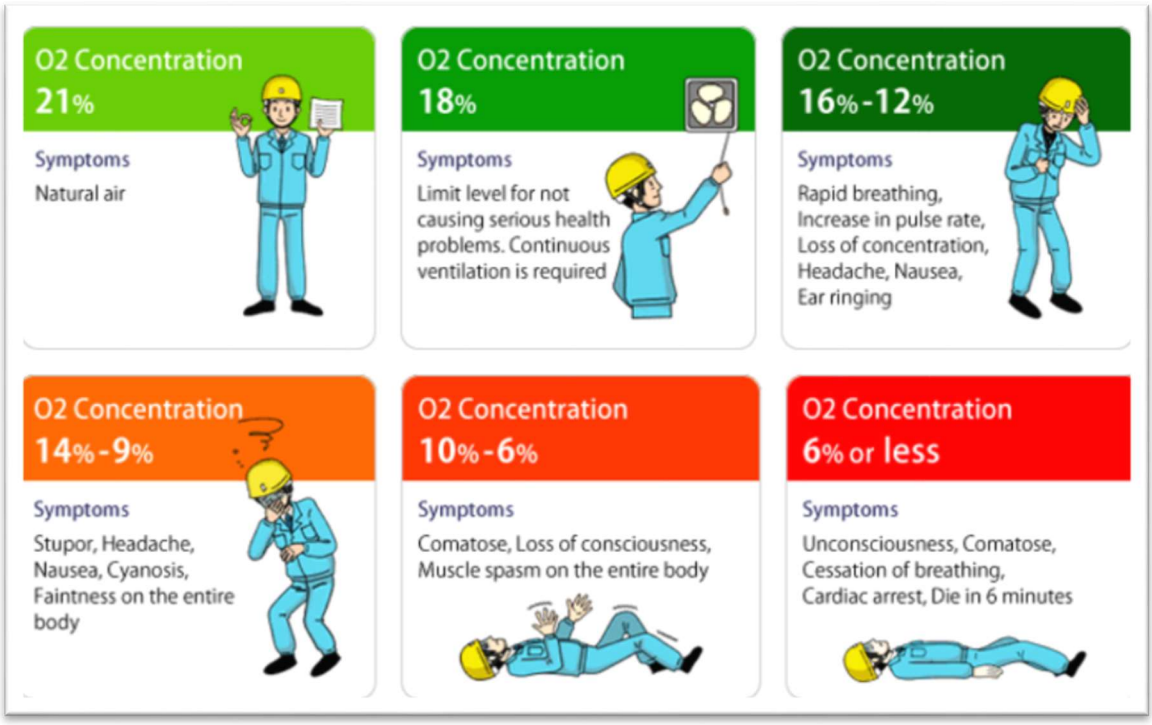
Oxygen deficient

A space is considered oxygen deficient when O2 concentrations equal or fall below 19.5%

Effects of Oxygen Deficiency

Impairs the mental faculties of the entrant (**simulating intoxication**), affecting:

- **Judgement**
- **Behavior**
- **Physical Capabilities**



Oxygen enriched environment

A space is considered O2 enriched when O2 concentration is 23.5% or higher O2 Enrichment dangers

- Increased rate of many chemical reactions
- Ordinary combustible materials to become flammable or explosive
- Accelerated combustion

NEVER USE O2 TO VENTILATE A CONFINED SPACE!

TOXIC ATMOSPHERES

Permissible **E**xposure **L**imits

PEL- Based on **8hr T**ime **W**eighted **A**verage
Is the level of exposure established as the highest level of an employee may be exposed to without incurring the risk of adverse health effects.

PEL IS OSHA's ENFORCEMENT LEVEL

Threshold Limit Value:

TLV- Limit of substance that is believed to be a level to which a worker can be exposed day after day for a working lifetime without adverse effects

American **C**onference of **G**overnmental **I**ndustrial **H**ygienists (ACGIH)
Recommended over using the PEL since it provides a higher level of protection for workers

PEL	**VS.**	**TLV**	
Ammonia NH3	50ppm	Ammonia NH3	25ppm
Carbon Monoxide CO	50ppm	Carbon Monoxide CO	25ppm
Hydrogen Sulfide H2S	10ppm	Hydrogen Sulfide H2S	1ppm
Methane CH4	1000ppm (0.1%)	Methane CH4	1000ppm (0.1%)
Carbon Dioxide CO2	5000ppm (0.5%)	Carbon Dioxide CO2	5000ppm (0.5%)
Chlorine CL2	1ppm	Chlorine CL2 0.5ppm	0.5ppm

For comparison: 1PPM equals 1" in 16 miles, or 1 cent in 10,000 dollars

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH

IDLH

Any condition that poses an immediate or delayed threat to life that would cause irreversible adverse health effects, or that would interfere with an individual's ability to escape unaided from a permit space

Carbon Monoxide CO (.97) PEL 50ppm TLV 25ppm IDLH 1200ppm

Known as the SILENT KILLER
Poor Warning Properties- **Odorless, Colorless gas**
More easily absorbed by the body then O2
Found in fumes produced anytime you burn fuel in vehicles, stoves, lanterns, grills, fireplaces, gas ranges or furnaces. CO can build up indoors and poison people and animals who breathe it.

Carbon Monoxide CO (.97) PEL 50ppm TLV 25ppm IDLH 1200ppm

Symptoms of Exposure (often described as flu-like)

- **Headache**
- **Dizziness**
- **Weakness**
- **Upset stomach**
- **Vomiting**
- **Chest pain**
- **Confusion**

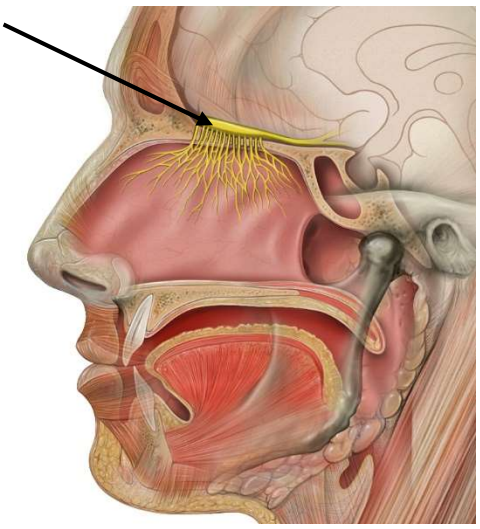
HEAVY EXPOSURE CAN CAUSE YOU TO PASS OUT, WHICH LEADS TO DEATH

Hydrogen Sulfide H2S (1.189) PEL 10ppm TLV 1ppm IDLH 100ppm

Commonly known as Sewer Gas/ Rotten Egg Gas
Colorless, corrosive, flammable gas with a strong odor of rotten eggs
Soluble in water
Sense of smell gets rapidly fatigued and cannot be relied on to warn of continuous presence H2S

Hydrogen Sulfide H2S (1.189) PEL 10ppm TLV 1ppm IDLH 100ppm

Overloads the olfactory bulb located in your nasal passage causing reduced sensitivity and loss of smell temporarily.



Hydrogen Sulfide H2S (1.189) PEL 10ppm TLV 1ppm IDLH 100ppm

Symptoms of exposure include

Eye irritation/ eye pain/ lacrimation/ photophobia

Dizziness

Headache

Weakness/ Exhaustion

Respiratory system; apnea

Coma

Convulsions

Irritability

Insomnia

Gastrointestinal disturbance

EXPLOSIVE ATMOSPHERES

Some gases may be <u>toxic at levels below</u> their flammability level

Toluene (3.1) PEL 200ppm TLV 50ppm IDLH 500ppm

Is flammable at **1100ppm**….What does that mean?

The toxicity of Toluene will kill you before it becomes flammable

ALWAYS REFER TO THE SDS IN REGARDS TO CHEMICAL/ GAS/ VAPOR EXPOSURE LEVELS

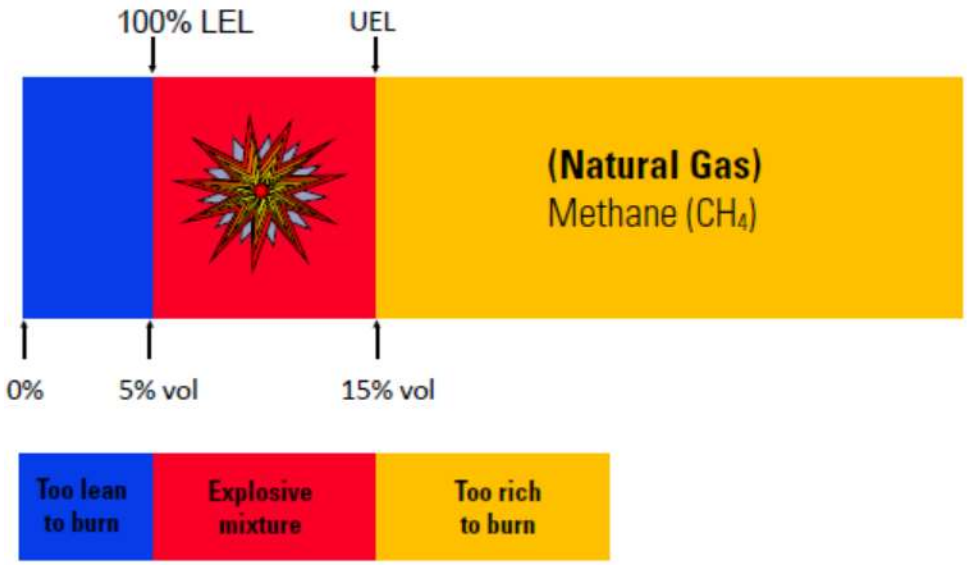
Lower **E**xplosive **L**imit **(LEL) is:**

The minimum concentration of combustible gas or vapor in air which will ignite if a source of ignition is present.

CONCENTRATION BELOW THE LEL ARE TO "LEAN" TO BURN

METHANE CH4 (.554) PEL & TLV 1000PPM IDLH 2100PPM

LEL OF 5%

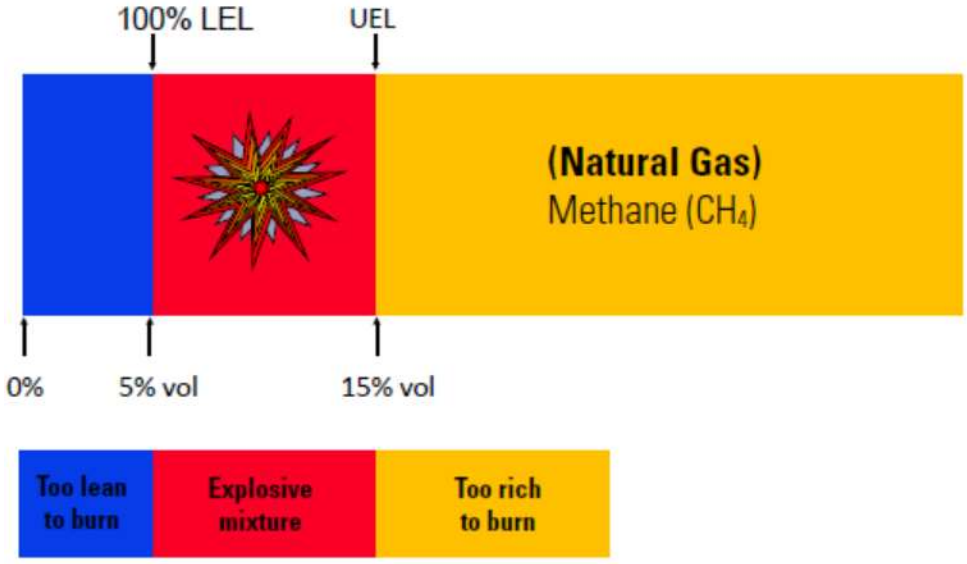


EXPLOSIVE ATMOSPHERES:

A monitor will recognize a hazard exists whenever readings exceed 10% of LEL

METHANE CH4 (.554) PEL & TLV 1000PPM IDLH 2100PPM

LEL of 5%

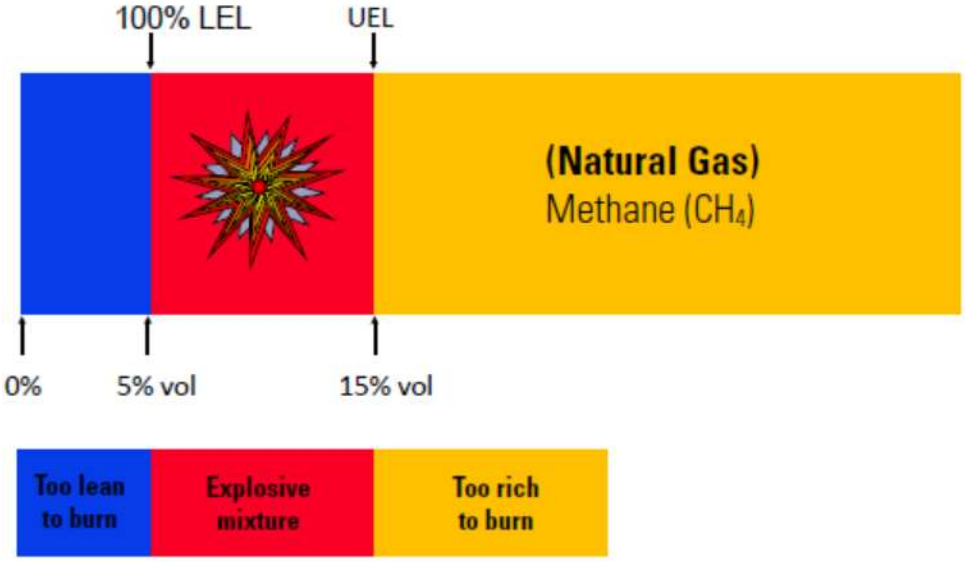


Upper **E**xplosive **L**imit **(UEL)**

Maximum concentration in air which will support combustion, concentration above the UEL are **too RICH to BURN**

METHANE CH4 (.554) PEL & TLV 1000PPM IDLH 2100PPM

UEL of 15%



IMPORTANT NOTE NOT ALL COMBUSTIBLE GASES HAVE A UEL

ATMOSPHERIC MONITORING/ TESTING

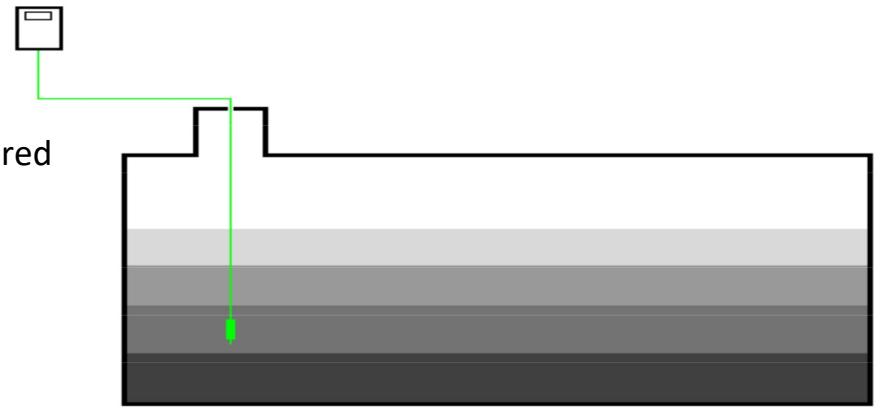
Atmospheric hazards form in layers, as discussed previously, OSHA requires air **sampling** to be performed **prior to entry, and continuously through the duration of the entry, recording** the reading at regular intervals to give a clear picture of the atmosphere in the confined space.

Many accidents result from changes in the confined space atmosphere which occur after the entry is initiated.

THE ONLY WAY TO PICK UP CHANGES BEFORE THEY BECOME LIFE THREATENING IS TO MONITOR CONTINUOUSLY

Stratification

Atmospheric hazards form in layers, testing is required every **4ft**



YOU STILL MUST PERFORM PRE ENTRY TESTING, AND TESTING AT THE OPENING

ALWAYS REFER TO YOUR MONITOR MANUFACTURER GUIDELINES FOR APPROPRIATE SAMPLE TIME PER LAYER.

Air monitors should provide continuous automatic measurement, either pump or diffusion, and no interpretation of reading. Air monitors will have three alarm types VISUAL, AUDIBLE, TACTILE. Air monitors should be of the data logging type.

AIR MONITORS:

Instrument reliability/response are dependent upon:

Proper Calibration Practices

Power (battery or rechargeable)

Sufficient sample time

Instrument Alarm Levels

Most monitors have 2 alarm levels

The warning alarm indicates that the instrument sees a detectable level of gas that is potentially hazardous

The danger alarm: Gas concentration has exceeded the monitors programed “hazard” threshold and the atmosphere is at or approaching a hazardous level

Instrument Sensors

Exposure to high gas concentrations “poisoning”

High levels of dust or moisture

Temperature extremes

Physical shock

Stability of span gas

Reactive gases have a “shelf life”

LEL sensors may be poisoned or suffer degraded performance with prolonged exposure to:

Silicones

Tetraethyl-lead

Halogenated hydrocarbons

High concentration of sulfides

High concentration of flammable gas

OSHA requires the use of a “calibrated” instrument

Calibration: Procedure that verifies instrument accuracy to guard against any unexpected loss of sensitivity

This means that the instrument must be maintained and calibrated according to manufacturer's guidelines

Fresh Air/ "Zero" Calibration:

Zeroing provides a reference point for each installed sensor to recognize the ambient air as clean air. If the ambient air is not truly clean air, a zero air cylinder should be used.

Some monitors perform a "fresh air" calibration when powered up, other models require a manual start-up of the process.

"BUMP" test is a function test of the monitor to verify the sensors are reacting and performing as expected. Also ensures alarm functions- Audible, Visual, Tactile

BUMP TEST BEFORE EACH DAYS USE

"SPAN" calibration includes sensor adjustment back to manufacturer's specifications

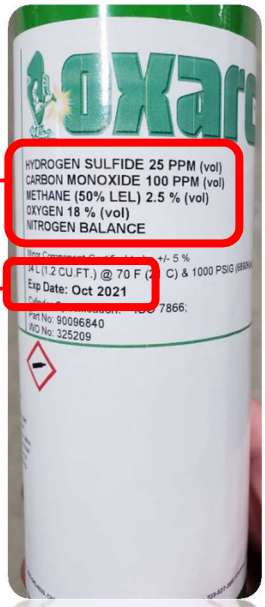
The use of correct calibration gas is important

Calibration gas has an expiration date due to reactive gases

ALWAYS CHECK THE DATE ON THE CALIBRATION GAS

CAL gas Mixture

EXPIRATION DATE



Ventilation

Ventilation is a critical component of confined space entry

Fumes, vapors, dust/particulates and volatile organic compounds (VOCs) can create a hazardous atmosphere which must be mitigated

OSHA considers ventilation one of the most important engineering controls to address hazardous atmospheres

OSHA 1910.146 does not specify how long or how many air exchanges are required

DOSH 296-24-71509 does not specify how long or how many air exchanges are required

Ventilation required when:

O2 deficient atmospheres- 19.5% or lower
O2 enriched atmospheres- 23.5% or higher
Combustible atmospheres (LEL) - 10% or higher dependent upon the type of gas present and type of work being performed **(May Require Special Equipment)**
Toxic atmospheres- "CO" and "H2S" or any other toxic above acceptable entry conditions (PEL or TLV)
Excessive high or Low temperatures

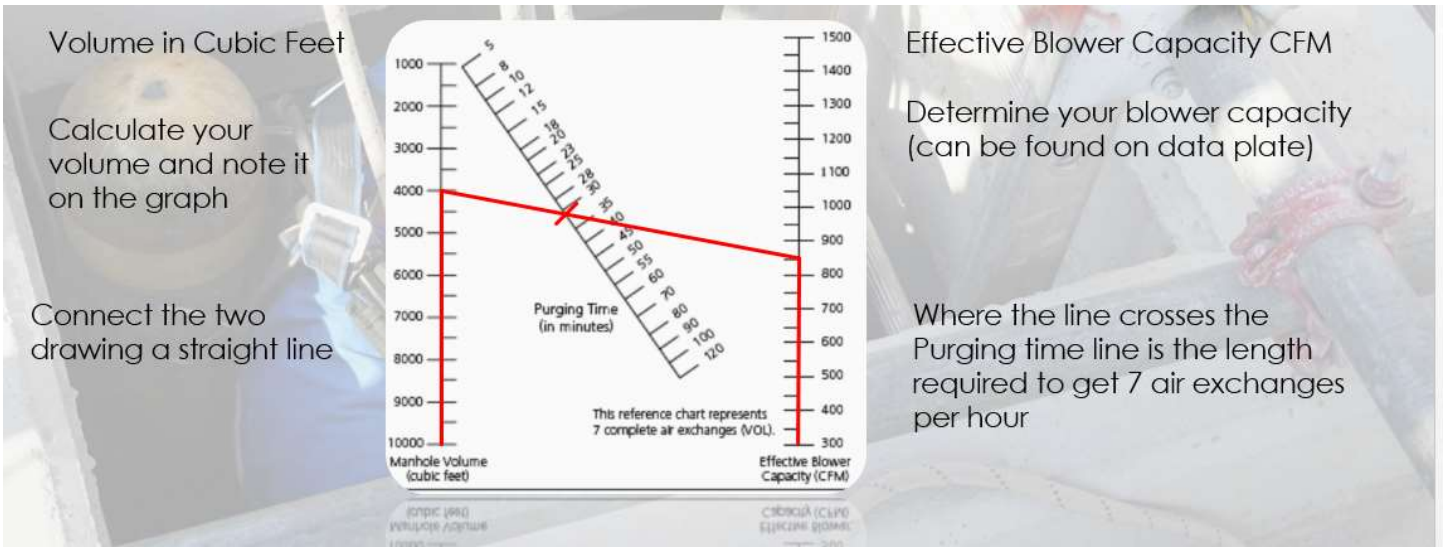
Continuous forced air ventilation **should continue until the hazardous atmosphere has been eliminated and is able to maintain acceptable entry conditions**

Continuous forced air ventilation must be used through the duration of the entry, until the last person is out of the space

Continuous force air ventilation shall be directed to ventilate the immediate areas where employees will be present, and continue until they leave the space.

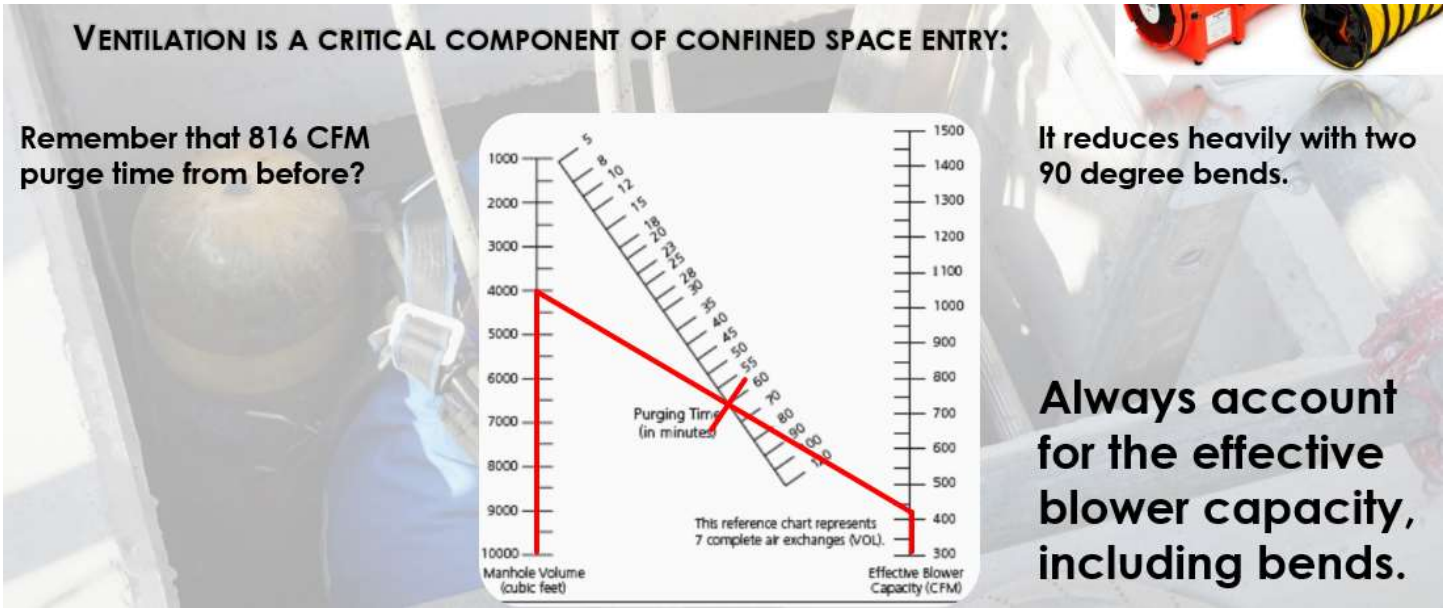
Air supply for the ventilation shall be from a CLEAN SOURCE

Ventilation purge time will depend on three things
Blowers cubic feet per minute output
Volume of the confined space
Contaminant levels



YOU SHOULD ALWAYS FOLLOW YOUR MANUFACTURES RECOMMENDATIONS ON PURGE TIMES

When CS volume is not known precisely, it will be necessary to estimate
If you don't know the volume and need to guess then as a safe guard double the time
When in doubt always increase purge times



EVEN IF YOU VENTILATE THE SPACE AS YOUR CALCULATIONS DETERMINED REMEMBER THAT YOUR AIR MONITOR WILL TELL YOU WHEN IT'S SAFE

YOUR AIR MONITOR IS THE DRIVING FORCE FOR ATMOSPHERIC CONDITIONS IN CONFINED SPACES

Blower Options Power- Electric, Battery, Gasoline

CFM- 300+

Accessories- Heaters, Duct connectors, Elbows, Saddle Vents

Blower Designs

AXIAL Blowers- <u>MOST COMMON</u>

Good for dilution (supply) ventilation

Better suited for shorter runs

Centrifugal Blowers- NOT AS COMMON

Lots of power

Effective for exhaust ventilation

Better for longer runs

Airflow Amplifiers:

Use compressed air to boost flow

Moves greater volumes of air

Used where fumes/vapors are poison, explosive or hazardous, or high heat conditions

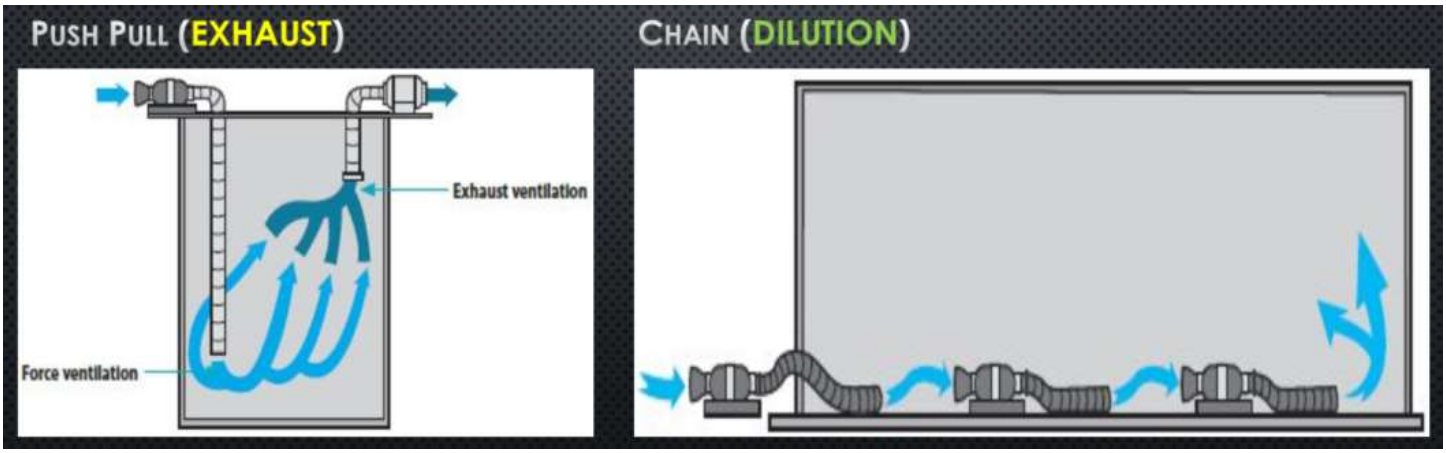
TECHNIQUES

Dilution ventilation

Used to dilute hazardous atmospheres by supplying continuous flow of fresh air
Requires the contaminant levels to be relatively low and produced at a steady rate

Source Capture/Exhaust ventilation

Used to control flammable & toxic contaminants being produced at a single point
Less effective if contaminants are widely dispersed



Using ducting effectively

Minimize bends, keep ducting as short as possible

Ducting used for source capture should only be used for source capture

Use ducting to deflect air off walls, floors, to aid in movement

Inspect for leaks and tears

Blower Placement

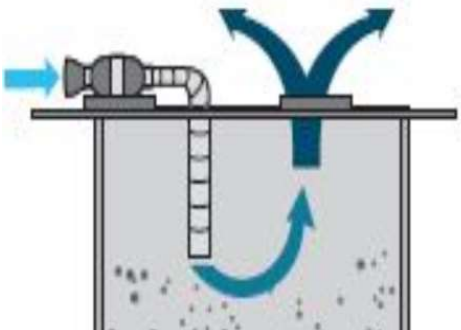
Place blower minimum of 5ft from the CS opening

Keep blower out of vehicle and foot traffic areas

Keep blower in fresh air (note vehicle exhaust)

Gas Powered blowers- Exhaust must be directed away from confined space.

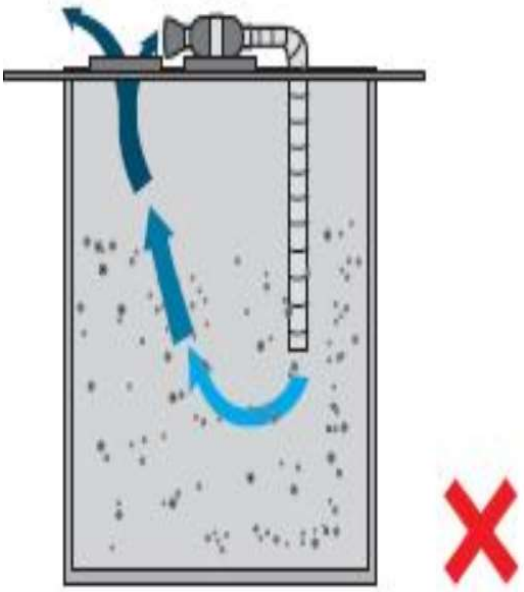
Common Blower Errors



SHORT-CIRCUITING

Fresh air moves directly from the inlet to an outlet preventing air exchange

Usually occurs when ducting is to short



RECIRCULATION:

When contaminated air is drawn back into the blower

Usually occurs with improper blower placement

ALWAYS TEST THE AIR AGAIN AFTER INITIAL PURGE VENTILATION

CONTINUOUSLY MONITOR & VENTILATE FOR THE ENTIRE DURATION OF THE ENTRY

If engineering controls cannot completely solve the issue, and you have implemented administrative controls and procedures, we then need to proceed with the selection of respirators

RESPIRATORY PROTECTION

The use of respiratory protection in confined spaces requires the compliance with

OSHA CFR 1910.134 or WAC 296-842

This will require comprehensive properly designed and administrated program

Some of the required sections include but not limited to:

Hazard surveys/evaluations/assessments

Written SOP's

Medical Evaluations

Selection of respiratory equipment

Fit-Testing (MUST BE CLEAN SHAVEN)

Regular scheduled training and retraining

The selection of respirators
We must know the hazard first
The concentration of the hazard
Do we need full face, half mask, dust mask and are gases or vapors involved
Do we need supplied air?

Air **P**urifying **R**espirators (**APR**)

APRs rely on cartridge or filter media to remove contaminants
- Half-mask
- Full-face

APR Limitations:
- Typically hazard specific, narrow range, lower concentrations
- Limited service life
- Subject to a change out schedule

Supplied **A**ir **R**espirators (**SAR**)

SARs rely on external fresh air supply
- Ambient air pumps- **Not designed for IDLH atmospheres**
- Cascade Bottle Systems
- Compressor systems

Limitations
- Mobility issues (25-300ft)
- Require an ESCBA
- Length of hose

Self-**C**ontained **B**reathing **A**pparatus (**SCBA**)

HIGHEST LEVEL OF RESPIRATORY PROTECTION
- Usually used in IDLH, emergencies, rescues and where **APR** and other **SARs** do not provide enough protection from Hazards.

Limitations:
- Regular training is required
- Regular inspection, maintenance w/ documentation
- Limited duration on cylinders

SCBA is quite often ***INVISIBLE***

Do you/your personnel know how to operate the SCBA?

Is your SCBA working and ready to go?

LOCKOUT/TAGOUT

LOTO is the process used to prevent energy from being released during the servicing or maintenance of equipment. This is accomplished by placing locks on energy isolation devices using an established procedure prior to starting work.

Requires a site specific written program
Employees must be trained according to their position
Authorized Employees- Perform the maintenance and LOTO equipment
Affected Employees- Usually the operators of the equipment during production
Other Employees- Employees not involved with the process
Equipment specific LOTO procedures must be developed, tested and reviewed.

LOTO applies during the servicing of equipment

Adjusting	Clearing jams
Inspecting	Lubricating
Modifying	Cleaning
Replacing parts	Tool changes

LOTO Devices

Must be sufficiently strong so that removing them by other than normal unlocking method requires **EXCESSIVE FORCE**. **Usually involves bolt cutters**

Tagout:

Tags are warning devices only
They do not provide the same level of protection as lockout devices
They can only be removed by an authorized person
They must be legible, securely attached and resistant to degradation

Procedures must be equipment specific and **include the 6 elements in sequence**
#1- Prepare for shutdown
#2- Shutdown machine or equipment
#3- Disconnect/Isolate the power source
#4- Apply LOTO devices
#5- Release stored energy
#6- Verify the safety of the machine or equipment

Non-Entry Rescue & Emergency Procedures

LEVELS OF RESCUE
Self-Rescue
Non-Entry rescue
Entry Rescue

As stated previously emergency and rescue must be planned in advance and described on your permit prior to entry. Know ahead of time who is available for:
RESCUE
ARE THEY TRAINED?
HOW FAR AWAY?

SELF- RESCUE - Preferred method:

In a self-rescue situation **hazards are recognized early**, the entrant is able to exit the space without assistance with zero, or minor injuries.

Example: Entrant slips while going down a ladder and sprains their ankle

Example: Monitor goes into alarm (**Warning** or **Danger**) and the entrant exits the space immediately without assistance.

NON-ENTRY RESCUE:

In this situation the entrant is not able to exit the space without assistance. The entrant either notifies the attendant or the attendant notifies the entrant or the entrant is non responsive.

Non-Entry Rescue is required unless

It increases the overall risk of injury to entrant
Would not contribute to the rescue of the entrant (**not effective**)

Entrant must have a full body harness w/retrieval line attached
Retrieval line must be attached to a mechanical device or fixed point outside of the space to allow for immediate rescue
Mechanical device must be available for rescue from a vertical space more than **5ft** deep.
Employer shall provide the following equipment to facilitate non-entry CS rescue

1. Full-body harness
2. Mechanical device with retrieval line
3. Ventilation
4. Air monitoring equipment

Any other equipment necessary for safe entry into and rescue

ENTRY RESCUE

CONTRACT:

Must pre-qualify rescue team response time, proficiency in rescue, notification. Must contain one member with current CPR and 1st aid certification. Must be informed of CS Hazards. Must have access to all CS to develop and practice

IN-HOUSE

No cost rescue training provide
PPE provided at no cost
Proficient with entry rescue
Able to perform rescue and emergency duties assigned
Knowledgeable in basic first aid and CPR

Both Contract and In-House

Must drill and be evaluated every **12 months** in Actual PRCS or simulated size, configuration and accessibility where rescues will be performed.

Establish procedures for: contacting rescue & emergency services, rescuing entrants from PRCS, providing emergency services to rescued entrants, preventing unauthorized person from rescuing

NOTE:
THE FOLLOWING IS NOT CONSIDERED A RESCUE PLAN:

Planning to rely on a rescue service and posting a contact number like 911 without contacting them and completing an evaluation in advance to ensure they meet the criteria

Entry into IDLH atmospheres will require standby rescue personnel per respiratory standard WAC 296-842

RESCUE CONSIDERATIONS

How is the fire department staffed? Paid or Volunteer
What is response time to your location?
Are they at all familiar with the confined space?
Are they trained in confined space rescue?
Do they have proper and required equipment?
Are they forbidden by statute from entering the confined space during a rescue?

CHALLENGES IN CS RESCUE

Locations

Remote
Hard to access

Equipment

Knowing how to operate effectively

Training

Skill levels and experience

YOUR RESCUE PLAN:

Do you have access to the basic tools?
Tripod & Harness
Air monitor
Blower
Lighting
Medical training

NOTE: ATTENDANT SHOULD NOT ENTER THE CONFINED SPACE UNTIL HELP ARRIVES AND ONLY IF TRAINED FOR ENTRY RESCUE AND ANOTHER TRAINED ATTENDANT IS ABLE TO REPLACE HIM PER STANDARDS

2/3 of workers killed in confined spaces are would be rescuers

Time is the enemy in CS rescue situations:

4-6 min in a low/ no O2 environment
Other atmospheric changes
Sudden Cardiac arrest
Other emergencies

Confined space Entry summary

Do the job from the outside if possible to eliminate the entry

Change the procedure
Redesign to eliminate the need to enter a confined space
Plan the entry completely; NO SHORTCUTS
Practice using, maintain equipment
Train & re-train

AVOID THESE COMMON HAZARDS
COMPLACENCY & SHORTCUTS

HAVE THE CSE STAPLES
AIR MONITOR
RESCUE TRIPOD & WINCH
BLOWER
COST OF THESE IS LESS THAN $10,000
KNOW HOW TO OPERATE THIS EQUIPMENT

AVOID THESE COMMON HAZARDS
COMPLACENCY & SHORTCUTS