

# Confined Spaces

- People are injured or killed every year as a result of improperly entering or working in a confined space.
- Potential hazards in every confined space include explosions, toxins, and oxygen-deficient atmospheres
- An average of 20 people a year die from confined space hazards – more than half of the fatality victims are would be rescuers
- You may encounter confined spaces in virtually any occupation; therefore, you need to be able to recognize confined spaces and understand their hazards.

## Training content:

Confined spaces

Hazards associated with confined spaces

Differences between flammable, toxic, irritant or corrosive & asphyxiating atmospheres

*Your ability to recognize a confined space could save your life*

## OSHA defines a confined space as a space that:

- Is large enough and configured, such that an employee can enter and perform work
- Is not designed for continuous occupancy
- Has limited or restricted means for entry or exit such as:
  - Tanks
  - Vessels
  - Silos
  - Storage Bins
  - Hoppers
  - Vaults
  - Pits





## Your Employer:

- Must develop and implement a written permit space program that outlines the policies and procedures associated with confined space entry
- Will also evaluate and identify confined spaces
- Will use engineering controls to reduce hazards within confined spaces
- Will provide personal protective gear



## Training

- Because of the serious potential for injury when entering a confined space, training must be provided to all employees involved in confined space entry
- This includes the entrant, attendants monitoring individuals entering and leaving confined spaces, and leaving confined spaces, and emergency personnel that may enter confined spaces to assist injured workers.
- Training must take place prior to working in a space and when hazards change
- Your ability to recognize a confined space and understand its potentially fatal hazards is critical.
- Permit-required confined spaces will be identified with a sign reading “Danger – Permit Required Confined Space, do Not Enter”



- You should always follow safe work practice and established procedures

- Never enter a confined space or attempt to rescue personnel inside a confined space unless trained to do so.
- More than 60% of confined space fatalities occur among would-be-rescuers

### **Fatal Fact:**

- On May 13, 1985, a 21 year old worker died inside a waste water holding tank that was 4 feet in diameter and 8 feet deep while attempting to clean and repair a drain line.
- Sulfuric acid was used to unclog a floor drain leading into the holding tank.
- The worker collapsed and fell face down into six inches of water in the bottom of the tank
- A second 21-year old worker attempted a rescue and was also overcome and collapsed
- The first worker was pronounced dead at the scene and the second worker died two weeks later
- Cause of death was attributed to asphyxiation by methane gas
- Sulfuric acid vapors may have also contributed to the cause of death

### **Types of Confined Spaces**

- Confined spaces can be described as spaces with open tops and with a depth that will limit the natural movement of air.
- An enclosed space with very limited openings for entry also describes a confined space
- Degreasers, pits, and certain types of storage tanks are examples
- Confined spaces such as sewers, castings, tanks, silos, vaults and compartments of ships usually have limited access
- Their limited access increases the risk of injury

### **Mechanical Devices**

- Mechanical devices introduce a very serious hazard in confined spaces
- Moving parts, coupled with the existing hazards of a confined space, can be deadly
- Digesters and boilers are especially hazardous because they usually contain power-driven equipment
- Such equipment may also contain physical hazards such as extreme heat, noise and vibration



## Harmful Gases

- Some confined spaces may appear to be harmless – however, they may contain very harmful gases
- Gases such as carbon dioxide and propane are heavier than air and may lie in a tank or vault for hours or even days after the containers have been opened
- Because some gasses are odorless, the hazard may be overlooked with fatal results



## Atmospheric Testing

- Since deaths in confined spaces often occur because the atmosphere is oxygen-deficient or toxic, confined spaces are always tested prior to entry and continually monitored
- A qualified person will test a confined space before entry to determine whether the confined space atmosphere is safe
- These tests will check for oxygen level, flammability, and known or suspected toxic substances

## Hazardous Atmospheres

- Hazardous atmospheres can be divided into four distinct categories:
  - ❖ Flammable
  - ❖ Toxic
  - ❖ Irritant and or Corrosive

## ❖ Asphyxiating

- Every confined space must be evaluated for these four types of hazards
- These atmospheric hazards are often difficult to identify since they might not be detected without the assistance of a gas monitor



## Flammable Atmospheres

- The Work being conducted in a confined space can generate flammable or explosive conditions
- Spray painting can result in the release of explosive gasses or vapors
- Welding in a confined space is a major cause of explosions in areas that contain combustible gas
- Flammable gases such as acetylene, butane, propane, hydrogen, or methane can be trapped in confine spaces
- Since many gases are heavier than air, they will settle in lower levels as in pits, sewers and various types of storage tanks and vessels
- In a closed top tank, lighter than air gases may rise and develop a flammable concentration if trapped above the opening
- In a source of ignition, such as when a sparking or electrical tool is introduced into a space containing a flammable atmosphere, an explosion will result
- An oxygen-enriched atmosphere (above 21%) will cause flammable materials, such as clothing and hair, to burn violently when ignited.

## Ignition Sources

- Pure oxygen is never used to ventilate a confined space
- Confined spaces are ventilated with normal air

## Fatal Fact:

- On December 5, 1984, a 22 year old worker died inside a toluene (toll U lene) Storage tank that was 20 feet high while attempting to clean the tank
- The worker entered the tank through the 16 inch diameter top opening using a ½ inch rope for descent
- Although a self contained breathing apparatus was present, the worker was not wearing it when he entered the tank

- In an attempt to rescue the worker, fire department personnel began cutting an opening into the side of the tank
- The tank exploded, killing the 32 year old firefighter and injuring 15 others

### **Toxic Atmospheres**

- Toxic fumes produced by processes near the confined space may enter and accumulate in the confined space
- For example, if the confined space is lower than the adjacent area and the toxic fume is heavier than air, the toxic fume may settle into the confined space
- When a product is stored in a confined space, the walls of the space can absorb the product and give off toxic vapors
- Toxic atmospheres can also be produced by work being performed in the confined space
- For example, welding or brazing with metals, painting, scrapping and sanding can introduce toxins into the air

### **Carbon Monoxide**

Carbon Monoxide (CO) is a hazardous gas that may build up in a confined space. All internal combustion engines, including diesel and propane powered engines, produce carbon monoxide.

Carbon Monoxide is also produced by burning wood, paper or plastic products. This odorless colorless gas is an insidious toxic gas because of its poor warning properties.

Early stages of CO intoxication are nausea and headache.

### **Fatal Fact**

- On July 2, 1985 a crew foreman became ill and was hospitalized after using an epoxy coating, which contained 2-nitropropane and coal tar pitch, to coat a valve on an underground waterline
- The valve was located in an enclosed service vault (12' x 15' x 15')
- The worker was released from the hospital on July 3, 1985, but was readmitted on July 6, 1985; he lapsed into a coma and died on July 12, 1985 as a result of acute liver failure induced by inhalation of 2-nitropropane and coal tar pitch vapors
- A co-worker was also hospitalized, but did not die.

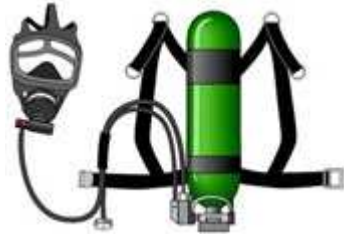
### **Irritant “Corrosive” Atmospheres**

- Irritant gasses are also a serious hazard
- They vary greatly among all areas of industrial activity
- Examples include chlorine ozone, hydrochloric acid, sulfuric acid, nitrogen dioxide ammonia, and sulfur dioxide



### **Asphyxiating Atmospheres**

- An oxygen-deficient atmosphere has less than 19.5% available oxygen (O<sub>2</sub>)
- The oxygen level in a confined space can decrease because of work being performed such as welding, cutting or brazing
- The oxygen level is also decreased when another gas such as carbon dioxide or nitrogen displaces oxygen
- Total displacement of oxygen by another gas, such as carbon dioxide, will result in unconsciousness, followed by death
- When hazardous atmospheres are present, entrants must wear appropriate respiratory equipment such as SCBA (self-contained breathing apparatuses)



### Fatal Fact

On December 29, 1983, a 54-year old worker died inside a floating cover of a sewage digester while attempting to restart a propane heater that was being used to warm the outside of the sewage digester cover prior to painting it  
Workers had wired the safety valve open so that the flow of propane would be constant, even if the flame went out



The heater was located near an opening in the cover of the digester  
When the worker attempted to restart the heater, an explosion occurred that vented through the opening  
The worker crawled away from the heater into an open area that was oxygen deficient and died  
A co-worker attempted a rescue and also died







The Training you have just completed has prepared you.

You should know how to recognize a confined space

You should know examples of hazards encountered in confined spaces

You should know the four categories of harmful atmospheres

1. Flammable
2. Toxic
3. Irritants
4. Asphyxiating

