

Construction Hazards and Risks Control

Lecture Title: – Confined space Entry

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Date: 5th February 2025



Undergraduate Diploma in
Occupational Health and Safety

Confined Spaces

- The risks associated with confined space work have been documented since Roman times, notably when Emperor Trajan condemned criminals to clean sewers—an occupation regarded as one of the most hazardous. While working conditions have significantly improved since then, the same dangers continue to cause injuries and fatalities in the workplace each year. According to the Bureau of Labor Statistics, nearly 100 fatalities occur annually in permit-required confined spaces.



How to identify a confined space?

- "confined space" means an enclosed space which has limited openings for entry or egress, and, or which may contain insufficient levels of oxygen or contain or produce dangerous air contaminants liable to cause a risk to the health and safety of workers who enter such a space, and includes any room, chamber, booth, tunnel, tank, silo, pit, pipe, drain, sewer or flue and any other enclosed space.
- Provided that for the purposes of these regulations, any enclosed space which is liable to be flooded or filled by the inflow of any liquid or solid material shall also be considered a confined space.



Never trust your senses to determine if the air in a confined space is safe!

You can not see or smell many toxic gases and vapours, nor can you determine the level of oxygen content



Minimum requirements for work in confined spaces

An employer shall :

- Ensure that all Confined Spaces at the Workplace are identified.
- Avoid work in Confined Spaces otherwise alterations in CS
- Ingress to and egress from to the space are taken into the system of work which minimises risks to health and safety
- Equipment is suitable to be used in confined space



Competent Person

- Suitable training
- Sufficient knowledge,
- Expertise and skill for the safe performance of the specific task



Duties and responsibilities of Competent Person

- To carry out a proper assessment of the risks and take into consideration of the below:
 1. Hazards which are present in the confined space
 2. Hazards which may arise during the course of work inside the confined space
 3. Hazards which are present outside but which may create an additional hazard for workers inside the confined space



The Competent Person shall Keep in Mind

- The general conditions and the dimensions of the space;
- The ease of access and egress;
- The risk of fire and explosion;
- Levels of any gas or fumes, the lack of oxygen;
- Temperatures present and to be generated;
- The level of lighting;



- What work activity is going to be carried out;
- The level of noise,
- The use of electrical equipment
- Oxygen depletion caused by burning, welding or grinding;
- The introduction of exhaust fumes from outside the confined space



Permit to Work

- The competent person examining a confined space shall issue two copies of a permit to work and shall state in writing:
 1. The level of the oxygen concentration and that of any explosive gas or vapour or of any other hazardous gases present in the confined space,
 2. The presence of any other substance which may cause a risk to health or safety,
 3. Whether work can be allowed, and the type of work activity to be allowed.
 4. The safety precautions required by any person entering the confined space, and any protective measures which are required to be taken by the employer or by the workers entering the confined space;
 5. The number of persons allowed at any one time in the confined space;
 6. The duration of the validity of the permit to work, and the time at which a further assessment is required.



Who is the supervisor in a confined space entry scenario?

- A person appointed or employed by an employer having overall direction on site and, or having the task of supervising entry and work in a confined space, and who has received appropriate training for such a task.
- An employer shall appoint a sufficient number of supervisors to ensure adequate supervision on all matters relating to the entry and work in a confined space.
- Shall be the duty of the supervisor to manage and implement the permit to work system, and to ensure that the terms, conditions or recommendations laid out in the permit to work are followed.



- At the end of a working shift, a supervisor should ensure that new workers, including replacements, are informed of the permit to work and its contents, including any terms, recommendations or conditions made by the competent person.



Working in Confined Space

- No one shall enter a confined space unless:
- Is authorised to enter by a competent person.
- As far as reasonably practicable, is wearing a harness with a securely attached rope.
- While another person is keeping watch outside and in so far as such other person is capable of pulling the person in a confined space out, the person outside is holding the free end of the rope.
- Provided that no person shall enter a confined space without wearing or using breathing apparatus if in the opinion of the competent person, breathing apparatus has to be worn to safeguard the health of the person or persons entering the space.



Health Surveillance

- Only workers who have undergone health surveillance and certified medically fit to enter and work in a Confined Space.
- Medical conditions for which a person may not be certified fit to enter and work in a confined space.
- A history of fainting, black-outs or bouts of loss of consciousness, including a history of epilepsy or uncontrolled diabetes mellitus
- A history of shortness of breath
- Disabilities related to limited dexterity or mobility, whether temporary or permanent
- A history of mental disease or of any other relevant mental condition
- A history of heart disease or high blood pressure
- Severe disabilities related to hearing or vision
- A history of drug or alcohol abuse, or when a worker is taking medication liable to cause drowsiness, lack of co-ordination, slowing of reflexes or response times or disorientation
- Any other serious medical condition which in the opinion of the medical practitioner carrying out the examination should preclude a worker from being certified fit to enter or to work in a confined space.



Workers who may not be certified as being fit for entry or to work in a confined space.

- Young workers
- Pregnant workers, or workers who have recently given birth or are breastfeeding



To take into consideration

- Oxygen Deficient Atmospheres
- Oxygen Enriched Atmospheres
- Flammable Atmospheres
- Toxic Atmospheres
- Temperature Extremes
- Engulfment Hazards
- Noise, Slick/Wet Surfaces, Falling Objects



Oxygen Deficient Atmospheres

19.5 %	Minimum acceptable oxygen level.
15 - 19%	Decreased ability to work strenuously. Impair coordination.
12-14%	Respiration increases. Poor judgment.
10-12%	Respiration increases. Lips blue.
8-10%	Mental failure. Fainting. Nausea Unconsciousness.
Vomiting.	
6-8%	8 minutes - fatal, 6 minutes - 50% fatal
4-5 minutes	- possible recovery.
4-6%	Coma in 40 seconds. Death



Oxygen Enriched Atmospheres

- Oxygen level above 21%.
- Causes flammable and combustible materials to burn violently when ignited.
- Never use pure oxygen to ventilate.
- Never store or place compressed tanks in a confined space.



Toxic Atmospheres

- Product stored in a confined space:
 - Gases released when cleaning.
 - Materials absorbed into walls of confined space.
 - Decomposition of materials in the confined space.
- Work performed in a confined space:
 - Welding, cutting, brazing, soldering.
 - Painting, scraping, sanding, degreasing.
 - Sealing, bonding, melting.
- Areas adjacent to a confined space



Hydrogen Sulfide

- Decomposition of materials. Human waste.
- Rotten egg odor at low concentrations.
- Possibly no warning at high concentrations.



Carbon Monoxide

- Combustion by-product
- Quickly collapse at high concentrations



Temperature Extremes

- Extremely hot or cold temperatures.
- Steam cleaning of confined spaces.
- Humidity factors.
- Extremely cold liquids.
- Work processes inside the confined space can increase temperature extremes.
- Personal protective equipment.



Engulfment Hazards

- Loose, granular materials stored in bins and hoppers – grain, sand, coal, etc.
- Crusting and bridging below a worker.
- Flooding of confined space.
- Water or sewage flow.



Isolation

- Locking and tagging out electrical sources.
- Blanking and bleeding pneumatic and hydraulic lines.
- Disconnecting mechanical drives and shafts.
- Securing mechanical parts.
- Blanking sewer and water flow.
- Locking and tagging out shutoff valves.



Permit Entry Systems

- Date, location, and name of confined space.
- Purpose of entry and known hazards.
- Duration of entry permit time.
- Authorized entrants, attendants, supervisors.
- Air testing results - signature of tester.
- Protective measures to be taken.
 - Ventilation, Isolation, Flushing
 - Lockout / Tagout, Purging



- Name and phone numbers of rescue and emergency services.
- Communication procedures.
- Special equipment and procedures.
 - Personal protective equipment.
 - Alarm procedures.
 - Rescue equipment.
 - Respirators.



Training and Education

- All workers who must enter confined spaces
- All attendants and rescue team members.
- Prior to initial work assignment.
- Retraining:
 - Job duties change.
 - Change in permit system.
 - New hazards are present.



Confined Space Entry Permit Example & Case Studies

- https://www.osha.gov/sites/default/files/2018-12/fy15_sh-27664-sh5_Confined_Space_Entry_Permit_Example.pdf
- <https://www.osha.gov/confined-spaces-construction/case-studies>
- <https://cpdonline.co.uk/knowledge-base/health-and-safety/lessons-from-confined-space-rescue-operations/>
- <https://www.imca-int.com/resources/safety/safety-flashes/2723-case-study-confined-space-fatalities-due-to-hydrogen-sulphide/>
- <https://www.scribd.com/document/260888920/Confined-Space-Accident-Case-Studies>

