



## What is Confined Space?

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### 1. Introduction

Many workplaces in manufacturing and construction Industries are considered as “confined space”. Confined space has limited or restricted means of entry or exit. In addition, it is large enough to allow a workman to enter and perform assigned work and is not designed for continuous human occupancy. Its configuration would always hinder the free movement or activities of people working inside it. There are several situations that could be considered as confined space obviously, for example, reaction vessels, closed tanks, manholes, large ducts, sewers, etc. However, some of them are less apparent such as open topped tanks, closed and unventilated rooms, medium-sized large furnaces and ovens. In many circumstances, employees who work in confined space would face an increased risk of exposure to serious physical injury from hazards such as entrapment, engulfment and hazardous atmospheric conditions. To summarize, the characteristics of confined space include (1) the space is an enclosed or partially enclosed space; (2) the space could be situated above or below ground; (3) the space could be in any shape or size; (4) the access of space may be restricted; (5) the space is likely to have poor ventilation; (6) hazardous gases, vapours, mists, fumes or dusts may be present or may be produced inside the space or may flow into the space; (7) the atmosphere of space may have insufficient or in excess of oxygen content; (8) the condition of space may be hot, humid and dark; (9) engulfment or entrapment hazards may exist in the space; (10) normal industrial hazards may be intensified in the space; and (11) mechanical, electrical or radiation hazards may exist in the space.

### 2. Definition of Confined Space

The definition of confined space is stated as follows:

“Confined Space” means any place in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk, and without limiting the generality of the foregoing, includes any chamber, tank, vat, pit, well, sewer, tunnel, pipe, flue, boiler, pressure receiver, hatch, caisson, shaft, or silo in which such risk arises.

“Specified Risk” means a risk of (1) serious injury to any person at work arising from a fire or explosion; (2) the loss of consciousness of any person at work arising from an increase in body temperature; (3) the loss of consciousness or asphyxiation of any person at work arising from gas, fume, vapour or the lack of oxygen; (3) the drowning of any person at work arising from an increase in the level of liquid; or (5) the asphyxiation of any person at work arising from a free flowing solid or inability to reach a respirable environment due to entrapment by a free flowing solid.

### 3. Potential Hazards of Confined Space

The potential hazards of confined space is mainly categorized into four main groups including (1) oxygen-deficient atmosphere; (2) flammable atmosphere; (3) toxic atmosphere; and (4) mechanical and physical hazards.

#### 3.1. Oxygen-deficient Atmosphere

The normal atmosphere is composed of around 21% oxygen and 79% nitrogen. An atmosphere containing less than 19.5% oxygen should be reckoned as oxygen-deficient. The oxygen content inside a confined space may be decreased through consumption and displacement.

Oxygen in a confined space could be consumed through a number of ways. A typical example is the combustion of flammable materials inside the space such as welding, cutting and brazing. A more subtle way that decreases the oxygen level in the confined space is bacterial activities, such as the fermentation process. Chemical reaction is also another common way to use up the oxygen, for instance, the formation of rust. Besides the above oxygen-consumption means, the number of workman in the confined space and the amount and nature of physical activities are also significant factors to influence the depletion of oxygen. Oxygen may also be reduced through displacement by other types of gas.

#### 3.2. Flammable Atmosphere

A flammable atmosphere is generally arisen from the accumulation of flammable gases, vapours, dust mixed in certain concentrations with air or an oxygen-enriched atmosphere.

Oxygen-enriched atmosphere contains more than 22% oxygen in concentration. Such atmosphere would cause flammable materials such as clothing and hair to burn violently when ignited.

Combustible gases or vapours could accumulate within a confined space when there is inadequate ventilation. Denser gases would accumulate in the lower levels of a confined space. Therefore, it is critical to carry out atmospheric test bear the bottom of all confined spaces.



Besides, the work being performed within a confined space could generate a flammable atmosphere. For example, spray painting, coating or the use of volatile flammable solvents. Welding or cutting with oxyacetylene equipment could also lead to a flammable atmosphere should there are any leakage in oxygen or acetylene hoses.

### 3.3. Toxic Atmosphere

When a product is stored in a confined space, it could be absorbed by the walls and give off toxic vapours when removed or when cleaning the residual material. The product may also release toxic vapour that would remain in the atmosphere due to poor ventilation.

Toxic atmosphere could also be formed as a result of work conducted inside the confined space. For example, welding or brazing with metals capable of producing toxic vapour, scraping, sanding, etc. In addition, many of the solvents utilized for cleaning or decreasing would produce highly toxic vapours.

Toxic fumes generated by any processes near the confined space may enter into the space and accumulate accordingly. For example, if the confined space is at a lower level than the adjacent area and the toxic fume is heavier than the air, toxic fume may settle into the confined space.

### 3.4. Mechanical and Physical Hazards

Problems may be arisen with the use of mechanical instruments, such as rotating or moving mechanical parts or energy sources. All rotating or moving equipment such as pumps, process lines, electrical sources, etc., within a confined space must be identified and handled with special care.

Physical factors such as heat, cold, noise, vibration and fatigue could contribute to accidents. These factors should also be carefully scrutinized.

Excavation works could also leads to possibility of engulfment. Workman should be protected from cave-ins by sloping, benching or shoring systems.

Sudden stream of water into the confined space may occur due to rainstorm in an area away from workplace. In addition, there is a risk of rapid release of water when carrying out an assignment in swimming pools, reservoirs, etc.

## 4. Statutory Requirements and Obligations



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In order to provide the best protection to workers in confined space, statutory requirements have enacted to ascertain the safety of working environment and the competency of workmanship. In addition, the employers should try every endeavor to protect their employees who work in confined space.

#### **4.1. Statutory Requirements**

In Hong Kong, the Factories and Industrial Undertakings (Confined Space) Regulation governs the requirements of confined space works. It stated that a competent person should be appointed by the employer to carry out an assessment of the working conditions in the confined space and make recommendations on measures to be taken with respect to the safety and health of workers while working in the confined space. After all precautional measures have been taken to eliminate the original hazards of the confined space, a permit-to-work should be issued before the commencement of work. The regulation also stated that only certified worker could work within a confined space; and a place within the immediate vicinity of, and is associated with work occurring within a confined space.

#### **4.2. Obligation of Employer**

The employer should provide adequate training to all staff working in the confined space. In addition, the employer should also appoint capable person to conduct careful and comprehensive risk assessment and provide corresponding precautional measures before allowing or instructing their employees to enter the confined space. Adequate personal protective equipments should also be provided. Continuous monitoring on the working condition should also be carried out to ascertain a safety environment through the working period.