

CONFINED SPACE SAFETY

Work in confined spaces can be dangerous. You need to be aware of the risks and know how to prevent them. Work in confined spaces can kill or cause injuries in any industries/organization, ranging from those involving complex plant/process system through to simple storage. Those victims include not only people working in the confined space but also those who try to rescue them without proper training and equipment.



WHAT IS A “CONFINED SPACE”?

A space that:

- Is large enough and so configured that an employee can enter bodily and perform work.
- Has limited (restricted) means of entry or exit.
- Is not designed for continuous human occupancy.

Some confined spaces are fairly easy to identify, e.g. enclosures with limited openings:

- Storage tanks; ■ Silos; ■ Reaction vessels; ■ Enclosed drains; ■ Sewers; ■ Wells; ■ Tunnels;
- Pits; ■ Caissons; ■ Shafts.

Others may be less obvious, but can be equally dangerous, for example:

- Chambers; ■ Vats; ■ Combustion chambers in furnaces; ■ Pipes; ■ Unventilated or poorly ventilated rooms;
- Flues; ■ Hatches.

WHAT ARE THE DANGERS FROM CONFINED SPACES?

Dangers can arise in confined spaces because of:

- Fire or explosion, e.g. from flammable vapours, excess oxygen, etc.
- Presence of dust in high concentrations, e.g. in flour silos.
- Hot conditions leading to a dangerous increase in body temperature.
- A lack of oxygen.

This can occur: -

where there is a reaction between the soils and the oxygen in the atmosphere, resulting in the oxygen being used up by the soil ingredients - where there is a reaction between the goods stored and the oxygen in the atmosphere, resulting in the oxygen being used up; - inside steel tanks and vessels when rust forms.



- Poisonous gases, fumes or vapours.

These can: -

- Build up in sewers and manholes and in pits connected to the system;
- Enter tanks or vessels from connecting pipes;
- Leak into trenches and pits in contaminated land, such as old refuse tips and old gas works.
- Liquids and solids which can suddenly release hazardous gases, fumes or vapours when disturbed.
- Residues left in tanks, vessels, etc. which can give off hazardous gases, fumes or vapours.
- Drowning of workers arising from an increase in the level of liquid.
- Free flowing solids such as grain and concrete which can partially solidify or “bridge” in silos. They can collapse unexpectedly when disturbed and press against workers resulting in asphyxiation.

Some of the above conditions may already be present in the confined space. However, some may arise through the work being carried out, or because of ineffective isolation of plant nearby, e.g. leakage from a pipe connected to the confined space. The enclosed working space may also give rise to other dangers due to the work being carried out. For example:

- Machinery being used may generate dust and require special precautions, such as provision of local exhaust system for portable grinders or special precautions against electric shock;
- Hazardous gases, fumes or vapours can arise from welding, or by use of volatile and flammable solvents, adhesives, etc.

BASIC PRINCIPLES OF SAFETY PRECAUTIONS FOR CONFINED SPACE WORK

- Avoid entering confined spaces, e.g. by doing the work from outside
- If entry to a confined space is unavoidable, develop and implement a safe system of work; and
- Devise an appropriate emergency plan before the work starts.

AVOID ENTERING CONFINED SPACES-

You need to check if the work can be done another way so that entry to or work in confined spaces is avoided. Better work-planning or a different approach can reduce the need for confined space working.

Ask yourself if the intended work is really necessary, or if you could:

- Modify the confined space itself or other plant to eliminate the confined space;

- Have the work done from outside, for example:
 - ✚ Blockages in silos can be cleared by use of remotely operated vibrators or air washers;
 - ✚ Inspection, sampling and cleaning operations can be done from outside the space using appropriate equipment and tools; and
 - ✚ Remote control monitors can be used for internal inspection of vessels.

SAFE SYSTEM OF WORK-

If entry to a confined space is unavoidable, a safe system for working inside the space should be developed. A “competent person” should be appointed to carry out a risk assessment of the conditions and the work and activities to be conducted in the confined space, and identify the necessary safety precautions to be taken according to the findings to avoid posing hazards to workers. The “competent person” should make recommendations on safety precautions to be taken having regard to the nature of the confined space, the associated risk and the work involved.

Make sure that the safe system of work, including the precautions identified, is developed and put into practice. Everyone involved will need to be properly trained and instructed to make sure they know what to do and how to do it safely. The following checklist is not intended to be exhaustive but includes many of the essential elements for reference to help prepare a safe system of work.

✓ **Appoint suitable persons for the work-**

Suitable workers should meet the following requirements:

- Have received training to become “certified workers”.
- Have sufficient experience in the type of work to be carried out.
- Have a suitable build for the work if the risk assessment highlights exceptional constraints as a result of the physical layout.
- He fit to wear breathing apparatus if the work requires the use of such apparatus, and there is no medical advice against an individual’s suitability to work in a confined space.

✓ **Isolation**

Disconnect and properly lock off the power supply of all the machinery and equipment that could cause hazards in a confined space; blank off pipelines and service pipes with contents that could cause hazards; take effective steps to prevent an ingress or in-rush to the confined space of hazardous gas, vapour, dust, fume or free flowing solid and liquid.

✓ **Cleaning and cooling before entry**

A confined space should be adequately purged before the entry of workers to ensure that no sludge or other deposits will give off hazardous gas, vapour, dust or fume during the course of work. If steam cleaning is used, sufficient time should be allowed for cooling to ensure that it is safe to work in the confined space.

✓ **Check the size of the entrance**

Is the entrance big enough to allow workers wearing all the necessary equipment to get in and out easily, and provide safe access and egress in an emergency? For example, if the entrance is narrow, air-line breathing apparatus should be used instead of self-contained breathing apparatus which is more bulky and therefore restricts passage.

✓ **Provision of ventilation**

You may increase the number of openings and therefore improve ventilation. Mechanical ventilation may be necessary to ensure an adequate supply of fresh air. Do not use oxygen to freshen the air inside the confined space as this will greatly increase the risk of fire or explosion. Adequate supply of fresh air is of particular importance if compressed gas or burning equipment is used inside the confined space because of the dangers from build-up of engine exhaust.

✓ **Testing the air**

This is necessary in order to check that the air is free from both toxic and flammable gases, and that there is no deficiency in oxygen and the air is fit to breathe. Testing should be carried out by a competent person using a suitable gas detector which is correctly calibrated. Where the risk assessment indicates that conditions may change in the course of work, or as a further precaution, continuous air monitoring as advised by the competent person is required.

✓ **Provision of special tools and lighting**

Non-sparking tools and specially protected lighting are essential where flammable or potentially explosive atmospheres are likely. In certain confined spaces (e.g. inside metal tanks), suitable precautions to prevent electric shock include the use of extra low voltage equipment (voltage not exceeding 50 volts alternating current or 120 volts direct current whether between conductors or to earth) and, where necessary, residual current devices.

✓ **Provision of personal protective equipment**

Where the use of “approved breathing apparatus” is recommended in a risk assessment report, or entry into a confined space for underground pipework is required, it is required to ensure that any person entering or remaining in the confined space:

- is properly wearing an approved breathing apparatus of a type that gives appropriate protection given the nature of the confined space;
- is wearing a suitable safety harness connected to a lifeline that is strong enough to enable him to be pulled out, and that the free end is held by a person staying outside the confined space who has sufficient physical strength to be capable of pulling the worker out of the confined space in an emergency. That person must remain in situ throughout the course of work.

✓ **Issuance of safety certificate**

You must issue a safety certificate, which ensures that all the safety precautions are in place and a formal check has been undertaken before workers are allowed to enter or work in the confined space. The certificate specifies the period during which workers may remain safely in the confined space. It is also a means of communication between site management, supervisors, and those carrying out the hazardous work. Essential features of a safety certificate are:

- Location of the confined space;
- Names of workers who are going to enter the confined space;
- Names of persons who may authorize particular jobs and any limits to their authority;
- risk control measures;
- Name of person who is responsible for specifying the necessary precautions (e.g. isolation, air testing, emergency arrangements, etc.);
- Name of person staying outside the confined space;
- Period during which workers may remain safely in the confined space.

EMERGENCY PLAN-

To deal with any serious and imminent danger to workers inside a confined space, appropriate emergency procedures should be formulated and implemented according to the nature of the confined space, the risks involved and the nature of an emergency rescue. Provide and keep readily available in a satisfactory condition a sufficient supply of:

- Approved breathing apparatus;
- Suitable reviving apparatus;
- Vessels containing oxygen or air;
- Safety harness and ropes;
- An audio and visual alarm for alerting others outside the confined space.

✓ **Communications**

How can an emergency call be communicated from inside the confined space to people outside so that rescue procedures can start? Don't forget that an emergency may occur during night shifts, weekends and times when the premises are closed, e.g. public holidays. Also, consider what might happen and how the alarm can be raised.

✓ **Liaison and rescue**

When work is being carried out in a confined space, another person should be assigned to station outside the confined space to maintain communication with the worker inside. Sufficient number of rescue personnel should also be made available outside the confined space. These persons need to be properly trained in rescues, physically fit and readily available to carry out rescue tasks, and capable of using any rescue equipment provided, e.g. breathing apparatus, reviving apparatus, lifelines and firefighting equipment. They should also be adequately protected against any harm.

✓ **Shut down**

It may be necessary to shut down adjacent plant before attempting emergency rescue.

✓ **First-aid procedures**

Qualified first-aiders need to be available to make proper use of any necessary first-aid equipment provided.

✓ **Drills**

Drills for the rescue should be conducted periodically for gaining practical experience and making sure that the rescue personnel understand and are familiar with the necessary rescue procedures.

✓ **Emergency services**

Procedures to notify emergency services departments (e.g. Fire Services Department) in case of an emergency should be formulated in advance. Preparation should also be made to provide these emergency services departments with relevant information on their arrival to help them understand the dangers in the confined space.
