

ELEMENT 11 EXCAVATIONS AND CONFINED SPACES

11.10 CONFINED SPACES

The Confined Spaces Regulations 1997 define confined spaces as “*Any place in which by virtue of its enclosed nature there arises a specified risk*”. This could include trenches, sewers, drains, some boiler rooms, inside machinery and the inside of storage vessels and tanks.

11.10.1 Specified Risk

- risk from fire or explosion
- loss of consciousness through lack of oxygen or increase in body temperature
- drowning
- free flowing solid



11.10.2 Main Hazards which could lead to a “Specified Risk”

- Flammable substances
- Oxygen enrichment
- Toxic Gas, fume or vapour
- Oxygen deficiency
- Ingress of liquids
- Free flowing solids e.g. grain, sugar, flour
- Excessive Heat
- Lack of Space
- Hazards due to previous contents

11.10.3 Confined Spaces Regulations

The regulations apply to all premises covered by HASAWA except mines and diving operations.

Key requirements:-

- the meaning of a confined space is recognised,
- that duties are placed on employers and employees,
- factors to be considered when undertaking risk assessments, where possible,
- preventing the need for entry into a confined space,
- safe working once in the confined space including a safe system of work,
- the suitability of the persons entering,
- emergency procedures including rescue and resuscitation equipment,



- raising the alarm and rescue,
- safeguarding the rescuers,

11.10.4. PRECAUTIONS

a. Trained and suitable employees

Certain factors require consideration when selecting the persons to enter a confined space;

- do they have sufficient experience of the type of work to be carried out,
- what training have they received,
- when risk assessment highlights exceptional constraints as a result of the physical layout, are individuals of suitable build, i.e. medical fitness etc.

Training standards must be appropriate to the task, and to the individual's roles and responsibilities.

Persons with any of the following disabilities should not be recruited for work in confined spaces. Also any persons already engaged in such work should cease to be employed in this type of work. The disabilities to be monitored are:-

- Claustrophobia or other nervous or mental disorder.
- History of fits, blackouts or fainting attacks.
- History of heart disease or disorder.
- High blood pressure.
- Asthma, bronchitis or a shortness of breath on exertion.
- Menieres disease or disease involving giddiness or loss of balance.
- Back pain or joint trouble that would limit mobility in confined spaces.
- Deformity or disease of the lower limbs, limiting movement.
- Chronic skin disease.
- Deafness.
- Serious defect in eyesight.
- Lack of smell.

Other consideration should include persons who normally wear a beard or sideburns, spectacle or contact lens wearers and the age of the person expected to undertake work in confined spaces.

Employees should be medically re-examined at reasonable intervals taking into account the person's age and duties. If there is any doubt about the fitness of any individual for confined space work specialist medical advice should be sought.

b. Testing for hazardous gases

Testing of the atmosphere should check that it is both free from toxic and flammable vapour and that it is fit to breath. Testing should be carried out using a suitable atmospheric monitor which is correctly calibrated. In the majority of confined spaces there should continuous monitoring of the air during entry.



For construction work most atmospheric testers are set up to detect for deficiency of oxygen, methane gas and hydrogen sulphide. Most atmospheric monitors have the facility to attach other sensors.

Gas	WEL	Properties	Symbol	Hazards
Hydrogen Sulphide	5 ppm STW 10ppm LTW	Colourless Rotten-egg Odour Heavier than air Flammable & Toxic	H ² S	Toxic Flammable Impairs sense of smell
Methane		Colourless & Odourless Lighter than air Flammable	CH ₄	Flammable Explosion
Chlorine	0.5ppm	Yellow/Green Colour Choking Odour Heavier than air Non-flammable	Cl ₂	Toxic Oxidiser
Carbon Dioxide	5000ppm	Colourless & Odourless Heavier than air Non-flammable	CO ₂	Toxic Suffocating
Carbon Monoxide	50ppm	Colourless & Odourless Lighter than air Flammable & Toxic	CO	Toxic Flammable
Petroleum Vapour	500ppm	Colourless Paraffinic Odour Heavier than air Toxic & Flammable	C ⁵ H ¹²	Flammable Explosion Toxic

c. Gas Detection (Atmosphere Monitoring)

Testing of the air may be necessary to check that it is free from toxic and flammable vapours and that it 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, or as a further precaution, continuous monitoring of the atmosphere may be necessary.

The first test should be to establish the oxygen content (21%),

- ❖ the minimum safe entry level is 19% and
- ❖ the maximum safe entry level is 23%.

This test can only determine oxygen content and cannot be considered appropriate to test for any toxic or flammable substances present.

The second test should be for flammability. The purpose for this sequence of testing is to ensure that there is sufficient oxygen present to allow for the correct function of the flammable sensor. Most flammable sensors will be calibrated for a specific vapour, or named number of vapours.

The final test is for toxicity and it is important to establish what is required because of the selective nature of gas detection equipment. The risk assessment should establish what toxic risks are present, so that the tester may be fully prepared.

Where flammable or potentially explosive atmospheres are likely the use of non-sparking tools and specially protected electrical equipment are essential. In certain confined spaces suitable precautions to prevent electric shock include use of extra low voltage equipment (typically less than 25V) and, where necessary, residual current devices, ie inside metal tanks.

d. Portable gas cylinders and internal combustion engines

The use of petrol-fuelled internal combustion engines in a confined space is unacceptable and will almost always result in a fatality. There are several air driven tools and equipment available.

Gas cylinders should not normally be used within a confined space unless special precautions are taken. Portable gas cylinders for heat, power or light, and diesel-fuelled internal combustion engines are nearly as dangerous as petrol-fuelled engines, and are inappropriate unless exceptional precautions are taken.

e. Gas supplied by pipe and hoses

The use of pipes and hoses for conveying oxygen or flammable gases into a confined space should be controlled to minimise the risks. Many fires and explosions have occurred due to leaking equipment. The use of “flash-back arrestors” is highly recommended.

It is important that at the end of every working period, the supply valves for pipes and hoses are securely closed and then the pipes and hoses withdrawn from the space to a well ventilated place. Where pipes and hoses cannot be withdrawn, they should be disconnected from the supply at a point outside the space and their contents safely vented.



f. Summary of precautions

- * Supervision
- * “Top Man”
- * Competent employees only
- * Communication arrangements in place
- * Testing/monitoring of atmosphere
- * Gas purging for noxious fumes
- * Ventilation during operation (Picture showing petrol centrifugal air mover)
- * Removal of residues
- * Isolation from gases, liquids and flowing materials
- * Isolation - electrical & mechanical
- * Suitable equipment – intrinsically safe
- * Emergency arrangements – calling for help, first aid facilities etc.
- * PPE – e.g. gloves, overalls, safety shoes & harnesses
- * RPE – respirators or breathing apparatus
- * Safe Access & Egress – via ladders, harnesses etc.
- * Fire Prevention Measures
- * Adequate Lighting (Non Sparking)
- * Limit working time



11.10.5 DEALING WITH EMERGENCIES

a. Rescue and Resuscitation Equipment

Provision of suitable rescue and resuscitation equipment will depend on the likely emergencies identified. Rescue equipment will often include lifelines, safety harnesses and lifting equipment, additional sets of breathing apparatus and first aid equipment. In determining if resuscitation is likely to be needed, consideration should be given to experience gained from knowledge of previous incidents.



b. Raising the alarm and rescue

It is important that the emergency be communicated from inside the confined space to people outside so that rescue procedures can start. Consideration should be given to night and shift work, weekends and times when premises might be closed, e.g. holidays. Adequate communication systems should be in place at all times, i.e. mobile telephone, two-way radio, whistle, klaxon, lone worker alarm, even tugging on rope.

c. Rescuers

It is not uncommon for multiple fatalities to have occurred when rescuers have been overcome by the same conditions that have affected the people they have tried to rescue. It is essential that those who have been assigned a rescue role are themselves protected against the cause of emergency. This means a top-man should always be in place with all the appropriate equipment should they need to enter. If the top-man does need to enter a secondary top-man should replace them, etc.

d. Control of plant

It may be necessary to shut down adjacent plant before attempting emergency rescue. Equally the plant may already be shut down as part of the permit-to-work and need re-activating. Communications routes are again important.

e. First aid

Trained first aiders need to be available to make proper use of any necessary first aid equipment provided and sustain any casualties until the ambulance arrives.

f. Public emergency services

Local emergency services should be made aware of a location i.e. fire brigade, ambulance.

Will they be able to get the ambulance to the scene? It may be necessary to send a lookout to guide them to the exact location.

Alternative transport may be required to transport an injured person across fields. How is information about the particular dangers in the confined space given to them on their arrival?