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Confined spaces

Managing the risk of entering cargo transport tanks

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Confined spaces can be deadly – Stop, think, ask

Key check list

- Never enter a confined space if there is a safer way to complete the task.
- Only ever enter a confined space if authorised to do so and there are safety controls in place.
- If concerned at any point whilst in the confined space, get out and report your concerns.

A confined space is a place which has limited openings for entry and egress, inadequate ventilation and is not designed for continuous worker occupation, and where serious injury may occur from hazardous substances or conditions (generally resulting from asphyxia).

There are a variety of tanks used to transport cargoes globally, including road tank trailers, tank railcars and (ISO) tank containers. Such cargo transport units (CTUs) comprise a prime example of a confined space risk in the supply chain. Whilst the man lid provides access and egress to the interior of the tank CTU, access is restricted and there exists an inherent danger to workers who do enter this space from oxygen concentration or the presence of toxic substances.

The air we usually breathe contains 79% nitrogen and 21% oxygen. Once the oxygen content of the air decreases or increases the associated risks change. Oxygen enriched atmospheres give rise to an increased risk of fire and explosion. An atmosphere with an increase of as little as 1-2% oxygen can be extremely hazardous. When compared to a fire in normal air, an oxygen enriched fire will be more intense, will burn at higher temperatures and has a greater heat output rate. Where reduced oxygen content is concerned, judgement becomes impaired and ultimately life can no longer be supported, even if the remaining content of the atmosphere is harmless.

Lack of oxygen is a silent killer; there are no obvious warning signs such as coughing or feeling breathless. Where the oxygen levels are sufficiently depleted the first sign is often that the individual will simply become unconscious. This can happen so quickly that there is no opportunity to raise an alert. Where there are pockets of atmosphere lacking sufficient oxygen breathed, an individual will start to feel very weak and confused; unable to undertake the simplest of tasks such as reaching the exit of the confined space. If not rescued quickly they will likely fall into unconsciousness.

Without sufficient oxygen the body starts to shut down very quickly; two primary resulting implications being heart failure and brain damage. The brain can survive for approximately six minutes, however, after around five minutes irreversible damage can be sustained even in the event that an individual is resuscitated. Rescue operations are therefore time critical.

Where it is essential that a worker enters a tank, atmosphere testing in advance is necessary, but critically oxygen levels should be adequately monitored throughout the required activity. Even where the tank is certified to be clean and the atmosphere adequate to support life, undertaking any work within the tank, whether it be cleaning, polishing or grinding, gives rise to the possibility of changes to the atmospheric content of what is a confined space.

All potentially confined spaces should be tested for oxygen content and toxic or flammable gas concentrations before controlled entry is allowed.

Assess the need to work in the confined space – is entry essential?
The first consideration is whether entry into the confined space is absolutely necessary. There are examples where work could be performed from the exterior. However, where a tank CTU is concerned, many tasks associated with cleaning and maintenance will require workers to enter the confined space inside the tank.

Where access to the confined space is assessed to be unavoidable, adequate precautions must be taken. This starts with a risk assessment of the work to be undertaken by a competent person and thereafter a safe system of work should be developed and implemented.

A competent person should be appointed and tasked with ensuring that the risk assessment is adequately completed and that the safe working practice is followed throughout. A competent “watcher” should be physically present throughout the work, providing an immediate response in case of emergency. The “watcher” should monitor each stage of the work undertaken to ensure compliance with the defined safe system of work.

Risk assessment
Annex 8 of the ILO, IMO and UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code) focuses on the risk assessment process covering items such as competence, working at height and emergency preparedness.

Sub-contractors may be employed to undertake work on your behalf, in supplement to the CTU Code, MSC Circ. 1531 provides valuable due diligence based guidance when selecting third party CTU-related service providers.

A risk assessment should consider as a minimum the following elements:

- The task
- The working environment
- Working materials and tools
- The competence of those undertaking the work
- Arrangements for emergency response/rescue

A permit to work in the space
Access should only be allowed under a safe system (permit) of work and the supervision of a responsible person.

A permit to work assists in ensuring that a formal check is undertaken, confirming that all elements of the safe system of work are in place ahead of a worker being allowed to enter the confined space.

The key features of a permit to work are:

- Clear identification of the person(s) who may authorise entry into the confined space and those who hold responsibility for specifying the necessary precautions
- Ensuring that employees and third party contractors engaged to undertake associated tasks are included
- Training and instruction in the issue of permits
- Training and instruction for confined space working
- Monitoring and auditing to make sure that the system works on an on-going basis as intended

Is the atmosphere suitable to sustain life?
The initial testing of the atmosphere inside the tank should be undertaken by a competent person using appropriate calibrated instruments to ascertain acceptable levels of oxygen and acceptable levels of toxic and flammable vapours.

Will the atmosphere remain safe throughout the intended work period?
Where the risk assessment identifies that the atmosphere cannot sustain life, or that there is a likelihood that the atmosphere is subject to change, respiratory apparatus is vital and the monitoring of noxious gases and oxygen will need to be continuous through the period of entry.

The provision of breathing apparatus is essential if the air inside the space cannot be made fit to breathe.

Additional physical and procedural checks

- Is there a defect reporting procedure in place?
- Is the gas testing equipment available and correctly calibrated?
- Is respiratory equipment and other appropriate personal protective equipment such as emergency life support apparatus available and in sound working condition?
- Is the previous cargo known? (Copy of the Safety Data Sheet (SDS) available?)
- Are there residues of a previous cargo?
- Is the access equipment / ladder in sound condition?
- Is this equipment positioned correctly?

Training and instruction
Additional training, instruction and signage should be considered. Are the workers aware of what is considered to be a confined space and are they sufficiently trained to recognise such spaces? Do they have experience of undertaking this type of work? Are the workers physically capable of entering and egressing from the tank container? Does the work require entry through the man lid or alternative and smaller diameter access hatches? Consideration may also need to be given where the person may suffer from claustrophobia or their fitness to wear and operate breathing gear.

Communications and emergency rescue plans
It is vital to develop an established method of communication between those workers inside the confined space and those outside it. This serves as the first step in emergency response.

Develop and communicate an emergency rescue plan. Regular drills should be undertaken to ensure effectiveness of the plan and familiarity of the workforce with procedures. The arrangements of the emergency rescue plan should be sufficiently communicated to all the workforce who may ultimately need to rely on it.

Recognise the tragic reality from experience of confined spaces incidents. Following the collapse of a co-worker in a confined space, the immediate reaction will be for colleagues to enter the space with the intention of assisting, without due consideration for their own safety. It is instinctive to assist a colleague in distress. There are many unfortunate incidents whereby a second and third worker have become unconscious because appropriate emergency response, escalation and reporting procedures have not been in place, understood or followed. Developing, communicating and practising an emergency rescue plan is an essential part of the risk assessment process.

Where things go wrong, the worker in the confined space is likely to be exposed to serious and immediate danger. Effective arrangements of quickly raising the alarm and triggering rescue procedures are essential. The watcher should never enter the confined space before securing assistance and taking additional precautions. Consideration in this regard should be given to the equipment available and the capabilities of the nominated rescuers.

Oxygen deficient atmospheres	
19.5%	Minimum acceptable oxygen level
15-19%	Decreased ability to work strenuously. Impaired coordination.
12-14%	Respiration increases. Poor judgement.
10-12%	Respiration increases. Blue lips.
8-10%	Mental failure. Fainting. Nausea. Vomiting. Unconsciousness.
6-8%	Fatal in eight minutes exposure. 50% fatal after six minutes exposure. Possible recovery after four-five minutes exposure.
4-6%	Coma after around 40 seconds exposure. Fatal.

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StopLoss series
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