Building a safer workplace together

Other Hazardous Gas

Acid Fumes
Skin reddens and blisters when exposed to acid fumes. If inhaled, a sore throat and shortness of breath result. Severe exposure can cause pulmonary oedema with a potentially fatal result when fluid accumulates in the lungs.

CASE STUDY
Lung injury from cleaning with acid in a tank.
A worker experienced breathing difficulties and chest pain after cleaning the interior of a stainless steel tank with hydrochloric acid. He was later diagnosed to be suffering from pulmonary oedema as a result of breathing in acid fumes while working in the confined space.

Investigations revealed:
- Forced ventilation was not provided.
- The organic vapour respirator worn by the worker was not suitable for acidic fumes.
- There were no safe work procedures for the usage of acid and for entry into and working in a confined space.
- Assessments were not conducted to ensure that cleaning did not create a hazardous environment inside a confined space.
- Safety precautions were not taken to control hazards.

Systemic failures:
The lack of safe work practices and hazard analysis.

Control and Preventive Measures

Entry permit
Before entering a confined space, a permit must be issued by a competent person certifying that all hazards have been assessed and precautionary measures have been taken to ensure the safety of entrants.

Forced ventilation
When a confined space is occupied, an adequate and continuous supply of fresh air should be provided. This can be from safe air blowers with trunking or extension hose.

Buddy system
A standby person should be stationed outside the confined space to keep a lookout and render help in the event of an emergency.

Safety appliances
When entering a confined space, a safety harness and lifeline should always be worn. This will facilitate retrieval during an emergency. Suitable respirators should be worn where toxic gases or vapours are known to be present. Air supplied respirators must be used if the space is likely to be deficient in oxygen or contain unknown or high concentrations of air contaminants.

Rescue equipment
On-site rescue equipment such as retrieval devices and breathing and reviving apparatus should be readily available for emergency use. The severity of accidents can be reduced by timely alerts from attendants outside the space and by having well-trained and fully equipped personnel to ensure a speedy response in the event of an emergency.

Other safety measures
- Diesel-driven and petrol-driven engines such as pumps and compressors should never be placed inside a confined space.
- Host employers should ensure that contractors are competent for work involving a confined space. They also need to brief their contractors on any safety and health procedures to be implemented.
- Every supervisor and entrant must be familiar with the safe work procedures for entry into and work in a confined space. They should also be fully aware of the hazards associated with the confined space, and that can be introduced into the space by any work that alters the concentration setting for calculation in the instrument. Calibrations must be carried out by trained personnel, and records kept.

Preventive Measures

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To report unsafe workplaces, please call the OSH hotline at 6317 1111.
To report accidents, dangerous occurrences and occupational diseases visit www.mom.gov.sg/agreport

For more safety requirements on entry into and working in confined spaces, please refer to Simple Guide to Applying the Singapore Standard Code of Practice (CP) 84 Code of Practice for Entry into and Safe Working in Confined Spaces The CP can be obtained from SPRING Singapore at SPRING Information Resource Centre 2 Bukit Merah Central #04-02 511835 Tel: (65) 6279 3002

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National OSH PROGRAMME-BASED ENGAGEMENT (ProBE)

Technical Advisory for Confined Spaces

Ensure the measures implemented to control the risk; and
- apply safe work procedures.

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- Chemical reactions (rusting, decomposition and fermentation).
- Absorption by porous materials (e.g. activated carbon).
- Reaction with material in the air (e.g. nitrogen and carbon dioxide).

As oxygen is vital for sustaining life, many physiological effects emerge when the oxygen content is below the deficient level. The effects are especially marked when the oxygen content is below 15%.

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Common Hazards and Case Studies

CASE STUDY

Worker poisoned by fumes from a petrol-driven pump in a sewer manhole

Worker poisoned by fumes from a petrol-driven pump in a sewer manhole

A sanitation worker who had been tasked to oversee the cleaning of a sewer manhole was overcome by hydrogen sulphide and collapsed. His position of the petrol-driven pump inside the manhole

Investigations revealed:

- the company had failed to implement safe work practices and a permit-to-work system for confined spaces.
- no suitable gas-testing meters were available onsite to monitor the confined space.
- the confined space had not been certified safe for entry.

Systemic failures:

- Lack of hazard analysis, safe work practices and safety training.
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Carbon Monoxide

Carbon monoxide is a colourless and odourless gas that is produced from incomplete combustion. The gas is a chemical irritant. It binds strongly to red blood cells, preventing the flow of oxygen to the brain. In the absence of adequate ventilation, the effects of carbon monoxide on the brain lead to unconsciousness and even death.

The Permissible Exposure Level (Long term) for carbon monoxide is 25 ppm.

Hydrogen Sulphide

Hydrogen sulphide is a rapidly acting systemic poison which, at high concentrations, paralyses the respiratory function and causes asphyxiation. When breathed in for prolonged periods at low concentrations, it can affect the nervous system and cause unconsciousness and even death.

The Permissible Exposure Level for hydrogen sulphide is 15 ppm (Short term) and 10 ppm (Long term).

CASE STUDY

Two killed and one injured by hydrogen sulphide

Two killed and one injured by hydrogen sulphide

A sanitation worker who had been tasked to oversee the cleaning of a sewer manhole was overcome by hydrogen sulphide and collapsed. His position of the petrol-driven pump inside the manhole

Investigations revealed:

- The concentration of the flammable gas or vapour in a confined space must not be more than 10% LEL.
- hydrogen sulphide trapped within the decomposed manhole did not contain any gas testing equipment.
- the actual concentration at the time of the accident could have been much higher.
- the sub-contractor had failed to identify the possibility of hydrogen sulphide release when carrying out sanitary maintenance in the sewer manhole.
- the preparation had not been certified safe for entry and had not been ventilated.
- workers were not instructed to use breathing apparatus or wear a proper safety bell with halyard attached for work inside the confined space.

Systemic failures:

- Lack of hazard analysis, safe work practices and management of sub-contractors.

Flammable Atmospheres

Flammable substances in a confined space can cause fire and explosions in the presence of an ignition source e.g. open flames, sparks, etc. Flammable substances include:

- residual gases or vapours e.g. petroleum vapours and residual gases from gas cylinders or pipelines e.g. acetylene, hydrogen, liquefied petroleum gas or natural gas.

When working in a confined space, it is important to take measures to prevent the build-up of flammable gases or vapours. These measures may include:

- ensuring that there are no residual gases or vapours e.g. petroleum vapours that could ignite the flammable vapours inside the confined space.
- using breathing apparatus or protective masks while working in a confined space.
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