



ACCIDENT ALERT

Build-up of toxic fumes in refrigerated hold halts work

The incident

In a recent incident, the build-up of toxic fumes in the refrigerated hold of a fishing vessel halted all work. Fourteen workers received medical checks but were not found to be seriously harmed and returned to work the next day. However, five of the workers had not fully recovered and were sent home. An independent expert, called in to carry out fume level tests, became affected by the fumes, was admitted to hospital overnight and discharged the next day.

The set up and work being done

The fishing vessel was being loaded with frozen fish. Each of the four refrigerated holds was being worked with a forklift truck. One forklift was an electric/battery unit and three were LPG powered. All forklifts had been hired for the job. Work had commenced at about 7 am. At about 10.30 am workers complained to the company of dizziness.

It was suspected that there had been a build-up of carbon monoxide in the three holds being worked by the LPG-powered forklifts.

The temperature in the hold was minus 20 degrees Celsius.

The ship's ventilation system was not turned on at the time.

Inspector's findings

The OSH inspector who investigated the incident found that:

- The three LPG forklifts were supplied in excellent condition with a gas analyser used every 200 hours to check engine emission. No catalytic converters were fitted.
- In the number four hold, the forklift was switched off after each operation (approximately 4 minutes work then off for 10 minutes).
- The holds were not adequately ventilated by outside means to ensure an ample supply of fresh air.

Caution: It should be noted that the blowers in refrigerated ship's holds are intended for introducing and circulating the cold air. They are not intended to ventilate the hold.

Test results

An independent expert who was called in by the company, carried out tests in the number four hold to measure the level of carbon monoxide (CO).

The tests were done with the knowledge that the hold had been worked for about 3 hours before workers had stopped and that the forklift had not been operated for about 4 hours.

A sample taken in the hold close to the entrance indicated in excess of 700 ppm. Five tests at the four corners and centre of the non-stacked space produced similar results.

The Drager tube used for the test, (CH25601) had a top scale reading of 700 ppm and it was not possible to provide a true indication of the carbon monoxide levels.

The expert put forward two possibilities for workers being affected:

- carbon monoxide contamination
- oxygen deficiency

It was concluded that there was an inherent danger to workers in the operation of LPG-fuelled vehicles within ships holds unless there is ventilation or induced air distribution.

In his view, LPG-fuelled engines were not suitable for use under conditions of low temperatures or in confined spaces such as holds of ships.

The workplace exposure standard recommended by OSH

For a normal 8-hour day, 40-hour work week, (time-weighted average - TWA)

Carbon monoxide - 50 ppm

OSH recommendations

Key considerations

The key points for employers to consider, if incidents of this type are to be avoided in future, are:

- Assess the risks before commencing work. If work is to be conducted in a confined space, determine what will be required to ensure safety. Especially consider ventilation needs and what type of machinery would be suitable for the purpose.
- Once work is underway, ensure that safety is being observed and maintained. Periodically check that systems and machinery are functioning properly. Ensure that the ventilation system is doing its job. If necessary, monitor the atmospheric conditions so as to detect any build-up of toxic fumes.
- Once work has been completed, review performance. Did the systems work as planned? Are any improvements required?

Vessels and other confined spaces

- For refrigerated holds on refrigerated (Reefer) vessels and other refrigerated

confined spaces, only electric/battery-powered forklifts should be used. This eliminates the machine as a potential cause of build-up of toxic fumes in holds and spaces through its exhaust emissions.

- For other general cargo vessels and confined spaces LPG/petrol-powered forklifts may be used in holds and spaces provided adequate ventilation is available and monitoring is carried out to ensure a safe atmosphere is being maintained. It is claimed that catalytic convertors are only efficient when machines are worked hard and would be of limited value on vehicles that are used for short periods or left idling. Employers need to fully investigate the effectiveness of catalytic convertors in removing carbon monoxide from exhaust gases.

Action taken by the employer involved in this incident

- Staff have been advised in writing not to use LPG-powered forklifts in freezer holds.
- The company will use gas detection equipment and monitor the levels of gases from time to time in holds where LPG-powered hoists are used.
- The company will make people aware of the problems that can arise through the use of internal combustion engines in confined spaces.

Further information

Any enquiries on the dangers of operating LPG/petrol-powered forklifts in confined spaces, or any other matters relating to health and safety in the workplace may be directed to OSH branch offices in the following areas:

Christchurch North
Christchurch South
Dunedin
Hamilton
Invercargill
Lower Hutt
Manukau
Napier
Nelson
New Plymouth
Palmerston North
Penrose
Rotorua
Takapuna
Tauranga
Wanganui (sub-branch)
Wellington
West Auckland
Whangarei