

## Fumes associated with fork lift truck operations

**The operation of gas and diesel powered fork lift trucks may generate dangerous levels of poisonous fumes, especially in confined space or areas of poor ventilation. Fumes including carbon monoxide, nitrogen oxides and a complex mixture of gases, vapours, liquid aerosols, and particulate substances can be produced.**

### Gas powered fork lift trucks emissions

There is a widespread misunderstanding that gas is a clean burning fuel and that liquefied petroleum gas (LPG) powered fork lift trucks are safe. Although LPG powered trucks offer advantages over diesel counterparts, they can produce dangerous toxins if not properly maintained and controlled.

LPG engines, like every internal combustion engine, emit combustible products from the exhaust. Some toxic products, such as carbon monoxide and nitrogen oxides, can be generated in quantities high enough to pose a health hazard to employees.

### Diesel engine exhaust emissions (DEEEs)

Exhaust emissions from diesel engines are usually more visible than those emitted from petrol engines because they contain over ten times more soot. In general, diesel engines produce less carbon monoxide (CO) than petrol engines but more nitrogen oxides (NOX), sulphur oxides, aldehydes and particulate matter.

The soot particulates in DEEEs have hundreds of organic substances adsorbed onto their surface, some of which are potentially more harmful to health than others. The soot content in the DEEEs varies from 60% to 80% depending on the fuel used and the type and condition of engine.

### How to keep workers safe

Employers have a duty to eliminate risks to health and safety, so far as is reasonably practicable. Therefore eliminating the source of CO and other toxic exhaust gas emissions from the workplace by using battery powered fork lift trucks, instead of fuel powered trucks should be the first option considered.

#### Develop a policy on the use and management of fuel powered fork lift truck, including:

- Restrict the use of Internal Combustion Engine (ICE) powered lift trucks in poorly ventilated or confined spaces.
- If there is no alternative other than to utilise ICE lift trucks, warm up engines outdoors since emissions are higher when the engine is cold.
- Ensure extraction systems (e.g. local exhaust ventilation (LEV)) are subject to regular checks, maintenance and through examination.
- Avoid excessive workload demand on the engine, e.g. where the engine is required to work near its capacity as this will increase the volume of toxic emissions.
- Do not allow prolonged engine idling, lift trucks should always be turned off when not in use.

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- Install CO alarms on fork lift trucks and in buildings where ICE trucks are deployed and have the alarms regularly calibrated.
- Ensure that ICE's are maintained and kept running at optimal efficiency to minimise the emission of harmful gases and particulates.  
they need to work safely and consider how to ensure it is acted on.
- Ensure workers know how to report any concerns they may have about the use of ICE lift trucks generating high pollutant levels.
- Inform workers of the risk of, and of how to recognise the symptoms of CO poisoning.

## Monitoring carbon monoxide in the work environment

When activities may expose workers to CO, employers should consider carrying out exposure monitoring to determine the concentration of CO in the workplace.

Exposure monitoring should be carried out by occupational hygienists or other suitably trained personnel. They will compare the levels of CO present in the workplace with the workplace exposures standard (WES) and can advise whether more is needed to be done to manage the risk.

## Air quality monitoring

Periodic air monitoring is important to ensure fork lift trucks are operated and maintained properly, and to minimize hazards to workers' health and safety.

- Air-monitoring equipment for CO and NOX are required for evaluating work environments.  
they need to work safely and consider how to ensure it is acted on.
- Measuring instruments are available in many forms, from sophisticated electronic instruments to manually operated aspirator pumps.
- Safety equipment distributors should be able to provide you with the type of monitoring devices most appropriate for your workplace.

## Symptoms and adverse health effects of exposure to internal combustion engine exhaust emissions

Research in recent decades consistently indicates the adverse effects of internal combustion engine (ICE) exhaust emissions on human health, and the evidence points to air pollution stemming from vehicles as an important contributor to these effects.

## Adverse health effects of exposure to carbon monoxide

Carbon monoxide (CO) is colourless, odourless and tasteless, yet toxic. A CO rich environment can lead to headaches, lethargy, dizziness, loss of consciousness, and even death. CO is slightly lighter than air and therefore tends to follow air currents, vehicles and people in the workplace until it is removed by ventilation. Prolonged exposure to CO can also damage an unborn child.

## Adverse health effects of exposure to nitrogen oxides

LPG powered lift truck exhausts can contain varying amounts of corrosive nitrogen oxides (NOX) gases. Depending on the individual, the concentration of NOX and the duration of exposure, immediate effects may include eye, nose and throat irritation. Effects may also be felt several hours after exposure and can cause a build-up of fluids in the lungs.

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### Adverse health effects of exposure to diesel engine exhaust emissions

It is not precisely known which components of combustion are responsible for ill health effects, but exposure to diesel engine exhaust emissions (DEEEs) is associated with irritation of the respiratory tract and eyes. This is particularly noticeable when there are high levels of white smoke in the workplace, especially when engines are started from cold in the morning with no controls measures, such as exhaust extraction. Irritation of the upper respiratory tract is the primary health effect following exposure to DEEEs.

Prolonged exposure to DEEEs, in particular to any blue or black smoke, could lead to coughing, increased sputum production and breathlessness.

DEEEs contain many known carcinogenic substances, for example Polycyclic Aromatic Hydrocarbons known as PAHs which are adsorbed onto the soot particulates. These particulates are easily inhaled into the respiratory tract and there is epidemiological evidence, which indicates that sustained occupational exposure to DEEEs may result in an increase in the risk of lung cancer.

### Measures to Reduce Emissions

- Avoid using diesel and LPG powered lift trucks in cold stores and indoors, including completely enclosed spaces, such as factory buildings or warehouses, and partially covered spaces, such as supply sheds.
- Use battery powered lift trucks, carts, trolleys, palletizers or similar equipment in cold stores, rooms or buildings that are small or have poor ventilation. Batteries pose their own risks, but CO poisoning is not one of them.
- Avoid engine idling, even outdoors and especially near windows or vent openings where exhaust fumes can be sucked into occupied spaces. Lift Trucks should always be shut down, when not in use, to maximise safety, reduce emissions and to save fuel.
- Ensure ICE's are regularly maintained and adjusted in accordance with the manufacturers recommendations. A regular maintenance program should be in place, including an analysis of exhaust emissions, particularly the CO content. Even this precaution may not be sufficient in the absence of minimum ventilation. Battery powered fork lifts provide a better solution, in areas where adequate ventilation cannot be provided.
- Where the indoors use of ICE fork lift trucks is unavoidably, always ensure the use of lowemission trucks. Most modern fork lifts trucks are equipped with electronic emission and fuel computer modules to provide optimum air-fuel ratios by continuous, active control of the fuel and emission systems. Consult your equipment supplier for information on the types of low emission lift trucks and aftermarket control devices available.
- Ensure that appropriate risk assessments are undertaken to determine the appropriate fuel type and ventilation requirements for each area of the workplace where fork lift trucks are to be deployed.

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### Legislation

The law requires that a suitable and sufficient assessment of the risks to health which arise from exposure to hazardous substances is made, e.g. DEEEs.

This is covered by the **Health and Safety at Work etc. Act 1974** and several other regulations, in particular **The Control of Substances Hazardous to Health Regulations 2002** (COSHH) and **The Management of Health and Safety at Work Regulations 1999**.

Having completed the assessment, there is a further duty to take the necessary steps to prevent or adequately control exposure to the hazard, and to use and maintain the relevant controls.

Exposure monitoring should be undertaken regularly to check the effectiveness of controls. If the controls are not working seek advice on improving controls from an occupational health specialist.

### Health and Safety Executive further guidance

**HSG187 Control of diesel engine exhaust emissions in the workplace** provides practical advice to employers and self-employed people on how to control exposure to diesel engine exhaust emissions (DEEEs) in the workplace, and so protect the health of employees and others who may be exposed.

**SR14 Vehicle exhaust fumes (in warehouses, garages, etc)** will help employers (including the self-employed and franchisees) comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH) legislation, to control exposure and protect workers' health.

**INDG408 Clearing the air** advises on how to select the right local exhaust ventilation (LEV) equipment. for your workplace and how to maintain it properly to help protect your employees.

### UKMHA further guidance

Also see UKMHA Fact Sheets 1, 2, 6, 9 and 12 for further information.

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The information in this Fact Sheet has been assembled and interpreted to give truck owners and users basic guidance on frequently asked questions. Further important information will be given in the quoted reference documents. Responsibility for meeting the safety obligations discussed rests with the employer, and the UKMHA will not accept liability for any problem arising as a result of the content of this document. Technical Bulletins, containing more detailed information and updated as appropriate, are made available free to members of the **UKMHA SAFE USER GROUP**.

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