



Government of **Western Australia**
Department of **Commerce**

Guidance note

Prevention of carbon monoxide
poisoning
from petrol and gas
powered equipment

2008



**commission
for occupational
safety and health**

Foreword

Guidance notes

A guidance note is an explanatory document issued by the Commission for Occupational Safety and Health (the Commission) providing detailed information on the requirements of legislation, regulations, standards, codes of practice or matters relating to occupational safety and health. Guidance notes are developed within the tripartite setting of the Commission, with input from representatives of employer organisations, unions, the state government and experts.

This guidance note provides information for workers on identifying and eliminating or managing carbon monoxide hazards in Western Australia workplaces. It sets out good practice that will assist in ensuring compliance with workplace safety and health legislation.

Authority

Issued by the Commission under the *Occupational Safety and Health Act 1984* (the Act).

Foreign language assistance

If you require the services of an interpreter contact the Translating and Interpreting Services on 131 450 and ask for connection to 1300 307 877.

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Carbon monoxide in workplaces can be a serious health hazard. In extreme cases it can kill.

Workers have suffered from a range of short term health effects. Some have collapsed at work and required resuscitation, while others have died.

What is carbon monoxide (CO)?

Carbon monoxide (CO) is a poisonous gas emitted by operating petrol, gas and, to a lesser extent, diesel powered motors. With the chemical formula 'CO', its molecules consist of one carbon atom covalently bonded to one oxygen atom.

Because CO is colourless, tasteless and odourless, in poorly ventilated workplaces it has the potential to be undetected and therefore build up to dangerous and even fatal levels.

While most people can tolerate small amounts of CO without noticeable ill effects, they may not realise they have suffered harm until severe symptoms occur.

What harm can CO cause?

Low levels of CO may occur unnoticed in the air we breathe wherever petroleum fuels are burnt, eg in car parks or city streets.

However, inhaling CO can cause headache, drowsiness, irritability, reduced judgement and motor skills, convulsions, unconsciousness, coma and death.

In the long term, CO may cause heart and circulatory disease. It may also harm the central nervous system and affect pregnant women.

Severe harm is most likely where petrol motors are run continuously in enclosed or poorly ventilated areas.

Physical activity will affect the worker's breathing rate and hence also the amount of CO inhaled.

What are the symptoms of CO poisoning?

Symptoms at low CO levels may be interpreted as a non-specific viral illness and include:

- tightness across the forehead;
- slight to moderate headache;
- weakness and fatigue;
- shortness of breath on exertion;
- nausea; and
- impaired motor skills.

At high blood CO concentrations, symptoms may include:

- severe headache;
- flushing;
- decreased vigilance and impaired judgement;
- excessive perspiration;
- dizziness and disorientation;
- rapid or irregular heart beat;
- personality changes (including aggressiveness and irritability);
- vomiting,
- collapse;
- convulsions and seizures; and
- coma.

In severe cases CO poisoning can lead to death.

Where it is suspected that a person has become ill due to inhalation of CO, medical attention should be sought immediately.

How does CO affect the body?

CO, if inhaled, interferes with the movement and use of oxygen in body tissues. It can cause chemical asphyxiation by displacing oxygen from the bloodstream.

Health effects may include:

- reduced capacity to undertake physical work;
- aggravation of pre-existing cardiovascular conditions;
- impairing the central nervous system;
- damaging blood vessels in the heart; and
- with pregnant women, causing harm to the foetus.

Where does CO occur?

CO is produced at any workplaces where petrol or liquefied natural gas (LNG), liquefied propane gas (LPG) or diesel motors are used to power vehicles or machinery.

CO occurs because hydrocarbon fuels are seldom completely burnt in combustion motors. Poorly tuned or infrequently maintained motors are likely to produce higher and more toxic concentrations of CO.

Although gas motors using LNG or LPG produce significantly less CO than petrol motors, caution must still be exercised, particularly in poorly ventilated areas.

Diesel motors produce much less CO than either petrol or gas. They are less of a problem because toxic diesel exhaust gases are unpleasant to inhale and a hazardous build up is easily identified and remedied.

However, diesel motors should not be run continuously in poorly ventilated enclosed areas, eg tractors in farm sheds.

In general, hazardous CO levels will not build-up where combustion motors are used outdoors or in open spaces where there is good air movement.

Which jobs involve CO hazards?

When any petrol, diesel, LPG or LNG powered equipment is in use within confined or semi-confined areas, CO levels and adequate ventilation need to be considered. Some examples of workplace situations where CO can be hazardous are provided below.

Concrete cutters: When petrol powered saws are used to cut channels in concrete wells (chasing) during construction, their motors can produce CO levels in excess of 1,000 parts per million (ppm) of air near the source. Even in areas of reasonable ventilation, ie structures with open roofs, CO levels may reach 400 ppm. The risk increases significantly in buildings where there are no window or roof openings, and in basements or under suspended concrete slabs where there is little air movement.

Underground car parks: Where there is continual vehicle movement and inadequate ventilation to remove exhaust fumes, hazardous pockets of CO can build up. Car park workers may inhale sufficient CO to affect their judgement and motor skills – ie when driving home after work.

Chainsaws: CO build up can become toxic when petrol powered chainsaws are used in confined or inadequately ventilated areas, such as small sheds.

Forklifts: Gas powered forklifts are preferred to petrol motors to reduce emissions in enclosed work areas. However, gas motors can also cause CO build up if poorly tuned or used for long periods in confined areas such as cool rooms and small warehouses.

Floor polishers: Gas powered floor polishers can produce significant amounts of CO if poorly tuned. Exposure can exceed acceptable standards if these machines are used in rooms with poor ventilation.

Generators: Petrol powered generators can produce significant amounts of CO if poorly tuned and maintained. Exposures can exceed acceptable standards if generators are used in rooms with poor ventilation.

Diving: CO poisoning is a well recognized, but uncommon hazard of diving, which occurs either as a result of a faulty air compressor or from air contamination by the exhaust of nearby engines. The incidence of CO poisoning may be under-reported as it may mimic decompression sickness, and respond to the same treatment – ie hyperbaric oxygen (in a decompression chamber).

What the law says

The Act says that, as far as practicable, employers must provide and maintain a work environment in which employees are not exposed to hazards. This includes providing a safe system of work, training, information, supervision and personal protective equipment where appropriate.

The Act also says employees must take reasonable care of their own safety and health, and avoid adversely affecting the safety and health of others. They must comply, as far as possible, with safety instructions, use the personal protective equipment provided, and report hazards or injuries.

The Occupational Safety and Health Regulations 1996 (the regulations) require that employers identify hazards, assess the risks and consider controls.

The regulations establish exposure standards for contaminants such as CO, outlined in the box below. These exposure standards are not to be exceeded.

Manage the risk

Risk to workers can be managed by:

1. Identifying work situations where CO may be a hazard – ie wherever fumes from machinery are present; and
2. Assessing the risk of exposure to dangerous levels of CO; and
3. Measuring CO levels;
 - in the air being breathed by the worker;
 - in a worker's blood at the end of a shift; and
 - in exhaled air at the end of a shift; and then
4. Putting controls in place.

In order of importance, the following controls should be used to reduce CO exposure.

Eliminate the need to use CO emitting machines – eg in the case of concrete cutters (ie. chasing saws), by designing buildings that require minimum cutting.

Substitute with safer equipment – eg in enclosed or poorly ventilated areas, use electric, hydraulic or pneumatic power sources instead of petrol or gas motors.

Plan ahead – eg where concrete cutters (ie. chasing saws) are to be used during construction, do so before the roof is built.

Engineering controls – eg exhaust ventilation, via ducted piping attached to the equipment and piped to an outdoor area, to remove CO from the source or improving ventilation with natural air flow or fans. Regular maintenance of motors will also minimise the amount of CO emitted.

Administrative controls – eg implementing time limits on machinery use and staff rosters to keep worker exposure below harmful levels.

Protective equipment – where protection is needed, air-supplied respirators must be used. Commonly available air purifying respirators are not effective against CO.

Information and training

CO hazard training should enable workers to work safely and react appropriately if things go wrong.

Workers must be:

- informed of all identified hazards at the workplace;
- given information, instruction, training and supervision in safe working procedures, including fitting, use, maintenance and storage of personal protective equipment;
- where necessary, provided with information in other languages, and increased supervision when workers are from a non-English speaking background;
- able to identify hazards and report them to a supervisor, and in particular able to recognise the symptoms of CO exposure;
- trained in emergency evacuation procedures; and
- provided with ongoing training, with regular revision of safe procedures.

CO exposure standard

The eight-hour time-weighted average occupational exposure standard for CO is 30 ppm (parts per million). Higher exposures are permitted for short periods of time, provided the average exposure does not exceed 30 ppm. For example, a total exposure time of 15 minutes is permitted at 200 ppm, 30 minutes at 100 ppm, and 60 minutes at 60 ppm. Exposures should never exceed 400 ppm.

Further information

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