

September 2022

Carbon monoxide: Invisible and deadly

This quick guide is for persons conducting a business or undertaking (PCBUs) and explains how to deal with health and safety risks arising from carbon monoxide.

Carbon monoxide is a common and deadly poison. It has caused serious illness and deaths at work.

Carbon monoxide is invisible. It has no smell or taste. It does not irritate your nose, mouth or skin.

You must, so far as is reasonably practicable, ensure the health and safety of workers, and that others are not put at risk from your work. To safely manage the health and safety risks from carbon monoxide, it is important to know what to look for and what to do.

Where can carbon monoxide be found?

Carbon monoxide comes from a range of sources, including emissions from:

- incompletely burned carbon-based material (for example, wood, paper, fuel)
- internal combustion engines (cars, trucks, forklifts, small portable petrol engines etc)
- kilns
- furnaces and fuel-powered boilers
- welding
- plastics moulding
- space heaters, oil or gas heaters
- fires and explosions.

How can carbon monoxide affect the body?

Carbon monoxide is easily absorbed through the lungs into the bloodstream where it attaches to the red blood cells and stops them transporting oxygen to the body. The brain and heart are particularly susceptible to damage caused by a reduction in oxygen supply.

Carbon monoxide can be absorbed through a pregnant woman's bloodstream into the foetus, where, depending on the amount of exposure, it may put the unborn baby at risk of brain damage and heart defects.

The first symptoms of carbon monoxide poisoning are mild headaches and dizziness. Most people recover from this low-level exposure without permanent damage.

CONCENTRATION OF CARBON MONOXIDE IN AIR ¹	SYMPTOMS THAT MAY OCCUR AT THIS CONCENTRATION
35ppm ¹	Headaches and dizziness within 6-8 hours of continual exposure
100ppm	Headache within 2-3 hours
200ppm	Headache within 2-3 hours; loss of judgement
400ppm	Headache within 1-2 hours

¹ Carbon monoxide is measured in the atmosphere in parts per million (ppm).

CONCENTRATION OF CARBON MONOXIDE IN AIR ¹	SYMPTOMS THAT MAY OCCUR AT THIS CONCENTRATION
800ppm	Headache, dizziness, nausea and convulsions within 45 minutes; unconscious within 2 hours
1,600ppm	Headache, accelerated heart rate, dizziness and nausea within 20 minutes; death in less than 2 hours
3,200ppm	Headache, dizziness and nausea within 5-10 minutes; death within 30 minutes
6,400ppm	Headache and dizziness in 1-2 minutes; convulsions, breathing stops, and death in less than 20 minutes
12,800ppm	Unconsciousness after 2-3 breaths; death in less than 3 minutes

TABLE 1: Symptoms after carbon monoxide exposure

How can you keep workers safe?

You must eliminate risks that arise from your work so far as is reasonably practicable. If you cannot eliminate the risk, you must minimise it so far as is reasonably practicable.

'Reasonably practicable' means doing what is reasonable in your circumstances to ensure health and safety.

For further information, read WorkSafe's fact sheet [Reasonably practicable](#)

To eliminate the risks you could:

- use electric forklifts instead of fuel-powered forklifts
- move carbon monoxide-generating processes outside
- use electrical, hydraulic or pneumatic tools instead of fuel-powered tools.

To minimise the risks you could:

- install ventilation in work areas that captures the contaminated air and extracts it safely outside
- regularly tune fuel-powered forklifts to ensure that carbon monoxide emissions are as low as possible.

Give preference to control measures that protect multiple people at once.

Seek your workers' views on which control measures to use.

Monitoring the work environment

PCBUs must, so far as is reasonably practicable, monitor any conditions at the workplace that could put a worker's health at risk.

When work activities may expose workers to carbon monoxide, WorkSafe recommends that the PCBU carries out exposure monitoring to determine the concentration of carbon monoxide in the workplace. If the PCBU is uncertain whether or not the concentration of carbon monoxide exceeds its workplace exposure standard (WES), they should carry out exposure monitoring.

Monitoring of workplace conditions should be carried out by, or under the supervision of, a competent person who has sufficient knowledge, skills and experience in the appropriate techniques and procedures, including the interpretation of results (such as an occupational hygienists or other suitably trained personnel). They will compare the levels of carbon monoxide present in your workplace with the WES and can advise you whether you need to do more to manage the risk.

Monitoring should be undertaken regularly and after any significant change at the workplace to check the effectiveness of controls. If the controls are not working, seek advice on improving controls from an occupational health specialist.

Workplace exposure standards (WES)

Exposure to carbon monoxide should be controlled and the following WES should not be exceeded. You should review and, as necessary, revise control measures if the results of exposure monitoring show that the WES are being exceeded.

EXPOSURE PERIOD	WES	MEASUREMENT
8 hours	WES-TWA of 20ppm	Average exposure over 8 hours
15 minutes	WES-STEL of 100ppm	Average exposure over 15 minutes
Ceiling (instant)	WES-Ceiling of 200ppm	Ceiling (instant) reading

TABLE 2: Carbon monoxide WES values

The WES are intended to be used as guidelines for health risk assessment. It is recommended that specialist advice is sought prior to engaging in monitoring programmes or exposure control. For further information on the interpretation of the WES: [Workplace exposure standards and biological exposure indices](#)

Monitoring worker health

PCBUs must, so far as is reasonably practicable, monitor any conditions at the workplace that could put a worker's health at risk.

There is no routine specified health monitoring for carbon monoxide exposure. However, a medical examination is recommended to identify those workers who may be more susceptible to carbon monoxide poisoning (such as a history of coronary heart disease, anaemia, pregnancy).

PCBUs should get advice from an occupational health practitioner with experience in health monitoring before engaging in monitoring programmes or exposure control.

Anyone who has been affected by carbon monoxide poisoning, even if they only have a headache, should see a doctor or go to the nearest hospital as soon as possible. A blood test should be carried out to determine if carbon monoxide poisoning has occurred.

WorkSafe must be notified in cases where a person has been admitted to hospital for treatment.

To notify WorkSafe, go to: [worksafe.govt.nz](https://www.worksafe.govt.nz)

What should you do in an emergency?

If someone at work seems to be affected by carbon monoxide poisoning, it is important to **act quickly**:

- assess whether you can safely intervene, before attempting any action or rescue
- make the situation safe by turning off the source
- get the affected person outside – call 111
- if it is impractical to move the affected person outside, ensure breathing apparatus is worn by rescuers
- if there is no heartbeat, begin CPR.

Anyone who has been affected by carbon monoxide poisoning, even if they only have a headache, must see a doctor or go to the nearest hospital as soon as possible.

For more information

WorkSafe guidance

[Forklifts and carbon monoxide](#)

[Suppliers of forklifts: Risk of carbon monoxide](#)