



澳門特別行政區政府  
Governo da Região Administrativa Especial de Macau  
衛生局  
Serviços de Saúde

## **Prevention of Carbon Monoxide Intoxication**

### **General information**

Carbon monoxide (CO) is colourless, tasteless and odourless, but lethal. It is produced when any carbon-containing compounds are burnt incompletely with insufficient oxygen. Using fuel-burning appliances (such as water heaters and gas stoves) not equipped with exhaust pipes in a poorly-ventilated environment can generate a large amount of carbon monoxide.

Long period of exposure under, and therefore inhalation of, a high concentration of the gas will cause carbon monoxide intoxication. Initial symptoms are minor, including fatigue and dizziness; however, with prolonged exposure, victims may lose consciousness or even die of serious oxygen deficit in the body. With its symptoms of intoxication not easily detectable, carbon monoxide has become a ‘silent killer’ lurking in the household.

### **Effects of carbon monoxide on human body**

Carbon monoxide binds to haemoglobin 250 times more tightly than oxygen and cannot be released as easily. Once inhaled into the lung, it decreases the oxygen-carrying capacity of the blood and inhibits the delivery of oxygen to different parts of the body, thus leading to oxygen deprivation in body tissues and the symptoms of intoxication.

The effect of carbon monoxide on the body depends on the exposure duration and concentration of carbon monoxide. Even a concentration level as low as 0.4% is enough to cause the victim to lose consciousness and die within a few minutes.

Symptoms of mild carbon monoxide intoxication include headache, dizziness, fatigue, nausea and vomiting.

More severe cases of intoxication may lead to disturbance of consciousness, shock, deep coma, urinary and faecal incontinence, hydrocephalus and even death.

### **High-risk group of carbon monoxide intoxication**

- ✧ Infants, young children, pregnant women and elderly people;
- ✧ People with cardiovascular and respiratory problems;
- ✧ People who suffer from undermined capacity of acquiring and delivering oxygen in the blood, such as those with anaemia.

### **Common situations leading to carbon monoxide hazards**

- ✧ Flueless gas water heaters are installed and used in poorly-ventilated spaces, such as in the bathroom or an enclosed balcony.
- ✧ Flued or room-sealed gas water heaters are installed without proper ventilation pipes as required, thereby trapping the exhaust.

- ✧ Cassette cookers or other open flame cooking appliances are used to boil water, cook food or prepare hotpot inside a room with closed doors and windows.

### **Key points in prevention of carbon monoxide intoxication**

Carbon monoxide is always the cause for many unfortunate accidents as it is colourless, tasteless, non-irritating and its intoxication symptoms are hard to detect. The following key points should always be remembered and acted upon to prevent the intoxication:

#### **1. Choose, install and use gas water heaters correctly**

##### **(1) Opt for a safer model of water heaters**

Room-sealed gas water heater is the safest choice; flued gas water heater is next. Models without a flue system should never be used in a domestic environment;

##### **(2) Install in appropriate locations**

Water heaters designed for outdoor use must not be installed indoor or on the balcony, while gas water heaters must not be installed in bathrooms;

##### **(3) Correct installation**

Water heaters must be properly installed by qualified technicians. Flues must be connected correctly.

##### **(4) Proper usage and maintenance**

Make sure that the air intake and flue terminals are unobstructed and that there is adequate ventilation around the aperture. Non-room-sealed water heater must be used in a well-ventilated area. If it is installed in the balcony, make sure the area is clutter-free and the window screens are free of dirt. Close the doors and windows leading indoor to prevent the exhaust from flowing back in.

#### **2. Prevent carbon monoxide intoxication under other circumstances:**

- (1) Do not cook, boil water, barbeque, keep warm or illuminate with open flame or any type of gas cooking appliances, kerosene stove, charcoal or firewood in a poorly-ventilated place.
- (2) Avoid running any type of gas and fuel engines, including vehicles and fuel generators, for a long period of time in confined spaces such as a carpark or a garage.

#### **3. Install carbon monoxide detectors in places with potential danger of carbon monoxide intoxication.**

#### **In case of an accident/ suspected intoxication, you must:**

1. Stay calm;
2. Evacuate and remove victims from the venue immediately, go to a well-ventilated place and loosen tight clothing.
3. Seek immediate medical assistance or call emergency number for help.

### Basics of Effective Ventilation – it does not simply mean air flow

- Effective ventilation is a must to prevent carbon monoxide intoxication or harms from other toxic gases, and can be achieved with ‘air circulation’. Air circulation is created when toxic gases are emitted to outdoor by mechanical (exhaust fan) or natural means (chimney) and outdoor fresh air is introduced directly or indirectly (through other indoor areas) from other directions at the same time.
- Carbon monoxide intoxication or harms from other toxic gases cannot be effectively prevented in the following conditions if no additional ventilation equipment is installed:
  - Switching on fans or split type air-conditioners in a room with closed doors and windows: Indoor air flow can be stimulated but the area is actually not ventilated.
  - When window or central air-conditioners are in operation even with the ventilation button switched on: There is a certain amount of outdoor fresh air to refill the indoor area but this does not provide enough ventilation.
  - Keeping doors and windows open yet without any equipment to actively discharge exhaust gases, especially when there is no wind or the wind blows to a wrong direction (blowing exhaust gases indoors).

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