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Carbon Monoxide

Hazard summary

Carbon monoxide is a toxic gas that can cause illness and even death. Carbon monoxide is known as a “silent killer” as it has no colour, odour, or taste. It is also extremely flammable.

What are common sources of carbon monoxide?

Appliances, vehicles, and equipment that burn any type of fuel can become a health risk when they are used indoors or in poorly ventilated areas. Common sources of carbon monoxide include:

- furnaces
- wood stoves
- fireplaces
- water heaters
- boilers
- gas or propane clothing dryers
- gas, propane, or charcoal barbecues
- cooking appliances
- vehicle exhaust
- generators
- portable space heaters
- pressure washers

How does carbon monoxide affect your health?

Carbon monoxide binds to red blood cells and deprives the body of oxygen. Symptoms depend on the concentration of carbon monoxide in the air, the length of time you are exposed, and your health.

Exposure to low levels of carbon monoxide over a long period (weeks or months) can cause flu-like symptoms including headache, fatigue, nausea, and vomiting. It is common to attribute signs of carbon monoxide poisoning to other factors. Exposure to a high concentration of carbon monoxide can cause death within minutes.



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Health effects of carbon monoxide

Low concentration	High concentration
Tiredness	Seizures
Dizziness/confusion	Loss of consciousness
Headaches	Coma
Chest pain	Death

After moderate to severe poisonings, there can be long-term or permanent neurological effects, including poor concentration and memory problems, personality changes, depression, anxiety, impaired vision, and effects that mimic Parkinson's Disease.

The organs most affected by oxygen deprivation are the heart and the brain. Carbon monoxide exposure can injure the heart and aggravate pre-existing cardiovascular diseases, such as coronary artery disease.

What should you do if you suspect carbon monoxide is in a building?

- Leave the area immediately and move outdoors to fresh air
- Once outside, call 9-1-1
- If it is safe to do so:
 - turn off the fuel source
 - remove sources of ignition to prevent fire
- Do not re-enter until the problem has been fixed by a professional

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How to manage risk of carbon monoxide exposure

The best way to control risk is to eliminate the hazard. If it is not possible to eliminate the hazard, then another risk control option should be used. Personal protective equipment (PPE) should be used as a last resort, and only in combination with other control measures.

Effectiveness	Risk control	Example
	Most effective control	Elimination or substitution Use electric vehicles and equipment instead of fuel-powered
		Engineering controls Improve ventilation design and use emission control devices
	Least effective control	Administrative controls Know the signs of carbon monoxide poisoning; install and maintain detectors that alarm when the carbon monoxide level is too high
		Personal protective equipment Respirators would be appropriate for some professionals, such as firefighters

Legal information

[The Nova Scotia Fire Safety Regulations](#)

- Inspection, testing, and maintenance of carbon monoxide alarms must be in accordance with the manufacturer's instructions.
- The Nova Scotia Fire Safety Regulations reference the National Fire Code of Canada and specify the requirements that apply to buildings in Nova Scotia.



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The Nova Scotia Building Code Regulations

- The Nova Scotia Building Code Regulations reference the National Building Code of Canada and specify the Code amendments that apply to buildings in Nova Scotia.
- The National Building Code of Canada specifies where a carbon monoxide alarm is required, and the standard that the alarm must conform to.
- A carbon monoxide alarm is required in a building designated for “residential occupancy” or “care occupancy” if the building has a fuel-burning appliance or storage garage.
 - A Building Official in Nova Scotia can answer questions about occupancy classification and the need for a carbon monoxide alarm.
 - Older buildings do not need to be retrofitted when an updated version of the Code is adopted in regulation unless a Building Official or Fire Inspector requires the installation of additional fire safety equipment due to unsafe conditions.

Fuel Safety Regulations

- The Fuel Safety codes and regulations require that installation and servicing be performed by qualified, trained, and licensed installers.
- Regular maintenance and service must be performed by qualified, trained, and licensed installers.
- Installers are required to ensure that fuel appliances are operating correctly and safely upon installation or servicing.
- Building owners should be familiar with their fuel burning systems and know when to call for service. They should also ensure that vents and air intakes are not blocked by high snow levels, or other obstructions.
- Building owners should install carbon monoxide monitors in all buildings with fuel burning equipment.
- The Fuel Safety Regulations reference CSA Codes B139.1, B149.1 and B149.2



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Occupational Health and Safety Act and Regulations

General duties for workplace parties

- Employers have a duty to ensure that employees and supervisors are familiar with the hazards in the workplace, and the equipment required for their protection (Occupational Health and Safety Act, section 13).
 - Employers must inform employees and supervisors of the potential sources of carbon monoxide in the workplace, the health effects of exposure, and risk control methods used to prevent carbon monoxide poisoning.
- Employees have a duty to protect their own health in the workplace by reporting hazards, and co-operating with others in the workplace ([Occupational Health and Safety Act](#), section 17).

Ventilation in a workplace

- An employer must provide a supply of fresh air into the workplace, keep the air reasonably pure, and ensure that all ventilation systems are designed, installed, operated, maintained and repaired in an adequate manner by a competent person ([Occupational Safety General Regulations](#), section 15).

Lift trucks in a workplace

- Where a lift truck that has an internal combustion engine is used indoors, the employer must ensure that adequate ventilation, monitoring and record keeping practices are carried out (Occupational Safety General Regulations, section 82).
- For propane-powered lift trucks, the employer must ensure that the truck has all engine and fuel components designed, assembled, examined, inspected, operated, and maintained in accordance with the latest version of CSA standard CSA B149.2, "Propane Storage and Handling Code" ([Occupational Safety General Regulations](#), section 82).



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Carbon Monoxide exposure limit for workplaces

The Workplace Health and Safety Regulations in Nova Scotia require the employer to comply with the latest version of the publication made by the American Conference of Governmental Industrial Hygienists (ACGIH) of threshold limit values.

For carbon monoxide gas in a workplace in 2023, an employee's average exposure must not exceed time-weighted average (TLV-TWA): **25 parts per million (ppm) over an 8-hour workday or 40-hour work week**. This exposure limit is subject to change as the TLVs are updated when new scientific information becomes available.

The maximum peak concentration may exceed three times the value of TLV-TWA (75 ppm for carbon monoxide) for maximum 15 minutes, for a maximum of four occasions spaced at least one hour apart during a workday. **The exposure should never exceed 5 times the TWA (125 ppm)** and the 8-hour TWA should not be exceeded for an 8-hour work period.

The TLV-TWA is a time-weighted average concentration of a hazardous substance in the air. The concentration is averaged over an 8-hour workday and a 40-hour work week. The exposure limits are believed to be the maximum levels to which a worker may be repeatedly exposed, day after day, for a working lifetime without adverse effects.

How to measure carbon monoxide

The most common ways to measure carbon monoxide are to use a fixed electronic detector or a portable electronic monitor.

1. Stationary electronic detectors

- A stationary carbon monoxide detector is commonly used in a home to alert occupants if the level of carbon monoxide is too high.
- Carbon monoxide alarms may be hard-wired to an electrical source, battery-operated, or plugged-in to a suitable electrical outlet.
- A sensor for carbon monoxide is different from a sensor for smoke. Some devices have two sensors – one for carbon monoxide and one for smoke.

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- A carbon monoxide detector must be approved by a certification body accredited by the Standards Council of Canada. Look for “CSA,” “ULC,” “ETL” or another recognized certification body on the packaging.
- Carbon monoxide detectors expire and need to be replaced. Follow the manufacturer’s instructions for installation, inspection, testing, and expiry. See below for some examples.



Wired



Digital



Plug in



Expiry dates



2. Portable electronic monitors



Portable CO monitor

- A portable carbon monoxide monitor is a hand-sized, battery-powered device that can be moved from one location to another.
- A portable monitor is commonly used to measure a person’s exposure to carbon monoxide as they move around a workplace over time.
- A portable monitor can help to ensure compliance with Nova Scotia’s legal requirement for workplace exposure to carbon monoxide.
- To operate a portable carbon monoxide monitor, a person who specializes in workplace exposure monitoring, such as an occupational hygienist, or occupational hygiene technician, may be needed for this job.

Choosing a monitor for a home or workplace

- A stationary carbon monoxide monitor is an effective way to prevent high-level exposure to carbon monoxide and acute health effects. These devices are not designed to prevent long-term exposure at a low level. They may not show the average exposure levels or confirm compliance with the workplace exposure limit in Nova Scotia.



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- The electronic monitors that are designed for use in a workplace can detect a range of carbon monoxide concentrations. Training is required to operate these monitors properly. The monitors used in a workplace may record measurements over time and show both maximum and average exposure levels. These monitors may be used to provide an indication of whether compliance with the workplace exposure level is achieved.

Where to install a carbon monoxide detector

The following factors should be considered when choosing where to install a carbon monoxide detector:

- What do the manufacturer's instructions say about installation and maintenance?
- Is the detector likely to be damaged or covered where it is installed?
- Can you hear the detector from each sleeping area on every level in the building?
- At what height should a fixed detector be installed?
 - Carbon monoxide is slightly lighter than air, and mixes with the air in a room rather than rising
 - A carbon monoxide detector can be installed at any height
 - It is common to install them 1.5 meters (5 feet) above the floor
 - Some devices are designed to plug into a wall outlet, and may be installed near the floor
 - If a combination smoke/carbon monoxide detector is used, the device should be installed on the ceiling to ensure that it will detect smoke

Carbon monoxide poisoning prevention tips

- Install a certified CO alarm in the hallways near the sleeping areas on each floor of the building.
- Follow the manufacturer's suggestions for installation, testing, use, maintenance, replacement of a carbon monoxide alarm.
- If your carbon monoxide alarm sounds, leave the building immediately and move to fresh air.
- Never use a barbecue, camp stove, or fuel-powered lamp indoors.



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- Never use an oven or range to heat your home.
- Hire a qualified technician to inspect and service the furnace, fireplaces, stoves, water heaters, clothes dryers, and all other fuel-burning appliances at least once a year, and in accordance with the manufacturer's instructions.
- Check chimneys, flues, and vents regularly to make sure they are in good shape, properly connected, and not blocked.
- Never idle a motor vehicle in a garage, even if the garage door is open.
- Never use gas-powered machines in a garage, such as:
 - trimmers
 - generators
 - lawnmowers
 - snowblowers
 - leaf-blowers
 - chainsaws
- When using a generator, pressure washer, or gas-powered engine outdoors, keep a safe distance to prevent the exhaust from entering the doors, windows, and vents of a building.

Weather events and carbon monoxide poisoning

Natural disasters, such as forest fires, floods and blizzards can affect fuel-powered appliances and equipment. Power outages are also common during extreme weather events and natural disasters.

- Check for signs of improper combustion, such as soot, during and after use.
- Check for damaged or missing venting systems and chimneys.
- Never use temporary heating devices, cooking devices, and generators indoors.
- Inspect exhaust vents during and after snowstorms to make sure they are not blocked with ice or covered by snow or debris. Do this for your:
 - clothes dryer
 - furnace
 - fireplace and chimney
 - heat recovery ventilator (HRV)
 - wood-burning or gas stove

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Fuel-powered Space Heaters

Portable fuel-powered space heaters must be selected carefully and used with caution. These heaters can cause carbon monoxide poisoning and even death.

There are two types of portable fuel-powered space heaters: direct and indirect. When installed properly, indirect space heaters exhaust carbon monoxide and other products of combustion to the outdoors.

Indirect fuel-powered heaters are recommended due to the lower risk of carbon monoxide poisoning. See the table below for key features of these two types of temporary space heaters.

Portable fuel-powered space heaters	
Direct	Indirect
<ul style="list-style-type: none">! Exhausts carbon monoxide and other products of combustion directly into heated area! Inefficient heat source due to need for adequate ventilation! Only for use in open spaces, such as outdoors or in unenclosed areas under construction! Not for use in an inhabited dwelling unit or inhabited section of a building	<ul style="list-style-type: none">✓ Exhausts carbon monoxide and other products of combustion outdoors✓ Reduces risk of carbon monoxide poisoning compared to direct fuel-powered heaters✓ Heats space efficiently due to reduced need for ventilation



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Other requirements that apply to both direct and indirect fuel-powered space heaters

- **The manufacturer's instructions must be followed**
- In a workplace, the supervisors and employees must be informed about the hazard of carbon monoxide and the level of carbon monoxide must be monitored near the source to ensure compliance with the workplace exposure limit
- Portable heaters must not be used where combustible materials or vapours present a risk to occupants
- Combustible materials, such as plastic, canvas and wood, must be kept clear of the heater – check the information plate on the heater to see how much clearance space is required
- Heaters must be located where they are protected from physical damage or upsetting
- Suppliers who lease temporary heating equipment have a duty to inform clients about the safe installation and use of the heater
- Propane tanks that are not in-use (connected to a heater) must not be stored inside a building
- There is a maximum amount of fuel that may be kept indoors
 - o Contact a Fuel Safety specialist for additional information about safe fuel use and storage

Contact Us

Safety Branch – SafetyBranch@novascotia.ca

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1-800-952-2687