

## Indoor air quality: Combustion by-products

### What are combustion by-products?

Combustion (burning) by-products are gases and small particles. They are produced when fuels such as oil, gas, kerosene, wood, coal and propane are incompletely burnt.

The type and amount of combustion by-product produced depends on the type of fuel and the combustion appliance. How the appliance is designed, built, installed and maintained affects the by-products it generates. Some appliances receive certifications based on their efficiency in clean burning. The Canadian Standards Association (CSA) and the Environmental Protection Agency (EPA) certify wood stoves and other burning appliances.

Examples of major combustion by-products include:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO<sub>2</sub>)
- Particulate matter (PM, PM<sub>2.5</sub>, PM<sub>10</sub>)
- Carbon dioxide (CO<sub>2</sub>)
- Sulphur dioxide (SO<sub>2</sub>)
- Water vapor
- Hydrocarbons (for example benzene)
- Aldehydes

### Where do combustion by-products come from?

Combustion by-products come from any heating appliances that burn fuel, for example wood heaters and wood stoves, furnaces, gas ranges, gas heaters, generators, fireplaces, vehicle exhaust, unvented kerosene heaters, stoves and other sources. Second-hand tobacco smoke also contains combustion by-products. These by-products can also get inside your home from car exhaust coming in through a garage.

### What are some health concerns of combustion by-products?

#### Carbon monoxide (CO):

- Reduces the blood's ability to carry oxygen. Acute exposure may cause tiredness, headaches, nausea, flu-like symptoms, dizziness, impaired vision and confusion

- If you have heart disease, it may cause chest pain
- High levels of carbon monoxide exposure can cause loss of consciousness and death. This gas is odourless, colourless and can only be identified with a carbon monoxide detector

#### Nitrogen dioxide (NO<sub>2</sub>):

- May irritate your eyes, nose, throat and lungs and cause shortness of breath
- If you have a respiratory illness, you may be at higher risk of experiencing health effects from nitrogen dioxide exposure

#### Particulate matter (PM, PM<sub>2.5</sub>, PM<sub>10</sub>):

- May irritate your eyes, nose and throat
- May lodge in the lungs, causing irritation or damage to lung tissue
- May cause inflammation, leading to heart problems
- Some combustion particles may contain cancer-causing substances

#### Carbon dioxide (CO<sub>2</sub>):

- May cause headaches, dizziness and fatigue at high levels. High levels of CO<sub>2</sub> are rare indoors, but levels can be monitored to ensure enough fresh air gets into a room or building
- Although carbon dioxide and carbon monoxide are both combustion by-products, the presence of carbon dioxide does not necessarily mean the highly toxic compound, carbon monoxide, is also present

### What can I do to prevent or limit health concerns?

Controlling the source, improving ventilation and using carbon monoxide (CO) detectors will help limit health concerns. Using an air cleaner may further improve air quality.

#### Control the source:

- Follow the manufacturers' instructions for all combustion appliances
- Regularly service and clean appliances and vents such as chimneys
- Use only fuels recommended for each appliance

- Make sure that wood stoves are installed and maintained correctly. Doors should be tight-fitting to prevent leakage
- Use only aged or dried wood, not pressure treated or painted wood that may form more toxic compounds when burned
- Inspect furnace and flues, and repair cracks and damaged parts. Open the flue when using your fireplace. Do not let a fire within a wood heater smolder, especially just before opening the firebox
- Change your furnace and air conditioning filters every couple of months if you use them often. Consider using a more effective furnace filter
- Never allow smoking in or near the home
- Reduce the use of candles and incense in the home

#### **Improve ventilation:**

- Use a stove hood and fan that vents outside when cooking with gas stoves and ranges
- When you need to replace a space heater, buy a vented heater
- Gases are not always noticeable by smell with smaller leaks and some gases have no odour
- Make sure enough fresh air gets into your home from the outdoors, especially when using combustion appliances. You can check the outdoor air quality in your area before opening windows. Visit [www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-quality/aqhi](http://www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-quality/aqhi)
- Make sure fresh air-intake vents are not blocked or covered
- Do not have air-intake vents coming into your home from your garage. Never idle a vehicle in an attached garage

#### **Use carbon monoxide (CO) detectors:**

Carbon monoxide detectors are readily available in hardware stores, electronic stores and online retailers. They are cheap to install, with a price range of \$25-\$200. Like smoke detectors, they need regular testing to make sure they are working properly. You can check with a consumer guide to find a carbon monoxide detector that best meets your needs. Health Canada recommends that you install and maintain at least one CO alarm in your home. For more information, visit [www.canada.ca/en/health-](http://www.canada.ca/en/health-)

[canada/services/air-quality/pollutants/carbon-monoxide/preventing-exposure.html#a2](http://www.canada.ca/en/health-).

#### **Use air cleaners:**

Air cleaners may reduce levels of pollutants in indoor air if used along with source control and improved ventilation. Air cleaners use electrical attraction, mechanical filters or ion generation to remove particles from the air. They vary in their cost and how well they work. No air cleaners will remove all pollutants from indoor air. Some air cleaners may produce harmful levels of ozone. This can cause adverse health effects. Look for air cleaners that are certified to release low amounts of ozone. For more information, visit Residential Air Cleaner Use to Improve Indoor Air Quality and Health at [www.nccelh.ca/sites/default/files/Air\\_Cleaners\\_Oct\\_2010.pdf](http://www.nccelh.ca/sites/default/files/Air_Cleaners_Oct_2010.pdf) (PDF 162 KB).

If you plan to buy an air cleaning system, make sure you get the device that best meets your needs.

#### **For more information**

For more information about indoor air quality and your health, visit:

- Health Canada: Air quality and health [www.canada.ca/en/health-canada/services/air-quality.html](http://www.canada.ca/en/health-canada/services/air-quality.html)
- Government of Canada: Combustion Gases in Your Home – Things You Should Know About Combustion Spillage <https://natural-resources.canada.ca/energy-efficiency/homes/combustion-gases-your-home-things-you-should-know-about-combustion-spillage/18639>
- Government of Canada: Cooking and indoor air quality [www.canada.ca/en/health-canada/services/publications/healthy-living/factsheet-cooking-and-indoor-air-quality.html](http://www.canada.ca/en/health-canada/services/publications/healthy-living/factsheet-cooking-and-indoor-air-quality.html)
- The B.C. Lung Foundation: Air Quality <https://bclung.ca/lung-health/air-quality/air-quality> or call toll-free 1 800 665-LUNG (5864)



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