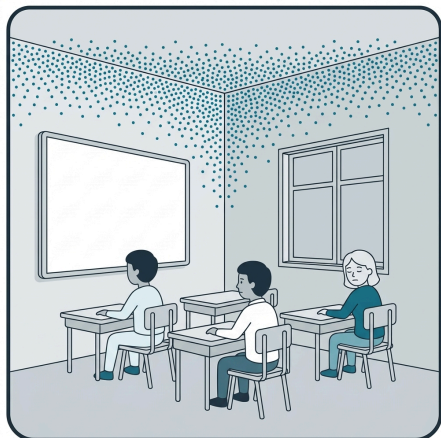


Healthy air, healthy home

measure, understand, ventilate



Remember that stuffy classroom?

Remember a classroom on a winter afternoon, windows shut, thirty children inside? The air felt heavy. Studies of schools link better ventilation to better test results and better attendance^{1,2,3}. The same thing can happen at home, especially in a bedroom with the door and window closed.

Why this matters now

When a home is sealed against draughts or insulated, less air leaks in through gaps. Then grilles, windows or a ventilation system have to bring in the fresh air^{4,5}. A room without a grille, with the window closed, gets little fresh air at all.

In this booklet

Why fresh air matters, how a CO₂ meter shows whether you get enough, and what you can do.

Why fresh air matters, especially at night

Sleep

Studies show that with less fresh air (CO₂ from about 1,000 to 2,500 ppm during the night), people sleep less deeply and wake up more often^{6,7,8}. In one study, people also felt more rested after nights with better ventilation⁶.

Stuffy rooms during the day

In stuffy, poorly ventilated rooms, more people report headaches and drowsiness^{9,10}.

Damp and mould

Breathing, cooking and showering add moisture to the air. Without enough ventilation it stays inside. That raises the risk of damp and mould, which are linked to breathing problems, allergies and asthma^{11,12}.

CO₂: a sign of how fresh the air is

Where CO₂ comes from

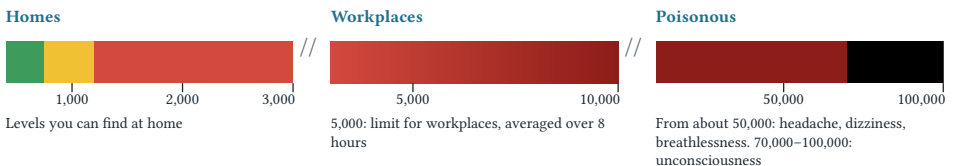
Outdoor air contains about 425 ppm CO₂¹³. (“ppm” means parts per million; 1,000 ppm is 0.1% of the air.) Everyone breathes out CO₂, together with moisture and other substances from breath and skin. In a closed room they build up together. So the CO₂ level shows how well a room is ventilated for the number of people in it^{14,15,16}.

You can’t smell it

CO₂ has no smell at these levels. The stuffy smell comes from the other substances. After a few minutes in the room you stop noticing it, while someone coming in from outside notices it straight away^{17,9}.

Is CO₂ itself harmful?

Short-term CO₂ poisoning only occurs at 10,000 ppm or higher^{18,19,20}. The effects of long-term exposure to elevated CO₂ (above 1,400 ppm) are still being studied^{21,22}. Some studies report cognitive impairment^{23,24}, others elevated chronic stress^{8,22}.



Levels in the scale: outdoor air¹³, workplace limit^{25,26}, poisoning^{27,18}.

What a CO₂ meter does not show

CO₂ is not a full measure of air quality¹⁴. Smoke, cooking fumes, fumes from paint or cleaning products, and damp are not measured by a CO₂ meter.

What level is good? Advice in the Netherlands and abroad



The Netherlands

The Netherlands has no legal CO₂ limit for homes. The building code sets how much ventilation a home must be able to provide, not a CO₂ level^{28,29}. Dutch health bodies use 1,200 ppm as a sign that a room is not ventilated enough^{30,31}. Milieu Centraal: up to 750 ppm is good, between 750 and 1,200 ppm it could be better⁴.

Other countries

Where	Value	Applies to	Status
Canada ³²	1,000 ppm, 24-hour average	homes	health ministry guideline
Germany ³³	below 1,000 no concern; 1,000–2,000 elevated; above 2,000 unacceptable	indoor spaces including homes	federal environment agency guide values
Norway ³⁴	1,000 ppm	all indoor spaces (not industry)	recommended norm (FHI)
Flanders (Belgium) ³⁵	500 ppm above outdoor air (≈ 925 ppm) ³⁶	homes and public buildings	guide value in a regional decree
Finland ³⁷	1,150 ppm above outdoor air (≈ 1,575 ppm) ³⁶	homes	binding: authorities can act above this
Denmark ³⁸	1,000 ppm (design)	schools, day care	building regulation BR18 §447
France ³⁹	800 ppm fine; above 1,500 act quickly	schools, childcare, care facilities	binding since 2023

Bedrooms

Sleep researchers advise keeping bedroom CO₂ below 1,000 ppm, preferably below 800 ppm. Scientific evidence suggests we should revise our legal limits⁴⁰.

How common is it in Dutch homes?

In a national study of about 1,200 Dutch homes, measured in 2004–2005, almost half of main bedrooms went above 1,200 ppm at least once during the measured week^{41,42}.

Measure it yourself

Borrow a CO₂ meter

TBD Borrow a CO₂ meter: [where] · [for how long] · [how to reserve] · [what you get: meter, short instruction].

With your own: a CO₂ meter with an NDIR sensor can be found starting at about €50⁴³. Milieu Centraal also advises measuring in the living room and bedrooms⁴.

Choose the right meter

Choose a meter with an NDIR sensor. Meters that show “eCO₂” or “CO₂ equivalent” do not measure CO₂; they estimate it from other gases¹⁵.

Where to put it

Guidance for workplaces and public buildings says:

- at head height;
- not next to a window, door or air inlet;
- not right next to people: at least 0.5 m¹⁵ to 1.5 m⁴⁴.

There is no specific guidance for bedrooms. In a bedroom, for example, on a cupboard or shelf away from the window and not next to your pillow.

Outdoors, a meter shows roughly 400–450 ppm: outdoor air is about 425 ppm¹³, and meters are not exact.

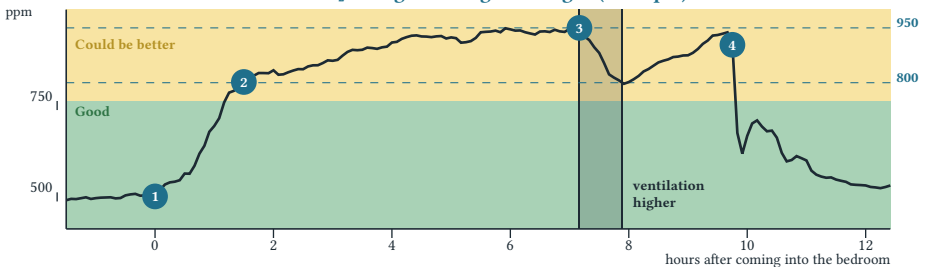
Read the night

Most meters store their readings. The next morning, look at the graph:

- When did CO₂ start rising?
- How high did it get?
- Did it drop when a grille or window was opened?

Then change one thing at a time, for example one night with the grille closed and one night with it open, and compare.

How CO₂ changes through the night (example)



Someone comes into the bedroom. CO₂ starts to rise.



Asleep. The rise slows down, but it does not stop.



The ventilation steps up by itself. More fresh air in, CO₂ reduced.



Out of bed and out of the room. The air clears.

One real night: one adult, door and window closed. This home's ventilation always runs and automatically adjusts with CO₂. For more than eight hours the room stayed above 750 ppm, but below 1,000 ppm. Without it, CO₂ in this room would rise above 4,000 ppm within three hours.

Without an automatic system, you should open a grille, or put a window ajar.

What helps and what doesn't

What helps

- **Grilles open.** Keep ventilation grilles open, day and night, all year. They don't need to be fully open. Clean them at least once a year⁴.
- **No grilles?** Ensure there's a window ajar in the rooms where you live⁴.
- **Can't open the window?** Leave the door open to the rest of the home.
- **Above 1,200 ppm?** Open the grille, door or window further⁴.
- **Mechanical ventilation.** Leave the fan on at all times¹². Studies of new Dutch homes found systems were often left on the lowest setting, partly because of noise, and often delivered less air than required^{45,46,47}. If your meter shows high values, try a higher setting.
- **Ventilation with heat recovery (HRV).** A balanced ventilation system with a heat-recovery unit ("wtw") brings in fresh outdoor air and uses the warmth of the air going out to pre-warm it, so you lose less heat in winter. When the air outside is cooler than inside, a bypass lets it in directly. There are also units for a single room, called decentralised balanced ventilation⁴⁸. Only then can you remain healthy with doors and windows closed.

This does not replace ventilation

- **Plants.** Plants do not measurably lower CO₂ in a home. Even in very bright light you would need hundreds to more than a thousand plants to take up the CO₂ of one person, and in the dark plants give off CO₂^{49,50,51}.
- **Air purifier or air conditioner.** They clean or cool the air that is already inside. They don't bring in fresh outdoor air, and they don't lower CO₂^{52,53}.
- **Airing at most twice a day (only in the evening, only in the morning, or both).** Airing refreshes the air, but once the window is closed, CO₂ rises again while people are in the room. As an example: one adult in a closed bedroom of 30 m³ with no air leaking in adds roughly 440 ppm per hour^{30,34}. Poorly insulated rooms leak some air, so the rise slows. In well-insulated rooms, the rise is faster⁵. Keep the grilles open as well⁴.

Fresh air and moisture in winter

Ventilation also removes moisture, which lowers the risk of damp and mould^{11,55}. Indoor humidity of 40–60% is good^{55,4}.

A window left wide open on tilt for hours in winter cools the wall around it, which can cause condensation and mould. German advice is to air briefly with the window wide open, and keep grilles open⁵⁵.

CUT CANDIDATE

Subsidy

Homeowners may get €400 ISDE subsidy for a CO₂-controlled or heat-recovery ventilation system, only together with an insulation measure (conditions 2026 check rvo.nl)⁵⁶.

Myths and facts

Myth	Fact
“CO ₂ is harmless — we breathe it out anyway.”	Partly true: at home levels, CO ₂ itself is not poisonous. But high CO ₂ means stale air, too little fresh air for the people in the room ¹⁴ . In studies, people slept less deeply in such bedrooms ^{7,8} .
“I don’t notice anything, so it’s fine.”	Your nose is not a good guide. CO ₂ has no smell, and you stop noticing stale air within minutes ^{17,9} . A meter shows what your nose misses.
“My house is old and draughty, so the air is fine.”	Not necessarily. In the national Dutch study (measured in 2004–2005), living rooms in homes built between 1945 and 1970 had higher CO ₂ than in newer homes ⁴¹ . And many people seal gaps against draughts; then grilles or windows must bring in the air ⁴ .
“Plants help a little.”	Not measurably. See page 5 ⁴⁹ .
“An air purifier with a CO ₂ sensor is enough.”	The sensor can show the problem, but the purifier doesn’t fix it: it brings in no outdoor air ⁵² .

CO is something else

CO (carbon monoxide) is a different gas. It can come from appliances that burn fuel, such as a central-heating boiler, geyser, gas fire, stove or open fireplace, when they don’t work properly or lack fresh air. It is poisonous even for a short time. Every year 5 to 10 people in the Netherlands die from it and hundreds go to hospital. The first signs (headache, dizziness, nausea) look like flu⁵⁷. A CO alarm does not measure CO₂, and a CO₂ meter does not warn you about CO: they do different jobs⁵⁸.

CUT CANDIDATE

Other substances

Fumes from paint, furniture, cleaning and personal-care products and cooking (VOCs) are not measured by a CO₂ meter either. Ventilation lowers both^{59,12,52}.

Want to know more?

- Milieu Centraal, ventilation: <https://www.milieucentraal.nl/energie-besparen/ventilatie/woning-ventileren/>
- RIVM, “Binnenmilieu in woningen”: <https://www.rivm.nl/binnenmilieu/binnenmilieu-in-woningen>



You can also find this information online
<https://knz.github.io/co2-booklet/>

About this booklet

An initiative of members of the Diemen city council · September 2026.
 Sources checked on 15 September 2026.
 This is not medical advice.

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