

Carbon monoxide concentrations

This factsheet reports on concentrations of carbon monoxide (CO) at outdoor monitoring sites in Aotearoa New Zealand between 2005 and 2020. The data used in this factsheet is gathered and reported by Regional Councils and published by the Ministry for the Environment and Statistics New Zealand.



Levels of carbon monoxide (CO) in the few areas monitored in New Zealand are well within the limits of the national air quality standard and meet all WHO guidelines. However, CO remains a hazard in indoor environments, for which no monitoring system exists.



There are 12 outdoor carbon monoxide monitoring stations in New Zealand, located only in two regions: Canterbury (9 stations) and Greater Wellington (3 stations). Only 7 of these monitoring stations had valid data for 2020, the latest year of data.



There have been no exceedances of the national standard for CO (8-hour average) since 2006. These exceedances were minor.



The last exceedances of the 2021 WHO guideline for daily average CO concentrations were also in 2006.

Health effects of carbon monoxide

Carbon monoxide (CO) is a colourless gas, formed by the incomplete combustion of fuels such as petrol, wood, coal and other gases. The main sources of ambient carbon monoxide in New Zealand are petrol motor vehicles and domestic home heating (wood and coal fires).

When breathed in, CO molecules inhibit the blood's ability to carry oxygen, which can lead to adverse effects on the brain, heart and general health (Bascom et al, 1996). Middle-aged and older people with heart disease, and unborn babies are most vulnerable to carbon monoxide exposure (Ministry for the Environment, 2023).

In New Zealand, some regional councils monitor ambient (outdoor) carbon monoxide, which can be measured against the national environmental standard, as well as against the national ambient guideline and World Health Organization guidelines (which carry no regulatory weight in New Zealand). Indoor air quality for carbon monoxide is not routinely monitored. This factsheet reports on short-term carbon monoxide concentrations at outdoor monitoring stations in New Zealand.

Outdoor data - indoor hazard

All the monitoring stations used to gather data on CO concentrations are outdoors and few in number. Therefore, the generally good performance against the NESAQ and WHO guidelines should not be taken to mean that CO is not a serious health hazard under certain conditions.

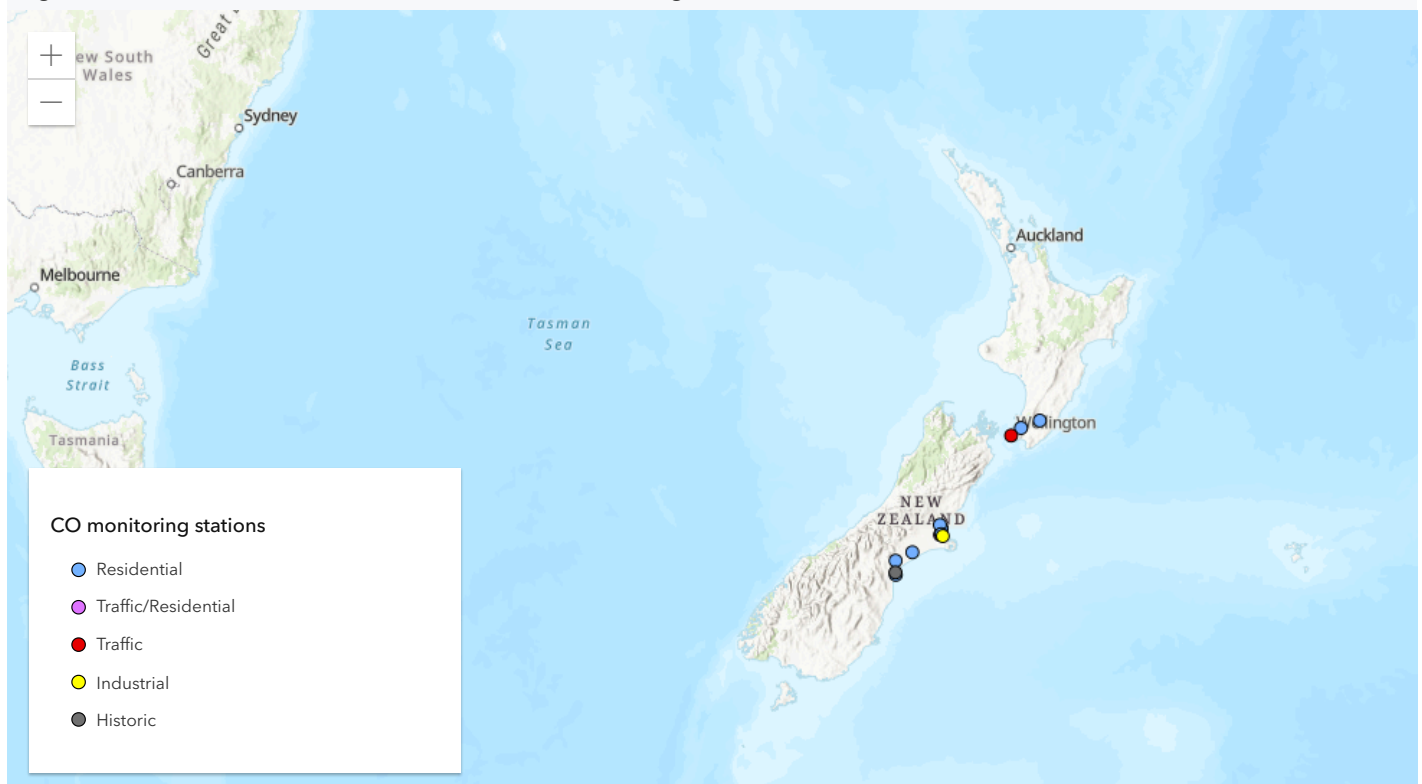
While ambient levels in the outdoors are generally low, carbon monoxide tends to become much more concentrated in enclosed (indoor) environments. In enclosed spaces, the onset of health effects from carbon monoxide exposure comes much earlier. Carbon monoxide poisoning is one of the most common forms of hazardous substance exposure, particularly in the home or workplace (See the '[Hazardous substances](#)' domain for more information).

Monitoring of carbon monoxide has limited coverage

As of 2021, there were a total of 12 outdoor monitoring stations being used to assess concentrations of carbon monoxide over time in New Zealand - 9 in the Canterbury region, and 3 in the Greater Wellington area (Figure 1). Of these, only 7 stations produced valid data for 2020 – the most recent year for which any data is available.

Consequently, the spatial coverage of carbon monoxide monitoring in New Zealand is very limited. This leaves several large metropolitan areas where outdoor CO levels are likely to be elevated, yet the actual levels of CO remain unknown.

Figure 1 Location of outdoor carbon monoxide monitoring stations in New Zealand, 2020



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Source: Ministry for the Environment and Statistics New Zealand

There have been no observed exceedances of any limit or guideline since 2009

Carbon monoxide concentrations can be measured against the following limits and guidelines.

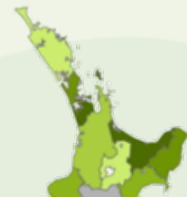
- The New Zealand national environmental standard for carbon monoxide is 10 mg/m³ as an 8-hour moving average (one exceedance of the limit is allowed per year).
- The New Zealand national ambient air quality guideline for carbon monoxide is 10 mg/m³ as a 1-hour average.
- The WHO 2021 air quality guideline for daily (24-hour) average for carbon monoxide is 4mg/m³.

For the national environmental standard, the last known exceedance of this 8-hour average limit occurred in June 2006 at the monitoring station in St. Albans, Christchurch. Five minor exceedances were recorded that month, with a peak value of 10.7mg/m³, slightly above the national environmental standard of 10mg/m³.

The national ambient air quality guideline was last exceeded in 2009, once again at St Albans. Four exceedances were recorded there in 2009, two in 2008 and 17 in 2006. Apart from two exceedances at the Woolston station (also Christchurch) in 2005, there have been no other breaches of the ambient guideline.

The last exceedances of the WHO guideline for daily carbon monoxide concentrations occurred in June and July 2006, once

Dashboard - Air quality



Data for this indicator

This indicator analyses data from the most recent (2021) 'Our Air' report, part of New Zealand's environmental reporting series, published by the Ministry for the Environment and Statistics New Zealand in December 2021. Data are gathered and reported to these agencies by regional councils, who maintain and operate the monitoring stations.

Data for CO concentrations is provided at hourly intervals; these measurements are an average of constant sampling over the course of that hour (Ministry for the Environment, 2009). The eight-hour rolling averages for the NESAQ exceedances are calculated based on these hourly averages by EHINZ after cleaning out invalid hourly data, e.g. negative concentrations, which imply a calibration error in the recording instrument. EHINZ also uses the hourly data to assess for exceedances of the WHO hourly guideline and the national ambient guideline.

Data completeness

For a monitoring site's records to count as valid data, it must meet the Ministry for the Environment's 'completeness' criteria:

- At least 75% of the hours in a day (18 hours) is needed for a valid daily average – a 'complete day'.
- At least 75% of the days in a year (274 days) must be complete for a valid annual average.
- If a given year does not meet this requirement, no daily average values or count of exceedances will be reported for that year either.
- Eight-hour averages require at least six individual hourly measurements.

These criteria and methods are discussed in greater detail in the metadata. For this, and descriptive information about the data, see the [Metadata](#)

References

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Ministry for the Environment. 2009. *Good Practice Guide for Air Quality Monitoring and Data Management 2009*. Wellington: Ministry for the Environment.

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Ministry for the Environment. 2023. *Carbon Monoxide*. Wellington: Ministry for the Environment URL: <https://environment.govt.nz/facts-and-science/air/air-pollutants/carbon-monoxide-effects-health> Accessed: 02/05/2023

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