

Carbon Dioxide (CO₂)

Carbon dioxide is a colorless, odorless, tasteless gas. Carbon dioxide is an atmospheric gas comprised of one carbon and two oxygen atoms. A very widely known chemical compound, it is frequently known by its formula CO₂. In its solid state, it is commonly called dry ice.

Where does carbon dioxide come from?

Atmospheric carbon dioxide derives from multiple natural sources including volcanic out-gassing, the combustion of organic matter, and the respiration processes of living aerobic organisms. Carbon dioxide is also produced by various microorganisms from fermentation and cellular respiration. Man-made sources of carbon dioxide come mainly from the burning of various fossil fuels for power generation and transport use. In classrooms, exhaled air is usually the largest source of carbon dioxide levels above outdoor carbon dioxide

Why measure carbon dioxide?

Carbon dioxide is a surrogate for other pollutants that are difficult to measure. High carbon dioxide concentrations (ppm) indicate that other pollutants are probably also high. Carbon dioxide levels can also be used to estimate the delivery of outdoor air (also called a ventilation rate).

How do I measure carbon dioxide?

There are a variety of meters for measuring carbon dioxide. You can Google “carbon dioxide meters” for a selection of meters. Pick a meter based on your needs and budget. You might want to consider also selecting a data logger or a carbon dioxide meter with data logging capacity. With data logging, you can collect data over time.

Carbon dioxide measurements for ventilation should be collected away from any source that could directly influence the reading (e.g., hold the sampling device away from exhaled breath). As with many other measurements of indoor air conditions, it is advisable to take one or more readings in “control” locations to serve as baselines for comparison. Readings from outdoors and from areas in which there are no apparent IAQ problems are frequently used as controls. In general, the room must be occupied to get a meaningful measurement using a carbon dioxide meter. Measurements taken in unoccupied areas will not give useful information about the ventilation.

You may also need to purchase a calibration kit for the meter.

What are normal levels that I might find?

As of March 2006, outside CO₂ levels are at 381 parts per million (ppm). Concentrations of carbon dioxide above 1,100 ppm indicate crowded spaces and / or low ventilation

rates. Even at elevated levels, carbon dioxide is usually not a hazardous pollutant. See the chart on the following page.

What standards are there for carbon dioxide?

The EPA has not established standards for carbon dioxide in indoor air.

Carbon dioxide is an asphyxiate. At concentrations above 1.5 percent (15,000 ppm) some loss of mental acuity has been noted.

Occupational Safety and Health Administration (OSHA) established a Permissible Exposure Limits of 5,000 ppm time weighed average.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62-2001 recommends 700 ppm above the outdoor concentration as the upper limit for occupied classrooms (usually around 1,100 ppm). This recommendation is to prevent body odor levels from being offensive. If there are additional pollutant sources besides humans, higher ventilation rates may be needed.

Carbon Dioxide Concentrations

Concentration (ppm)	Approximate Ventilation Rate (cfm/person)	Air Quality
380		Outdoor
800	20	
1,000	15	
1,100		Good
1,400	10	Poor
2,400	5	Unacceptable