

Every Breath You Take



Twelve to twenty times a minute, without knowing and without controlling it, the average human takes a breath of air. With every breath, humans and other living organisms are releasing a potentially hazardous gas into the atmosphere.

Cans, bottles, or draught (draft) beer is one of the most popular beverages in the world. By the glass, bottle, and carafe or even by the box, wine is enjoyed by everyone. Both beer and wine go through a fermentation process to create the final drinkable beverage. If not monitored properly, this process can produce the same gas as normal respiration, but in harmful doses.

What is this potentially harmful gas? Carbon dioxide (CO₂) is a chemical compound that is produced by all plants, animals and microorganisms. It is a byproduct of respiration, combustion and fermentation. This compound consists of one carbon atom and two oxygen atoms. It is continuously present in the atmosphere and is considered to be a greenhouse gas. In normal conditions, the average background concentration of CO₂ is about 380 parts per million (ppm). At these levels, carbon dioxide is not harmful. However, if concentrations increase, dangerous situations can occur.

Carbon dioxide is a colorless, odorless gas. In normal conditions, it is safe and not harmful. Typically the ambient background concentration of CO₂ is about 380 ppm. This may vary due to location, temperature and humidity. When concentrations increase to levels about 5000 ppm it is considered to be unhealthy. At 50,000 ppm, or 5% by volume, CO₂ becomes dangerous to humans and other animals. At these higher concentrations CO₂ poses another serious threat. CO₂ is heavier than oxygen (O₂) and at higher concentrations, it will displace O₂, resulting in lower oxygen concentrations.

Low oxygen concentrations are dangerous to living creatures. The minimal safe level of oxygen is 19.5%. Below this level breathing and heart rate will increase. Fatigue will set in. At levels lower than 10%, nausea and vomiting can occur as well as loss of consciousness. This is a very serious situation especially if it occurs within a confined space where someone may not have clear access to an exit or method for getting fresh air into the confined area.

Carbon dioxide within an indoor space, can be detected easily and monitored by infrared gas monitors such as the CTX300 manufactured by Industrial Scientific Corporation. Carbon dioxide absorbs infrared energy. Infrared gas monitors detect concentrations of gas based on how much infrared energy is absorbed. The amount absorbed is directly proportional to the concentration of gas present.

Monitoring levels of CO₂ is very important in a number of industries, two of which were mentioned earlier in this article. Wineries and breweries are very concerned with the amount of CO₂ that is produced during the fermentation process.

Wineries will place both carbon dioxide and oxygen monitors in the fermenting cellars where the casks of wine are placed during the fermentation process. These monitor for increased levels of carbon dioxide as well as decreased levels of oxygen. The main purpose of them is to alert workers and possibly guests touring the facility, of a potentially hazardous condition.

During the brewing process, yeast is used to ferment the beer. A byproduct of the fermentation process is CO₂. In large breweries, high concentrations of carbon dioxide can be produced. Workers in these areas of the breweries are susceptible to exposure to high concentrations of carbon dioxide as well as low oxygen levels that are a result of the CO₂ displacing the breathing air. In these areas monitors such as the CTX 300 for CO₂ and O₂ can be used to monitor hazardous conditions. A control unit such as the MX32 from Industrial Scientific can be used to display the gas concentrations as well as activate alarm devices or turn on a ventilation fan.

Food storage industries use carbon dioxide to help preserve foods such as dairy and meats. Carbon dioxide in its solid form, dry ice, is used to displace the oxygen in the containers in which the items are stored, which allows the food products to stay fresher during shipment. CO₂ is also used as a refrigerant for the chillers and blast freezers in the food processing industry, replacing other toxic gases such as ammonia or freons. The food industry also uses CO₂ to inject into beverages such as

soda, to give them carbonation. A massive leak in any of these applications can result in an accident.

Outside of manufacturing and the food and beverage industry, carbon dioxide can pose serious health concerns. In any area where a lot of people are present and ventilation is poor, levels of carbon dioxide can increase. This can result in some of the symptoms of "sick building syndrome" (SBS). These symptoms can include headaches, dizziness, fatigue, light headedness, irritation of eyes, skin or throat, and nausea. Sick building syndrome occurs when building occupants' health and well being is affected by an identifiable source. This source can be a number of things from fungus, mold, micro organisms, volatile organic compounds, or gases such as carbon dioxide. These symptoms can be located throughout the entire building or localized into a particular zone.

HVAC, heating, ventilation and air conditioning contractors are concerned about these potentially dangerous conditions. Using gas monitors such as the CTX 300, they can monitor for increased levels of carbon dioxide and carbon monoxide (CO) as well as levels of oxygen. When alarm levels are detected, the HVAC system can be activated to either exhaust the gas or to bring in fresh air.

Another sick building syndrome concern is the presence of volatile organic compounds (VOCs) which are byproducts of cleaning agents, adhesives, carpeting, paints, smoking, and other toxic compounds. At higher concentrations VOCs can cause respiratory problems as well as irritate the eyes, nose and mouth. With so many potential sources of VOC's and their irritant effects, they should be monitored as well. These gases can also be monitored by the CTX 300 family of gas monitors outfitted with a special sensor designed specifically for VOC detection. Increasing ventilation in these problem areas will reduce or eliminate exposure to these compounds.

With an appropriate monitoring system of detectors and controllers, the ventilation system can be turned on to increase the flow of fresh air to specific areas or the entire building when increased levels of harmful gasses are detected. This is a practice that many casinos employ. With large numbers of guests and gamers, CO₂ levels are higher in the high traffic areas. When the levels get higher and oxygen levels decrease, guests get tired and could possibly retire to their rooms for the evening. Managing the ventilation and maintaining low levels of CO₂ keep people alert and on the gaming floor, where the casinos want them to be. Industrial Scientific Corporation's CTX 300 family of monitors and control systems can offer a complete monitoring solution for these applications.

The hazards associated with carbon dioxide reach far beyond the industrial marketplace. These hazards are everywhere from the places we work, to the malls and grocery stores we shop in, to the casinos and concert halls where we go for entertainment. With proper monitoring, notification, and ventilation, the risks of overexposure are greatly reduced and minimized. Monitoring with both fixed mounted and portable gas detectors are tools used to help identify and mitigate these situations. So the next time you are out playing Black Jack or Poker and you start to feel a bit tired, it may not be a result of lack of sleep, but possibly poor ventilation. Open a window or go outside and get some fresh air, it will do you good!

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