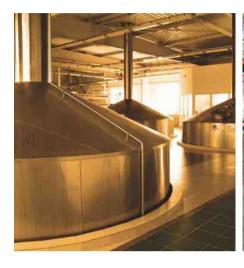


Know the Risks - Work Safely with CO₂







In addition to its vital role in photosynthesis, respiration and carbon cycle, carbon dioxide (CO_2) has many industrial applications. Both solid and liquid CO_2 are used in refrigeration and cooling. In the beverage industry, CO_2 gives the fizz to the drinks and prevents bacterial and fungal growth in soft drinks, beer and wine. CO_2 is an environmentally friendly propellant in aerosols and due to its unreactive nature it is used as an inert gas in various processes, packaging and fire extinguishers, to mention some applications. CO_2 is produced in combustion processes of carbon containing material.

In addition to its excellent refrigerant properties, the safety and the non-flammable nature of CO₂ have already been realized in the early days of refrigeration. CO₂ is one of the natural refrigerants that does not harm the ozone layer and has no or negligible climate impact. CO₂ has replaced the restricted CFC, HCFC and HFC refrigerants, which cause ozone depletion and are powerful greenhouse gases.

CO₂ Exposure Limits in the Working Environment

CO₂ is a non-toxic and nonflammable gas. However, it does not support life and exposure to elevated CO₂ concentrations can induce a risk to life. The leakage of odorless and colorless CO₂ refrigerant cannot be detected without proper sensors. Although CO₂ is considered to be a non-toxic gas, CO_2 concentration can reach dangerously high levels in poorly ventilated spaces.

There are guidelines and regulations related to the acceptable levels of CO₂ in working environments. For example, the U.S. Occupational Safety & Health Administration, OSHA, has set limitation to CO₂ exposure. The permissible

exposure limit (PEL) describes the maximum daily human exposure to a substance allowed in a workroom's air over an 8-hour shift. PEL for CO_a is 5 000 ppm measured as time weighted average (TWA) level of exposure. In addition, the American Conference of Governmental Industrial Hygienists, ACGIH, has set the short-term exposure limit to 30,000 ppm of CO₂.

Risks of CO₂

CO2 is always present in the atmosphere at a low level of approximately 400 ppm. However, high concentrations of CO₂ are extremely dangerous. Drowsiness is experienced under continuous CO₂ exposure at a level of 10,000 ppm (1%). At 2-3% of CO₂ heaviness in the chest is experienced and breathing becomes more frequent and deeper. Headache and sweating will also develop during the exposure. Levels above 5% of CO₂ are considered toxic. At 4-5% of CO₂, breathing becomes uncomfortable and lack of oxygen starts causing dizziness. At 6% of CO₂ the sensory processing abilities start

deteriorating after some minutes. Less than one minute of exposure to 10-15% of CO₂ results quickly in unconsciousness. When the CO₂ level is between 17 and 30%, fatal exposure occurs in less than one minute.

At all places where CO, gas or CO₂ ice is used, produced, shipped or stored, the levels of CO₂ can rise dangerously high and the environment must be monitored with an appropriate sensor.

Selecting the Location for the CO, Measurement

When measuring CO₂ for the safety of the personnel, the CO₂ transmitter should be installed as close as possible to potential leakage points for early detection. Transmitters should also be placed in all human occupied spaces. When designing the CO₂ safety monitoring solution, the geometry of the monitored area should be considered, taking into account ventilation and air flow in the space. The number and location of the CO₂ transmitters should always be based on risk assessment of the monitored area.

Learn about Vaisala's reliable and accurate CO₂ transmitters at www.vaisala.com/gmp251 and www.vaisala.com/gmp252

Typical Concentrations and Effects

Effect CO, Concentration Typical atmosphere 350 - 450 ppm Acceptable indoor air quality 600 - 800 ppm Tolerable indoor air quality 1000 ppm Average exposure limit over 8 hours 5000 ppm Concern, short exposure only 6000 - 30000 ppm Increased respiration and headache 3 - 8 % Nausea, vomiting, unconsciousness 10 % + Sudden unconsciousness, death 20 % +





All specifications - technical included - are subject to change

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