






Carbon & its oxides

including carbon dioxide, carbon monoxide

Substance	Hazard	Comment
Carbon dioxide <i>Gas</i>	 COMPRESSED GAS otherwise LOW HAZARD	WARNING (if supplied in cylinder) may explode if heated. Otherwise, not classed as hazardous but it can cause asphyxiation if the proportion of carbon dioxide in the air becomes too high, eg, as a result of the rapid evaporation of the solid in a confined space or, in some African lakes, it is released from decaying organic matter. Because it is denser than air, it may build up in low areas, eg, in caves. For a 15-minute exposure, the concentration in the atmosphere should not exceed 27 000 mg m ⁻³ . About 0.04% is present in normal air, as compared with about 0.03% fifty years ago. This increase is a result of burning fossil fuels in motor vehicles, power stations, etc. This in turn is believed by almost all scientists to be contributing to a very gradual rise in the temperature of the Earth (global warming) as a result of the greenhouse effect.
Carbon dioxide <i>Solid</i> 'dry ice'	 COLD	It causes frostbite (burns) and needs careful handling. If it evaporates rapidly in a closed vessel, it may cause an explosion or, in a confined space, it may cause asphyxiation as the air is forced out.
Carbon monoxide <i>Gas</i>	 FLAMMABLE  TOXIC  HEALTH HAZARD	DANGER: extremely flammable gas; toxic if inhaled; may damage the unborn child; causes damage to organs through prolonged or repeated inhalation. As little as 0.01% can cause headaches. The gas has no taste or smell and is not trapped by the filters in filter fume cupboards It is often formed when hydrocarbon fuels burn in a limited supply of air, eg, car engines especially in confined spaces, or gas-powered water heaters with poor ventilation. Every year, this causes many deaths in the home. Traces also occur in cigarette smoke and are implicated in heart and artery diseases. It also contributes to the greenhouse effect. For a 15-minute exposure, the concentration in the atmosphere should not exceed 232 mg m ⁻³ . It forms explosive mixtures with air and oxygen. Mixtures with air between 12% and 74% carbon monoxide by volume are explosive.
Carbon <i>Graphite, diamond, buckminsterfullerene</i>	LOW HAZARD	Applies to lampblack, charcoal, activated carbon, decolourising charcoal. Soot is also mainly carbon but may be contaminated with carcinogenic chemicals. This was a cause of cancer amongst chimney sweeps in Victorian times. The hazards of buckminsterfullerene nanotubes are not fully known yet. Hot charcoal (carbon blocks), even if not glowing red, can slowly combust and stay hot for many hours.

Typical control measures to reduce risk

- Wear protective thermal gloves or use tongs for handling solid carbon dioxide.
- Use energy-efficient vehicles and power stations and/or non-fossil fuels or wind or solar power to limit the amount of carbon dioxide or monoxide emitted.
- Use a ducted fume cupboard (**not** a recirculatory filter fume cupboard) for handling carbon monoxide.
- Have gas appliances serviced regularly and consider installing a carbon monoxide detector,
- Use catalytic converters in car exhausts to reduce the amount of carbon monoxide released into the air.
- After use, allow hot charcoal blocks to cool in air; store them in air-tight metal containers.

Assessing the risks

- **What are the details of the activity to be undertaken? What are the hazards?**
- **What is the chance of something going wrong?**
- **How serious would it be if something did go wrong?**
eg, global warming causing rising sea level and resultant flooding of low-lying areas.
- **How can the risk(s) be controlled for this activity?**
eg, can it be done safely? Does the procedure need to be altered? Should goggles or safety spectacles be worn?

Emergency action

- **Solid in the eye** Flood eye with gently-running tap water for 10 minutes. Consult a medic if solid carbon dioxide.
- **Solid on the skin or clothing** Brush off quickly and immerse the affected area in cold water. If there are any signs of burning from solid carbon dioxide consult a medic.
- **Vapour breathed in** For carbon monoxide, or carbon dioxide in larger quantities, remove the casualty to fresh air. Consult a medic if carbon monoxide was inhaled or breathing is difficult.
- **Gas escape in lab.** Open all windows. For large amounts of carbon monoxide, evacuate the laboratory.