






## Carbon and its oxides

including carbon dioxide and carbon monoxide

Substance	Hazard	Comment
<b>Carbon dioxide</b> Gas	 <b>GAS UNDER PRESSURE</b>	WARNING (if supplied in cylinder) may explode if heated. Otherwise, not classed as hazardous. 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. Because it is denser than air, it may build up in low areas, eg at floor level. A greenhouse gas that contributes to global warming. For a 15-minute exposure, the concentration in the atmosphere should not exceed 27 000 mg m <sup>-3</sup> .
<b>Carbon dioxide</b> (dry ice) Solid	 <b>COLD</b>	It causes frostbite (burns) and needs careful dispensing/transferring. 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.
<b>Carbon monoxide</b> Gas	 <b>HIGHLY FLAMMABLE</b>  <b>TOXIC</b>  <b>HEALTH HAZARD</b>	<b>DANGER:</b> 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. 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 117 mg m <sup>-3</sup> . It forms explosive mixtures with air and oxygen. Mixtures with air between 12% and 74% carbon monoxide by volume are explosive.
<b>Carbon</b> (Graphite, diamond, buckminsterfullerene)	<b>Currently not classified as hazardous</b>	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 and carbon nanotubes are not yet fully known. 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 transferring/dispensing solid carbon dioxide.
- Use a ducted fume cupboard (not a recirculatory filter fume cupboard) for dispensing/transferring carbon monoxide.
- After use, allow hot charcoal blocks to cool in air; store them in air-tight metal containers.
- 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.
- 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.

**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?
- 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**

In all emergency situations, alert the responsible adult immediately. Be aware that actions may include the following:

- Solid in the eye      Irrigate the eye with gently-running tap water for at least 20 minutes. Call 999/111.
- 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 call 999/111
- 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 laboratory      Open all windows. For large amounts of carbon monoxide, evacuate the laboratory/building.