

**Material Safety Data Sheet (MSDS)
Carbon Monoxide**

Please ensure that this MSDS is received by an appropriate person

Date: January 2015

Version 2

Ref: MS114

1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFICATION

Product Name CARBON MONOXIDE
 Chemical Formula CO
 Trade Name Carbon Monoxide (N3.7)
 Colour coding Signal Red (A.11) body with a Yellow (C.61) shoulder.
 Valve Neriki Brass 5/8-inch BSP left hand female.
 Company Identification BOC Zimbabwe
 1282 Hull Road
 Southerton, Harare
 P.O Box 1282 Harare
 Tel No: (04) 757171
 Fax No: (04) 755780

EMERGENCY NUMBER 0800 322230 (24 hours)

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name Carbon Monoxide
 Chemical Family Flammable, toxic, reactive gas
 CAS No. 630-08-0
 UN No. 1016
 ERG No. 119
 Hazchem Warning Toxic gas

3 HAZARDS IDENTIFICATION

Main Hazards. All cylinders are portable gas containers, and must be regarded as pressure vessels at all times Carbon monoxide is a toxic, flammable gas. The flammability limits in the air are between 12, 5% and 74, 2% by volume. Inhaled carbon monoxide binds to the blood haemoglobin, greatly reducing the red blood cells ability to transport oxygen to body tissues. Effects may include headaches, dizziness, convulsions, loss of consciousness and death.

Adverse Health effects. Carbon monoxide is a chemical asphyxiant, and the inhalation of concentrations as low as 400 ppm in air could result in headache and discomfort within 2 - 3 hours. Inhalation of concentrations of 4000 ppm in air could prove fatal in less than one hour.

Chemical Hazards. Carbon monoxide containing moisture and sulphur-containing impurities can cause corrosion of steel at any pressure. Dry, sulphur-free carbon monoxide is safe for use with steel and other common metals at pressures up to 13790 kPa.

Biological Hazards. Carbon monoxide in excess of 50 ppm will produce symptoms of poisoning if breathed in for a sufficiently long time. As little as 200 ppm will produce slight symptoms (slight headache, discomfort) in several hours. A concentration of 400 ppm will produce headache and discomfort within two to three hours. With moderate exercise, 1000 - 2000 ppm will produce slight palpitation of the heart in 30 minutes, a tendency to stagger in 1, 5 hours, and confusion of the mind, headache, and nausea in 2 hours. A concentration of 2000 - 2500 ppm will usually produce unconsciousness in about 30 minutes. Its effects at higher concentrations may be so sudden that a man has little or no warning before he collapses. These effects are summarised in the following table.

Effect	Concentration (ppm)
Permissible for an exposure of 8 hours	50
Concentration which can be inhaled for 1 hour without appreciable effect	400 - 500
Concentration causing a just appreciable effect after 1 hour of exposure	600 - 700
Concentration causing unpleasant but not dangerous symptoms after 1 hour of exposure	1000 - 2000
Dangerous for exposure of 1 hour	1500 - 2000
Fatal in exposures of less than 1 hour	4000 & above

Vapour Inhalation. The concentration, exposure time and physical activity of the individual will determine the percentage conversion of haemoglobin to carboxyhaemoglobin. The effects produced depend on the degree and duration of saturation of blood with carbon monoxide. The symptoms caused by various amounts of carboxyhaemoglobin in the blood are given in the following table.

Blood Saturation % Carboxyhaemoglobin	Symptoms
0 - 10	No symptoms.
10 - 20	Tightness across forehead, possibly slight headache.
20 - 30	Headache and throbbing in temples.
30 - 40	Severe headache, weakness, dizziness, dimness of vision, nausea, vomiting, collapse.

40 - 50 Same as previous item but with more possibility of collapse and syncope, increased respiration and pulse.
 50 - 60 Syncope, increased respiration and pulse, coma with intermittent convulsions.
 60 - 70 Coma with intermittent convulsions, depressed heart action and respiration, possibly death.
 70 - 80 Weak pulse and slow respiration, respiratory failure and death

Eye Contact No known effect.
Skin Contact No known effect.
Ingestion No known effect.

4 FIRST AID MEASURES

Conscious persons should be assisted to an uncontaminated area and be treated with supplemental oxygen. Quick removal from the contaminated area is most important. Unconscious persons should be removed to an uncontaminated area, and given artificial respiration and oxygen at the same time. The administering of the oxygen at an elevated pressure (up to 2 to 2.5 atmospheres) has shown to be beneficial as has treatment in a hyperbaric chamber. The physician should be informed that the patient has inhaled toxic quantities of carbon monoxide. Prompt medical attention is mandatory in all cases of overexposure to carbon monoxide. Rescue personnel should be equipped with self-contained breathing apparatus and be cognisant of extreme fire and explosion hazard.

5 FIRE FIGHTING MEASURES

Extinguishing media. Dry powder. Carbon dioxide. Fog-water spray. (In the absence of fog equipment a fine spray of water may be used.)

Specific hazards. Highly flammable. May form explosive gas mixtures with air is a chemical asphyxiant.

Emergency actions. Evacuate area. Post warnings to prevent persons from approaching with lit cigarettes or open flames. Using water, keep all cylinders in the vicinity of the fire cool. Remove cylinders from the vicinity of the fire if possible. Remove all cylinders with signs of overheating to a safe area. Keep cool. CONTACT THE NEAREST AFROX BRANCH.

Protective Clothing. Exposed fire fighters should wear approved self-contained breathing apparatus with full-face mask. Safety gloves and shoes, or boots, should be worn when handling cylinders.

Environmental precautions. As carbon monoxide is only slightly lighter than air it will not diffuse rapidly. Caution should be taken when entering confined spaces as pockets of high concentrations may occur. Ventilate all confined spaces using forced draught if necessary. Ensure that all electrically powered equipment is flameproof.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions. As carbon monoxide is a chemical asphyxiant, self-contained breathing apparatus should be used when entering confined spaces where leaks have occurred. Do not enter any potentially hazardous area with any source of ignition such as a lit cigarette or match.

Environmental precautions. Carbon monoxide does not pose a hazard to the environment. An explosive gas-air mixture could be formed when leaks occur, so eliminate all forms of ignition.

Small spills. Small leaks should be extinguished by shutting off the source of supply, e.g. closing the valve on the cylinder, or tightening the gland nut. If unable to stop small leaks the cylinder should be moved into the open, well away from any source of ignition. Should a small leak have ignited, use a multi-purpose dry powder or carbon dioxide extinguisher. Should there be no extinguisher available, a welder's glove or heavy cloth, soaked in water may be used to extinguish the flame.

Large spills. Stop the source if it can be done without risk. Eliminate all sources of ignition and static discharges. Restrict access to the area until completion of the clean-up procedure. Post-relevant warning signs. Wear adequate protective clothing when working near the source of the leak. Ventilate the area using forced-draught if necessary. Ensure that all equipment is flameproof.

7 HANDLING AND STORAGE

Do not allow cylinders to slide or come into contact with sharp edges. Carbon monoxide cylinders may be stacked horizontally provided that they are firmly secured at each end to prevent rolling. Ensure that equipment is adequately earthed. Conspicuous signs should be posted in the storage area forbidding

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smoking or the use of naked lights. Do not store reserve stocks of carbon monoxide with cylinders containing oxygen, or other highly oxidising or flammable materials. Use the "first-in first-out" inventory system to prevent full cylinders from being stored for excessive periods of time. Compliance with all relevant legislation is essential. Keep out of reach of children.

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8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure hazards. Lacking odour and colour, carbon monoxide gives no warning of its presence, and inhalation of high concentrations can cause sudden, unexpected collapse. The eight-hour time-weighted average threshold limit value (TLV) adopted by the American Conference of Governmental Industrial Hygienists is 50 ppm (55 mg/m³) for exposure to carbon monoxide. Occupational Safety & Health Administration has adopted an eight-hour time-weighted average exposure limit of 35 ppm (40 mg/m³) and a ceiling limit of 200 ppm (229 mg/m³) for carbon monoxide.

Engineering control measures. Engineering control measures are preferred to reduce exposures. General methods include mechanical ventilation, process or personal enclosure, and control of process conditions. Administrative controls and personal protective equipment may also be required. Use a suitable flameproof ventilation system separate from other exhaust ventilation systems. Exhaust direct to outside. Supply sufficient replacement air to make up for air removed by exhaust system.

Personal protection. Use self-contained breathing apparatus when fighting large fires.

Eyes Use safety glasses when working with cylinders

Hands Use suitable protective gloves when working with cylinders

Skin No known effect.

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	CO
Molecular Weight	28, 01
Specific volume @ 20°C & 101,325 kPa	850 ml/g
Density gas @ 20°C & 101,325 kPa	1,165 kg/m ³
Auto-ignition temperature	652°C
Relative density (Air=1) @ 101,325 kPa	0,967
Flammability limits in air	12, 5 - 74, 2% (by vol)
Colour	None
Taste	None
Odour	None

10 STABILITY AND REACTIVITY

Conditions to avoid. Overheating of cylinders. Never test for leaks with a flame. Use soapy water when testing for leaks. Never use cylinders as rollers or supports, or for any other purposes other than the storing of carbon monoxide. Do not use carbon monoxide cylinders for the storage of any other gas.

Incompatible materials. Steel and other common metals are satisfactory for use with dry, sulphur-free carbon monoxide at pressures up to 13790 kPa. The presence of moisture and sulphur-compounds appreciably increases the corrosive action on steel at any pressures.

Hazardous decomposition products. Only carbon dioxide is formed when carbon monoxide burns in air.

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	Exposure to concentrations of more than 4000 ppm could be fatal in less than one hour. (See Table in Section 3)
Skin & eye contact	No known effect
Chronic Toxicity	The effects of prolonged exposure to low concentrations of carbon monoxide are similar to the acute effects (see above)
Carcinogenicity	No known effect
Mutagenicity	No known effect
Reproductive Hazards	No known effect

12 ECOLOGICAL INFORMATION

As carbon monoxide is only slightly lighter than air it will not disperse rapidly. However, it does not pose a hazard to the ecology.

13 DISPOSAL CONSIDERATIONS

Disposal Methods Small amounts may be blown to the atmosphere under controlled conditions. No sources of ignition should be in the vicinity. Large amounts should only be handled by the gas supplier.

Disposal of packaging the disposal of containers must only be handled by the gas supplier.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No.	1016
Class	2.3
Subsidiary risk	Chemical asphyxiant
ERG No.	119
Hazchem warning	Toxic gas

SEA TRANSPORTATION

IMDG	1016
Class	2.3
Packaging group	
Label	

AIR TRANSPORTATION

ICAO/IATA Code	1016
Class	2.3
Subsidiary risk	Chemical asphyxiant
Packaging group	
Packaging instructions	
- Cargo	200
- Passenger	Forbidden
Maximum quantity allowed	
- Cargo	25 kg
- Passenger	Nil

15 REGULATORY INFORMATION

EEC Hazard class	Toxic gas
Risk phrases	R11 Highly flammable R18 In use may form flammable explosive vapour-air mixture R20 Harmful by inhalation R23 Toxic by inhalation R44 Risk of explosion if heated under confinement. R48 Danger of serious damage to health by prolonged exposure
Safety phrases	S2 Keep out of reach of children S9 Keep container in a well-ventilated place S16 Keep away from sources of ignition S33 Take precautionary measures against static discharges S36 Wear suitable protective clothing S38 In case of insufficient ventilation, wear suitable respiratory equipment S44 If you feel unwell, seek medical advice (show the label where possible) S51 Use only in well ventilated areas
National legislation	none
Refer to SANS 10265 for explanation of the above.	

16 OTHER INFORMATION

Bibliography
Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases - 3rd Edition
Matheson. Matheson Gas Data Book - 6th Edition
SANS 10265 - Labelling of Dangerous Substances

17 EXCLUSION OF LIABILITY

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