MATERIAL SAFETY DATA SHEET

PRODUCT NAME: CARBON MONOXIDE

1. Chemical Product and Company Identification

TAKORADI GAS LTD
E56, EFFIA INDUSTRIAL AREA TAKORADI
GHANA

TELEPHONE NUMBER: 0540 111 8989
24-HOUR EMERGENCY TELEPHONE NUMBER: 0244 330 594 / 0244 354 394
tgl@tglgh.com

PRODUCT NAME: CARBON MONOXIDE
CHEMICAL NAME: Carbon Monoxide
COMMON NAMES/SYNONYMS: Carbonic Oxide, Exhaust Gas, Flue Gas **TDG (Canada)**
CLASSIFICATION: 2.3 (2.1)
WHMIS CLASSIFICATION: A, D1A, D2A, D2B, B1

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Carbon Monoxide FORMULA: CO CAS: 630-08-0 RTECS #: FG3500000	100.0	50 ppm TWA	25 ppm TWA	LC_{50} 1807 ppm/4H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

Inhaled Carbon Monoxide binds to the blood hemoglobin, greatly reducing the red blood cell's ability to transport oxygen to body tissues. Effects may include headaches, dizziness, convulsions, loss of consciousness and death. Extremely flammable gas.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	No	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
Yes	No	No
Teratogen	Reproductive Hazard	Mutagen
Yes	Yes	Yes
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
None reported.

SKIN EFFECTS:
None reported.

INGESTION EFFECTS:
None reported.

INHALATION EFFECTS:
Inhaled carbon monoxide binds with blood hemoglobin to form carboxyhemoglobin. Carboxyhemoglobin can not take part in normal oxygen transport, greatly reducing the blood's ability to transport oxygen. Depending on levels and duration of exposure, symptoms may include headache, dizziness, heart palpitations, weakness, confusion, nausea, and even convulsions, eventual unconsciousness and death.

Some experimental evidence indicating teratogenic and reproductive effects.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 2	Health: 2	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Reactivity: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures

EYES:
None required.

SKIN EFFECTS:
None required.

INGESTION:
None required.

INGESTION EFFECTS:
None required.

INHALATION:
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 moved to an uncontaminated area and be 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 COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

5. Fire Fighting Measures

Conditions of Flammability: Flammable gas		
Flash point: Not Available	Method: Not Applicable	Autoignition: Temperature: 116 ^{o}F (639 ^{o}C)
LEL(%): 12.5	UEL(%): 74.0	
Hazardous combustion products: None		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Having almost the same density as air, it will not diffuse by rising as with some lighter flammable gases such as hydrogen or natural gas (methane). Flammable in air over a very wide range. It reacts violently with oxygen difluoride and barium peroxide.

EXTINGUISHING MEDIA:
Water, dry chemical, carbon dioxide.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop flow of gas; use water spray to cool surrounding containers.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classification:
Class 1, Group C

Earth-ground and bond all lines and equipment associated with the carbon monoxide system. Electrical equipment should be non sparking or explosion proof.

Carbon Monoxide can be handled in all commonly used metals up to approximately 500 psig (3450 kPa). Above that pressure it forms toxic and corrosive carbonyl compounds with some metals. Carbon steels, aluminum alloys, copper and copper alloys, low carbon stainless steels and nickel-based alloys such as Hastelloy A, B & C are recommended for higher pressure applications.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated areas away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in the storage area or use area. There should be no sources of ignition in the storage area or use area.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the system.

ENGINEERING CONTROLS:
Hood with forced ventilation. Use local exhaust to prevent accumulation above the exposure limit. Use general mechanical ventilation in accordance with electrical codes.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Carbon Monoxide FORMULA: CO CAS: 630-08-0 RTECS #: FG3500000	100.0	50 ppm TWA	25 ppm TWA	LC_{50} 1807 ppm/4H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Any material protective gloves.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: >220.4	psia
Vapor density (Air = 1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: -312.7	^{o}F
	: -191.5	^{o}C
Freezing point	: -337.1	^{o}F
	: -205.1	^{o}C
pH	: Not Available	
Specific gravity	: 0.96	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Very slight	
Odor threshold	: Not Applicable	
Odor and appearance	: Odorless; colorless gas	

10. Stability and Reactivity

STABILITY:
Stable

INCOMPATIBLE MATERIALS:
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon dioxide

HAZARDOUS POLYMERIZATION:
Will not occur.

11. Toxicological Information

REPRODUCTIVE:
Inhalation of 150 ppm carbon monoxide for 24 hours by pregnant rats produced cardiovascular and behavioral defects in offspring. Toxic effects to fertility were observed in female rats exposed to 1 mg/m^3 for 24 hours. Similar effects observed in other mammalian species.

MUTAGENIC:
Genetic changes observed in mammalian cell assay systems at exposures of 1500 to 2500 ppm for 10 minutes.

OTHER:
Degenerative changes to the brain in rats chronically exposed to 30 mg/m^3.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Carbon Monoxide	Carbon Monoxide
HAZARD CLASS:	2.3	2.3 (2.1)
IDENTIFICATION NUMBER:	UN 1016	UN 1016
SHIPPING LABEL:	POISON GAS, FLAMMABLE GAS	POISON GAS, FLAMMABLE GAS

Additional Marking Requirement: "Inhalation Hazard"
Additional Shipping Paper Description Requirement: "Poison-Inhalation Hazard, Zone D"

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Chronic Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

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