CARBON MONOXIDE
Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	CARBON MONOXIDE
Product Code(s)	G-112, 1008
UN-Number	UN1016
Recommended Use	Compressed gas.
Synonyms	Carbonic Oxide; Carbon Oxide; Exhaust Gas; Flue Gas
Supplier Address*	Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC 575 Mountain Ave. Murray Hill, NJ 07974 Phone: 908-464-8100 www.lindeus.com Linde Gas Puerto Rico, Inc. Las Palmas Village Road No. 869, Street No. 7 Catano, Puerto Rico 00962 Phone: 787-641-7445 www.pr.lindegas.com Linde Canada Limited 5860 Chedworth Way Mississauga, Ontario L5R 0A2 Phone: 905-501-1700 www.lindecanada.com * May include subsidiaries or affiliate companies / divisions. For additional product information contact your local customer service.
Chemical Emergency Phone Number	Chemtrec: 1-800-424-9300 for US / 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

DANGER!

Emergency Overview

Flammable gas
May form explosive mixtures with air
Chemical Asphyxiant-interferes with oxygen transport
Contents under pressure
Keep at temperatures below 52°C / 125°F
WARNING! This product contains a chemical known in the State of California to cause birth defects or other reproductive harm.

Appearance Colorless | Physical State Compressed gas. | Odor Odorless

OSHA Regulatory Status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential Health Effects

Principle Routes of Exposure	Inhalation.
Acute Toxicity	
Inhalation	Carbon monoxide is odorless and colorless. There may be no warning of overexposure until symptoms occur. Inhaled carbon monoxide binds with blood hemoglobin to form carboxylhemoglobin, a susbstance that can not take part in the normal oxygen transport. This greatly reduces the blood's ability to transport oxygen. Depending on levels and duration of exposure, symptoms may include headache, dizziness, heart palpitations, weakness, confusion, nausea, convulsions, eventual unconsciousness and death.
Eyes	None known. Contact with rapidly expanding gas near the point of release may cause frostbite.
Skin	None known. Contact with rapidly expanding gas near the point of release may cause frostbite.
Skin Absorption Hazard	No known effect based on information supplied.
Ingestion	Not an expected route of exposure.
Chronic Effects	None known
Aggravated Medical Conditions	Central nervous system. Blood disorders. Overexposure may cause female and male reproductive disorder(s). Respiratory disorders. Central Vascular System (CVS). Lungs.
Environmental Hazard	See Section 12 for additional Ecological Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Carbon monoxide	630-08-0	>99	CO

4. FIRST AID MEASURES

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye Contact	None required for gas. If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.
Skin Contact	None required for gas. For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physican should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.
Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and be treated with supplemental oxygen. Quick removal from the contaminated area is most important. The administering of 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.
Ingestion	None under normal use. Get medical attention if symptoms occur.

Notes to Physician	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Flammable.
Suitable Extinguishing Media	Dry chemical or CO_2. Water spray or fog. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Hazardous Combustion Products	None.
Explosion Data	
Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	Yes.
Specific Hazards Arising from the Chemical	Having almost the same density as air, carbon monoxide will not diffuse by rising. Flammable in air over a very wide range. May form explosive mixtures with air. Continue to cool fire exposed cylinders until flames are extinguished. Cylinders may rupture under extreme heat. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	If possible, stop the flow of gas. Do not extinguish the fire until supply is shut off as otherwise an explosive-ignition may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Ventilation fans must be explosion proof. Use non-sparking tools to close container valves. Isolate spill or leak area for at least 100 meters (330 feet) in all directions. Vapors may accumulate in confined areas (basement, tanks, hopper / tank cars, etc.). Vapors may travel to source of ignition and flash back. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible withdraw from area and let fire burn. Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA / NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Evacuate personnel to safe areas. Keep people away from and upwind of spill / leak. All equipment used when handling the product must be grounded. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Monitor oxygen level.
Environmental Precautions	Beware of vapors accumulating to form explosive concentrations. Prevent spreading of vapors through sewers, ventilation systems and confined areas.
Methods for Containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Handling

Remove all sources of ignition. Ground and bond all lines and equipment associated with product system. All equipment should be non-sparking and explosion proof. Use only in ventilated areas. "NO SMOKING" signs should be posted in storage and use areas.

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 steel and nickel-based alloys such as Hastelloy A, B, & C are recommended for higher pressure applications.

Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Use equipment rated for cylinder pressure. Use backflow preventive device in piping.

Use an adjustable strap wrench to remove over-tight or rusted caps. Never insert an object (e.g. wrench, screwdriver, pry bar,etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

For additional recommendations, consult Compressed Gas Associataion's Pamphlets G5.7 and P-57.

Storage

Outside or detached storage is preferred. Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregrated. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Carbon monoxide 630-08-0	TWA: 25 ppm	TWA: 50 ppm TWA: 55 mg / m^3 (vacated) TWA: 35 ppm (vacated) TWA: 40 mg / m^3 (vacated) Ceiling: 200 ppm (vacated) Ceiling: 229 mg / m^3	IDLH: 1200 ppm Ceiling: 200 ppm Ceiling: 229 mg / m^3 TWA: 35 ppm TWA: 40 mg / m^3

Immediately Dangerous to Life or Health.

Other Exposure Guidelines

Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Engineering Measures

Showers. Eyewash stations. Explosion proof ventilation systems. Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%.

Ventilation

Use ventilation adequate to keep exposures below recommended exposure limits.

Personal Protective Equipment

Eye / Face Protection	Wear protective eyewear (safety glasses).
Skin and Body Protection	Work gloves and safety shoes are recommended when handling cylinders. Cotton or Nomex® clothing is recommended to prevent static build-up.
Respiratory Protection	
General Use	If exposure limits are exceeded or irritation is experienced, NIOSH / MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Emergency Use	Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%).
Hygiene Measures	When using, do not eat, drink or smoke. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. Keep away from food, drink and animal feeding stuffs.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless.	Odor	Odorless.
Odor Threshold	No information available	Physical State	Compressed gas
Flash Point	No information available.	Autoignition Temperature	639 °C / 1182.2 °F
Decomposition Temperature	No information available.	Boiling Point / Boiling Range	-191.5 °C / -312.7 °F
Freezing Point	-205.1 °C / -337.1 °F	Molecular Weight	28.01
Water Solubility	Very slight	Evaporation Rate	No information available
Vapor Pressure	506.7 PSIA @ -140.23°C	Vapor Density	No data available.
Gas Density	@ 21.1°C (70°F): 0.0725 lb. / ft³ (1.161 kg / m³)	VOC Content (%)	Not applicable.
Specific Vol. @ 21.1°C & 1 atm	13.8 ft³ / lb (0.862 m³ / kg)	Critical Pressure	507.5 psia (3499 kPa abs)
Flammability Limits in Air			
Upper	74%		
Lower	12.5%		

10. STABILITY AND REACTIVITY

Stability	Stable.
Incompatible Products	Oxidizing agents.
Conditions to Avoid	Heat, flames and sparks.
Hazardous Decomposition Products	Carbon dioxide (CO_2).
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

LD50 Oral:	No information available.

LD50 Dermal:	No information available.
LC50 Inhalation:	Per CGA P-20: LC50: 3760 ppm / 1 hr. (Rat) (Time adjusted)
Eye Contact	Non-irritating.
Skin Contact	Non-irritating.
Repeated Dose Toxicity	No information available.

Chronic Toxicity

Chronic Toxicity	None known.
Carcinogenicity	Contains no ingredient listed as a carcinogen.

Irritation	No information available.
Sensitization	No information available.
Mutagenic Effects	Genetic changes observed in mammalian cell assay systems at exposures of 1500 to 2500 ppm of carbon monoxide for 10 minutes.
Reproductive Toxicity	Overexposure to carbon monoxide may also decrease the likelihood of successful pregnancy. In rats treated with carbon monoxide, the rate of successful pregnancy in the control group was 100% whereas the rate of successful pregnancy in animals treated with 30 and 90 ppm of carbon monoxide was 69% and 38% respectively.
Developmental Toxicity	Mice exposed to concentrations of carbon monoxide at 65 ppm and higher demonstrated dose-dependent effects on the fetus (increased mortality and decreased weight) with no signs of maternal toxicity. Offspring of rats exposed to 150 ppm carbon monoxide had minor reductions in birth weight and persistent memory deficits which became more pronounced in adulthood.
Synergistic Materials	None known.
Target Organ Effects	Blood. Central nervous system (CNS). Central vascular system (CVS). Lungs.

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	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 Linde for proper disposal.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Carbon monoxide, compressed
Hazard Class	2.3
Subsidiary Class	2.1
UN-Number	UN1016
Special Provisions	This material is toxic by inhalation in Hazard Zone D.
Description	UN1016,Carbon monoxide, compressed,2.3,(2.1)
Additional Description:	"Toxic-Inhalation Hazard Zone D".
Additional Marking Requirements:	"Inhalation Hazard".
Emergency Response Guide Number	119

TDG

Proper Shipping Name	Carbon monoxide, compressed
Hazard Class	2.3
Subsidiary Class	(2.1)
UN-Number	UN1016
Description	UN1016,CARBON MONOXIDE, COMPRESSED,2.3(2.1)

MEX

Proper Shipping Name	Compressed carbon monoxide
Hazard Class	2.3
Subsidiary Class	2.1
UN-Number	UN1016
Description	UN1016 Compressed carbon monoxide,2.3

IATA

UN-Number	UN1016
Proper Shipping Name	Carbon monoxide, compressed
Hazard Class	2.3
Subsidiary Class	2.1
ERG Code	10P
Description	UN1016,Carbon monoxide, compressed,2.3(2.1)
Maximum Quantity for Passenger	Forbidden
Maximum Quantity for Cargo Only	Forbidden
Limited Quantity	No information available.

IMDG / IMO

Proper Shipping Name	Carbon monoxide, compressed
Hazard Class	2.3
Subsidiary Class	2.1
UN-Number	UN1016
EmS No.	F-D, S-U
Description	UN1016, Carbon monoxide, compressed,2.3(2.1)

ADR

Proper Shipping Name	Carbon monoxide, compressed
Hazard Class	2.3
UN-Number	UN1016
Classification Code	1TF
Description	UN1016 Carbon monoxide, compressed,2.3,
ADR / RID-Labels	.1

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS / ELINCS	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL / NDSL - Canadian Domestic Substances List / Non-Domestic Substances List
EINECS / ELINCS - European Inventory of Existing Commercial Chemical Substances / EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311 / 312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	Yes
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs
This material, as supplied, does not contain any regulated substances with specified thresholds under 40 CFR Part 68.
This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)
This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA / SARA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals:

Chemical Name	CAS-No	California Prop. 65
Carbon monoxide	630-08-0	Developmental

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Carbon monoxide	X	X	X	-	X

International Regulations

Chemical Name	Carcinogen Status	Exposure Limits
Carbon monoxide	-	Mexico: TWA 50 ppm Mexico: TWA 55 mg / m^3 Mexico: STEL 400 ppm Mexico: STEL 400 mg / m^3

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
A Compressed gases
B1 Flammable gas
D1A Very toxic materials
D2A Very toxic materials

Chemical Name	NPRI
Carbon monoxide	X

Legend
NPRI - National Pollutant Release Inventory

Prepared By	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501
Issuing Date	02-Apr-2010
Revision Date	27-Sep-2013
Revision Number	2
Revision Note	Not applicable.

NFPA	Health Hazard 2	Flammability 4	Stability 0	Physical and Chemical Hazards -
HMIS	Health Hazard 1	Flammability 4	Physical Hazard 3	Personal Protection -

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

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End of Safety Data Sheet