1. IDENTIFICATION

Product identifier
Product Name CARBON DIOXIDE

Other means of identification
Safety data sheet number LIND-P023
UN/ID no. UN1013
Synonyms LASER Carbon Dioxide, LASER Carbon Dioxide Ultra, Carbonic Anhydride, Carbonic Acid Gas, Carbon Dioxide USP

Recommended use of the chemical and restrictions on use
Recommended Use Industrial and professional use.
Uses advised against Consumer use

Details of the supplier of the safety data sheet
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.
Road 869, Km 1.8
Barrio Palmas, Catano, PR 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.

Emergency telephone number
Company Phone Number 800-232-4726 (Linde National Operations Center, US)
905-501-0802 (Canada)
CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)
2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

<table>
<thead>
<tr>
<th>Gases under pressure</th>
<th>Liquefied gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple asphyxiants</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Label elements

Signal word Warning

Hazard Statements
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation
May cause frostbite
May increase respiration and heart rate

Precautionary Statements - Prevention
Do not handle until all safety precautions have been read and understood
Avoid breathing gas
Do not get in eyes, on skin, or on clothing
Use and store only outdoors or in a well ventilated place
Use a backflow preventive device in piping
Use only with equipment rated for cylinder pressure
Close valve after each use and when empty

Precautionary Statements - Response
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Get medical attention/advice.
IF ON SKIN: Get immediate medical advice/attention. Thaw frosted parts with lukewarm water. Do not rub affected area.

Precautionary Statements - Storage
Protect from sunlight when ambient temperature exceeds 52°C/125°F

Hazards not otherwise classified (HNOC)
Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Volume %</th>
<th>Chemical Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>124-38-9</td>
<td>100</td>
<td>CO₂</td>
</tr>
</tbody>
</table>
4. FIRST AID MEASURES

Description of first aid measures

General advice
Show this safety data sheet to the doctor in attendance.

Inhalation
Remove to fresh air and keep comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately.

Skin contact
For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.

Eye contact
If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.

Ingestion
Not an expected route of exposure.

Self-protection of the first aider
RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Most important symptoms and effects, both acute and delayed

Symptoms
Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death. Depending on concentration and duration of exposure to carbon dioxide may cause increased respiration, headache, mild narcotic effects, increased blood pressure and pulse, and asphyxiation. Symptoms of overexposure become more apparent when atmospheric oxygen is decreased to 15-17%. Contact with liquid may cause cold burns/ frostbite.

Indication of any immediate medical attention and special treatment needed

Note to physicians
Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Specific extinguishing methods
Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.

Specific hazards arising from the chemical
Non-flammable gas. Cylinders may rupture under extreme heat.

Protective equipment and precautions for firefighters
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, protective equipment and emergency procedures

Personal precautions
Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas. Monitor oxygen level. Wear self-contained breathing apparatus when entering area unless
Environmental precautions

Prevent spreading of vapors through sewers, ventilation systems and confined areas.

Methods and material for containment and cleaning up

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

Precautions for safe handling

Advice on safe handling
For applications with moist Carbon Dioxide, 316, 309 and 310 stainless steels may be used as well as Hastelloy® A, B, & C and Monel®. Ferrous nickel alloys are slightly susceptible to corrosion. At normal temperatures carbon dioxide is compatible with most plastics and elastomers.

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. Never attempt to lift a cylinder by its valve protection cap. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Use only with adequate ventilation. Use a backflow preventive device in piping. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Ensure the complete gas system has been checked for leaks before use.

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.

Only experienced and properly instructed persons should handle gases under pressure. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.


Conditions for safe storage, including any incompatibilities

Storage Conditions
Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Stored containers should be periodically checked for general condition and leakage.

Incompatible materials
Certain reactive metals, hydrides, moist cesium monoxide, or lithium acetylene carbide diammino may ignite. Passing carbon dioxide over a mixture of sodium peroxide and aluminum or magnesium may explode.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
Exposure Guidelines

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>STEL = 30000 ppm</td>
<td>TWA: 5000 ppm</td>
<td>IDLH: 40000 ppm</td>
</tr>
<tr>
<td></td>
<td>TWA: 5000 ppm</td>
<td>TWA: 9000 mg/m³</td>
<td>TWA: 5000 ppm</td>
</tr>
<tr>
<td></td>
<td>(vacated) TWA: 10000 ppm</td>
<td>(vacated) TWA: 18000 mg/m³</td>
<td>TWA: 9000 mg/m³</td>
</tr>
<tr>
<td></td>
<td>(vacated) STEL: 30000 ppm</td>
<td>(vacated) STEL: 54000 mg/m³</td>
<td>STEL: 30000 ppm</td>
</tr>
</tbody>
</table>

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health

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

Appropriate engineering controls

Engineering Controls
Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%. Oxygen detectors should be used when asphyxiating gases may be released. Systems under pressure should be regularly checked for leakages.

Individual protection measures, such as personal protective equipment

Eye/face protection
Wear safety glasses with side shields (or goggles). If splashes are likely to occur, wear: Goggles. Face-shield.

Skin and body protection
Work gloves and safety shoes are recommended when handling cylinders. Wear cold insulating gloves when handling liquid.

Respiratory protection
Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%). 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.

General Hygiene Considerations
Handle in accordance with good industrial hygiene and safety practice. Do not get in eyes, on skin, or on clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Physical state</th>
<th>Compressed liquefied gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Colorless.</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless.</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting point</td>
<td>-56.6 °C / -69.8 °F</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Lower flammability limit</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Upper flammability limit</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Water solubility</td>
<td>0.145 g/ml @ 25°C</td>
</tr>
<tr>
<td>Partition coefficient</td>
<td>No data available</td>
</tr>
<tr>
<td>Kinematic viscosity</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Component Level Information:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Molecular weight</th>
<th>Boiling point</th>
<th>Vapor Pressure</th>
<th>Vapor density (air =1)</th>
<th>Gas Density kg/ m³@ 20°C</th>
<th>Critical Temperature</th>
</tr>
</thead>
</table>
10. STABILITY AND REACTIVITY

Reactivity
Not reactive under normal conditions.

Chemical stability
Stable under normal conditions.

Explosion data
- Sensitivity to Mechanical Impact: None.
- Sensitivity to Static Discharge: None.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
Due to the presence of Carbon dioxide, Carbonic acid is formed in the presence of moisture.

Incompatible materials
Certain reactive metals, hydrides, moist cesium monoxide, or lithium acetylene carbide diammino may ignite. Passing carbon dioxide over a mixture of sodium peroxide and aluminum or magnesium may explode.

Hazardous Decomposition Products
Oxygen. Carbon monoxide (CO).

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation
Acidosis, adrenal cortical exhaustion, and other metabolic stresses have resulted from prolonged continuous exposure to 1-2% carbon dioxide (10,000 ppm-20,000 ppm). The ACGIH TLV of 5,000 ppm is expected to provide a good margin of safety from asphyxiation and undue metabolic stress provided sufficient oxygen levels are maintained in the air. Increased physical activity, duration of exposure, and decreased oxygen content can affect systemic and respiratory effects resulting from exposure to carbon dioxide.

Skin contact
Contact with liquid may cause cold burns/frostbite.

Eye contact
Contact with liquid may cause cold burns/frostbite.

Ingestion
Not an expected route of exposure.

Information on toxicological effects

Symptoms
Depending on concentration and duration of exposure to carbon dioxide may cause increased respiration, headache, mild narcotic effects, increased blood pressure and pulse, and asphyxiation. Symptoms of overexposure become more apparent when atmospheric oxygen is decreased to 15-17%.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Not classified.

Sensitization
Not classified.

Germ cell mutagenicity
Not classified.

Carcinogenicity
This product does not contain any carcinogens or potential carcinogens listed by OSHA, IARC or NTP.

Reproductive toxicity
Not classified.
Stot - Single Exposure: Not classified.
Stot - repeated exposure: Not classified.

Chronic Toxicity: Chronic harmful effects are not known from repeated inhalation of concentrations below PEL/TLV.

Target Organ Effects: Central Vascular System (CVS), Respiratory system.
Aspiration Hazard: Not applicable.

Numerical measures of toxicity

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
<th>Inhalation LC50 (CGA P-20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>-</td>
<td>-</td>
<td>470,000 ppm (Rat)</td>
<td>-</td>
</tr>
</tbody>
</table>

Product Information

Oral LD50: No information available
Dermal LD50: No information available
Inhalation LC50: TCLo - 10,000 ppm (Rat) 24 hours/30 days-continuous

12. Ecological Information

Ecotoxicity
No known acute aquatic toxicity.

Persistence and degradability
No information available.

Bioaccumulation
No information available.

Global warming potential (GWP) 1

13. Disposal Considerations

Waste treatment methods

Disposal of wastes: 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
- UN/ID no.: UN1013
- Proper shipping name: Carbon Dioxide
- Hazard Class: 2.2
- Description: UN1013, Carbon dioxide, 2.2
- Emergency Response Guide Number: 120

TDG
- UN/ID no.: UN1013
- Proper shipping name: Carbon Dioxide
- Hazard Class: 2.2
- Description: UN1013, Carbon dioxide, 2.2

MEX
- UN/ID no.: UN1013
<table>
<thead>
<tr>
<th><strong>Proper shipping name</strong></th>
<th>Carbon Dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazard Class</strong></td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>UN1013, Carbon dioxide, 2.2</td>
</tr>
</tbody>
</table>

**IATA**

<table>
<thead>
<tr>
<th><strong>UN/ ID no.</strong></th>
<th>UN1013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proper shipping name</strong></td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td><strong>Hazard Class</strong></td>
<td>2.2</td>
</tr>
<tr>
<td><strong>ERG Code</strong></td>
<td>2L</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>UN1013, Carbon dioxide, 2.2</td>
</tr>
</tbody>
</table>

**IMDG**

<table>
<thead>
<tr>
<th><strong>UN/ ID no.</strong></th>
<th>UN1013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proper shipping name</strong></td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td><strong>Hazard Class</strong></td>
<td>2.2</td>
</tr>
<tr>
<td><strong>EmS-No.</strong></td>
<td>F-C, S-V</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>UN1013, Carbon dioxide, 2.2</td>
</tr>
</tbody>
</table>

**ADR**

<table>
<thead>
<tr>
<th><strong>UN/ ID no.</strong></th>
<th>UN1013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proper shipping name</strong></td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td><strong>Hazard Class</strong></td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Classification code</strong></td>
<td>2A</td>
</tr>
<tr>
<td><strong>Tunnel restriction code</strong></td>
<td>(C/ E)</td>
</tr>
<tr>
<td><strong>Special Provisions</strong></td>
<td>584, 653</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>UN1013, Carbon dioxide, 2.2</td>
</tr>
</tbody>
</table>

## 15. REGULATORY INFORMATION

### International Inventories

<table>
<thead>
<tr>
<th><strong>TSCA</strong></th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DSL/ NDSL</strong></td>
<td>Complies</td>
</tr>
<tr>
<td><strong>EINECS/ ELINCS</strong></td>
<td>Complies</td>
</tr>
</tbody>
</table>

**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 Chemical Substances/ European List of Notified Chemical Substances

### US 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**

<table>
<thead>
<tr>
<th><strong>Acute Health Hazard</strong></th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronic Health Hazard</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Fire Hazard</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Sudden release of pressure hazard</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Reactive Hazard</strong></td>
<td>No</td>
</tr>
</tbody>
</table>

**CERCLA**

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.
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.

CWA (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.

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>124-38-9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

International Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Carcinogenicity</th>
<th>Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>-</td>
<td>Mexico: TWA=5000 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mexico: TWA=9000 mg/ m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mexico: STEL=15000 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mexico: STEL=27000 mg/ m³</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

NFPA
Health hazards 2
Flammability 0
Instability 0
Physical and Chemical Properties Simple asphyxiant

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.

Issue Date 17-Feb-2015
Revision Date 17-Apr-2015
Revision Note Initial Release.

General Disclaimer
For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user’s intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

End of Safety Data Sheet