

Safety Data Sheet



Material Name: **Carbon Dioxide, Refrigerated Liquid**

Location: **Canada**

Section 1 – Product & Company Identification

GHS Product Identifier	Carbon Dioxide, Refrigerated Liquid
Chemical Name	Carbon Dioxide
Other Names	Carbon Dioxide Liquid, Carbon Dioxide Refrigerated Liquid
Product Use	Pressure stabilizer in enhanced oil/natural gas recovery
Synonyms	Carbon Dioxide Liquid, Carbon Dioxide Refrigerated Liquid
Manufacturer Info	Ferus, Inc. Elmworth CO ₂ Plant 01-08-70-11W6 Beaverlodge, AB T0H 0C1 Ft. Saskatchewan CO ₂ Plant 11647 – 99 th Ave. Ft. Saskatchewan, AB T8L 2T3 Rimbey CO ₂ Plant 02-05-44-01-W5 Rimbey, AB T0C 2J0
Supplier Info	Ferus, Inc. Suite 1220, 401-9 th Ave SW Calgary, AB T2P 3C5
24-Hr Phone	Ferus Canada 1-877-923-3787 Ferus USA 1-855-903-3787 CANUTEC 1-613-996-6666

Section 2 – Hazards Identification

GHS Classification Refrigerated liquefied gas H281

Hazard Pictograms



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Signal Word	Warning
Hazard Statements	H281 – CONTAINS REFRIGERATED GAS; MAY CAUSE CRYOGENIC BURNS OR INJURY. OSHA-H01 – MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFICATION. CGA-HG03 – MAY INCREASE RESPIRATION AND HEART RATE.
Precautionary Statements	P202 – Do not handle until all safety precautions have been read and understood. P271+P403 – Use and store only outdoors or in a well-ventilated place. P282 – Wear cold insulating gloves, face shield, eye protection. P283 – Wear fire/flame resistant/retardant clothing. P336 – Thaw frosted parts with lukewarm water. Do not rub affected areas. CGA-PG05 – Use a back flow preventive device in the piping. CGA-PG24 – DO NOT change or force fit connections. CGA-PG06 – Close valve after each use and when empty. CGA-PG23 – Always keep container in upright position.
Other Hazards not Contributing to the Classification	Asphyxiant in high concentrations. Contact with liquid may cause cold burns/frostbite.

Section 3 – Composition / Information on Ingredients

Substance/Mixture	Substance
Chemical Name	Carbon Dioxide, Refrigerated Liquid
Other Names	Carbon Dioxide Liquid, Carbon Dioxide Refrigerated Liquid
CAS Number	124-38-9

Chemical Name	CAS#	Percent
CARBON DIOXIDE, REFRIGERATED LIQUID	124-38-9	> 99%

Section 4 – First Aid Measures

Necessary First Aid Measures:

General	Remove victim from source of contamination. Medical attention should be prompt in all cases of over-exposure to carbon dioxide.
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	Rescue personnel should be equipped with Self-Contained Breathing Apparatus.
Eyes	Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
Skin	Wash contaminated skin with soap and water. Remove contaminated clothing and shoes after thawing. Get medical attention if symptoms occur. In case of contact with liquid, warm frozen tissues slowly with lukewarm water and get medical attention. Do not rub affected area. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if adverse health effects persist or are severe. Ingestion of liquid can cause burns similar to frostbite. If frostbite occurs, get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. As this product rapidly becomes a gas when released, refer to the inhalation section.
Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Important Symptoms/Effects (Acute and Delayed):

Acute

Eyes	Extremely cold material. Liquid can cause burns similar to frostbite.
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Skin	Extremely cold material. Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.
Frostbite	Try to warm up the frozen tissues and seek medical attention.
Ingestion	Ingestion of liquid can cause burns similar to frostbite.
Inhalation	No known significant effects or critical hazards.

Over-exposure Signs/Symptoms

Eyes	Adverse symptoms may include the following: frostbite, dizziness.
Skin	Adverse symptoms may include the following: frostbite.
Ingestion	Adverse symptoms may include the following: frostbite.
Inhalation	Adverse symptoms may include the following: headache, drowsiness, stinging of the nose and throat, excitation, rapid breathing and heart rate, excess salivation, vomiting, and unconsciousness. If large concentrations are inhaled, it will result in rapid circulatory insufficiency leading to coma and death.

Indication of Immediate Medical Attention and Special Treatment:

Notes to Physician	Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
Specific Treatments	No specific treatment.

*****Section 5 – Fire Fighting Measures*****

Extinguishing Media	Use an extinguishing agent suitable for the surrounding fire.
Unsuitable Extinguishing Media	None.
Specific Hazards From Chemical	Contains gas under pressure. Contains refrigerated gas. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

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**Hazardous Thermal
Decomposition**

Decomposition products may include the following materials: carbon dioxide, carbon monoxide.

**Special Protective
Actions for Fire-
Fighters**

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. If tank, rail car, or tank truck is involved in fire, isolate for 800 m (1/2 mi) in all directions.

Material itself does not burn or burns with difficulty. Extinguish fire using agent suitable for type of surrounding fire. Cool affected containers with flooding quantities of water. Do not use water on material itself or near pressure relief devices. Apply water from as far a distance as possible.

**Special Protective
Equipment for Fire-
Fighters**

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. For incidents involving large quantities, thermally insulated undergarments and thick textile or leather gloves should be worn.

*****Section 6 – Accidental Release Measures*****

Precautions, Protective Equipment, and Emergency Procedures

**Non-emergency
Personnel**

No action shall be taken involving any personal risk or without suitable training. Consider initial downwind evacuation of surrounding areas for at least 100 m (330 ft). Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

Emergency Responders

If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel". Test for sufficient oxygen and ensure oxygen level is at least 19.5% prior to re-entry.

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**Environmental
Precautions**

Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Materials and Methods for Containment and Clean-up

Small Spill

Immediately contact emergency personnel. Stop leak if without risk.

Large Spill

Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

*****Section 7 – Handling and Storage*****

Safe Handling

Protective Measures

Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Contains refrigerated gas. Do not get in eyes or on skin or clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.

**General Occupational
Hygiene**

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Storage Conditions

**Conditions for Safe
Storage (plus
incompatibilities)**

Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to

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prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Liquid carbon dioxide is stored in insulated vessels. Storage vessels must meet applicable governmental standards. Use vessels in accordance with equipment manufacturer's operating instructions. Do not attempt to repair, adjust, or modify the operation of these vessels.

*****Section 8 – Exposure Controls / Personal Protection*****

Occupational Exposure Limits

Chemical Name	Exposure Limits
CARBON DIOXIDE, REFRIGERATED LIQUID	<p>ACGIH TLV (United States, 3/2012) Oxygen Depletion [Asphyxiant] STEL: 54,000 mg/m³ 15 minutes. STEL: 30,000 ppm 15 minutes. TWA: 9,000 mg/m³ 8 hours. TWA: 5,000 ppm 8 hours.</p> <p>NIOSH REL (United States, 1/2013) STEL: 54,000 mg/m³ 15 minutes. STEL: 30,000 ppm 15 minutes. TWA: 9,000 mg/m³ 10 hours. TWA: 5,000 ppm 10 hours.</p> <p>OSHA PEL (United States, 6/2010) TWA: 9,000 mg/m³ 8 hours. TWA: 5,000 ppm 8 hours.</p> <p>OSHA PEL 1989 (United States, 3/1989) STEL: 54,000 mg/m³ 15 minutes. STEL: 30,000 ppm 15 minutes. TWA: 18,000 mg/m³ 8 hours. TWA: 10,000 ppm 8 hours.</p>

Engineering Controls

Good general ventilation, oxygen detectors.

Environmental Exposure Controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

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Protection Measures

Hygiene

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/Face Protection

The following protection should be worn: safety glasses and full face shields.

Respiratory Protection

Use a properly fitted, air supplied respirators where local or general exhaust ventilation is inadequate. OSHA approved supplied air/self-contained air respirators must be used in confined spaces, oxygen deficient atmospheres, and rescue situations.

Skin Protection

Hand Protection

Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times. Insulated gloves suitable for low temperatures are to be worn.

Body Protection

Use fire/flammable resistant/retardant clothing while handling material, and in accordance with the hazards of the task and site.

Other

Safety footwear is to be used in accordance with the hazards of the task and site.

Section 9 – Physical & Chemical Properties

Physical State

Liquid. [Cryogenic liquid]

Color

White crystalline snow-like particles [vapor]

Molecular Weight

44 g/mole

Molecular Formula

C-O₂

Boiling/Condensation Point

-79 °C (-110.2 °F)

Melting/Freezing Point

-79 °C (-110.2 °F)

Critical Temperature

30.85 °C (87.5 °F)

Critical Pressure

7375 kPa

Odor

Odorless. Water contact – pungent odor

Odor Threshold

Not available.

pH

3.2 - 3.7

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Taste	Faint acid taste.
Flash Point	Not available.
Burning Time	Not available.
Burning Rate	Not available.
Evaporation Rate	Not available.
Flammability (solid, gas)	Not available.
Lower and Upper Explosive (Flammable Limits)	Not available.
Vapor Pressure	5730 kPa
Vapor Density	1.53
Specific Volume (ft³/lb)	8.7719
Specific Gravity/Density	762 kg/m ³
Gas Density (lb/ft³)	0.114
Relative Density	1.52
Solubility	Water – 2,000 mg/L (completely soluble)
Solubility in Water	0.023 g/L
Partition Coefficient: n-Octanol/Water	0.83
Auto-Ignition Temperature	Not available.
Decomposition Temperature	Not available.
SADT	Not available.
Viscosity	Not available.

Section 10 – Chemical Stability & Reactivity Information

Reactivity	None known.
Chemical Stability	The product is stable.
Hazardous Reactions	Dust of various metals (magnesium, zirconium, titanium, aluminum, chromium, manganese). Liquid or solid carbon dioxide will attack some forms of plastics, rubber, and coatings. Forms carbonic acid in water.
Conditions to Avoid	None known.
Incompatible Materials	Alkali metals, alkaline earth metals, metal acetylides, chromium, titanium above 550 °C (1,022 °F), uranium above 750 °C (1,382 °F). Incompatible with acrylaidehyde, aziridine, sodium peroxide.

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Hazardous Decomposition Products	Electrical discharges and high temperatures decompose carbon dioxide into carbon monoxide and oxygen.
Hazardous Polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11 – Toxicological Information

Toxicological Effects

Acute Toxicity	Not available.
Irritation/Corrosion	Not available.
Sensitization	Not available.
Mutagenicity	Not available.
Carcinogenicity	Not available.
Reproductive Toxicity	Not available.
Teratogenicity	Not available.
Specific Target Organ Toxicity (Single Exposure)	Not available.
Specific Target Organ Toxicity (Repeated Exposure)	Not available.
Aspiration Hazard	Not available.
Information on Likely Routes of Exposure	Not available.

Potential Acute Health Effects

Eye Contact	Extremely cold material. Liquid can cause burns similar to frostbite.
Inhalation	No known significant effects or critical hazards.
Skin Contact	Extremely cold material. Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.
Ingestion	Ingestion of liquid can cause burns similar to frostbite.

Symptoms Related to Physical, Chemical, and Toxicological Characteristics

Eye Contact	Adverse symptoms may include the following: frostbite.
Inhalation	No specific data.
Skin Contact	Adverse symptoms may include the following: frostbite.
Ingestion	Adverse symptoms may include the following: frostbite.

Delayed and Immediate Effects/Chronic Effects from Short and Long-term Exposure

Short-term Immediate Effects	Not available.
Short-term Delayed Effects	Not available.
Long-term Immediate Effects	Not available.

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Long-term Delayed Effects | Not available.
Potential Chronic Health Effects | Not available.

General | No known significant effects or critical hazards.
Carcinogenicity | No known significant effects or critical hazards.
Mutagenicity | No known significant effects or critical hazards.
Teratogenicity | No known significant effects or critical hazards.
Developmental Effects | No known significant effects or critical hazards.
Fertility Effects | No known significant effects or critical hazards.

Numerical Measures of Toxicity

Acute Toxicity Estimates | Not available.

Section 12 – Ecological Information

Toxicity | Not available.
Persistence and Degradability | Not available.
Mobility in Soil | Soil/water partition coefficient (K_{oc}) – Not available.
Other Adverse Effects | Can cause frost damage to vegetation.
Global Warming Potential | 1
Effect on Global Warming | When discharged in large quantities, may contribute to the greenhouse effect.

Chemical Name	LogP _{ow}	BCF	Potential
CARBON DIOXIDE, REFRIGERATED LIQUID	0.83	-	Low

Section 13 – Disposal Considerations

Disposal Methods | The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.






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Section 14 – Transportation Information

	DOT	TDG	Mexico	IMDG	IATA
UN Number	UN2187	UN2187	UN2187	UN2187	UN2187
UN Proper Shipping Name	CARBON DIOXIDE, REFRIGERATED LIQUID	CARBON DIOXIDE, REFRIGERATED LIQUID	CARBON DIOXIDE, REFRIGERATED LIQUID	CARBON DIOXIDE, REFRIGERATED LIQUID	CARBON DIOXIDE, REFRIGERATED LIQUID
Transport Hazard Class(es)	2.2 	2.2 	2.2 	2.2 	2.2 
Packing Group	---	---	---	---	---
Environment	No.	No.	No.	No.	No.
Additional Information	<p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: 75 kg</p> <p>Cargo aircraft Quantity limitation: 150 kg</p>	<p>Explosive Limit and Limited Quantity Index 0.125</p> <p>Passenger Carrying Road or Rail Index 75</p>	---	---	<p>Passenger and Cargo Aircraft Quantity limitation: 75 kg</p> <p>Cargo Aircraft Only Quantity limitation: 150 kg</p>

Special Precautions

Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC Code

Not available.

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*****Section 15 – Regulatory Information*****

US Federal Regulations	TSCA 8(a) CDR Exempt/Partial exemption: This material is listed or exempted. United States inventory (TSCA 8b): This material is listed or exempted.
Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)	Not listed.
Clean Air Act Section 602 Class I Substances	Not listed.
Clean Air Act Section 602 Class II Substances	Not listed.
DEA List I Chemicals (Precursor Chemicals)	Not listed.
DEA List II Chemicals (Essential Chemicals)	Not listed.

SARA 302/304

Composition Information on Ingredients	No products were found.
SARA 304 RQ	Not applicable.

SARA 311/312

Classification	Sudden release of pressure.
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Name	%	Fire Hazard	Sudden Release of Pressure	Reactive	Immediate (Acute) Health Hazard	Delayed (Chronic) Health Hazard
CARBON DIOXIDE, REFRIGERATED LIQUID	100	No.	Yes.	No.	Yes.	No.

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United States - State Regulations

Massachusetts	Right to Know List
New Jersey	Right to Know Hazardous Substance List
Pennsylvania	RTK (Right to Know) List

Canada

WHMIS	Class A: Compressed gas.
Domestic Substances List	Listed.
CEPA Toxic substances	Not listed.
Canadian ARET	Not listed.
Canadian NPRI	Not listed.
Alberta Designated Substances	Not listed.
Ontario Designated Substances	Not listed.
Quebec Designated Substances	Not listed.
Ingredient Disclosure List	Listed.

International Regulations

Australia	AICS (Australian Inventory of Chemical Substances)
China	IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
EU	EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)
Japan	ENCS (Existing & New Chemical Substances) Inventory
Korea	ECL (Existing Chemicals List)
New Zealand	NZIoC (New Zealand Inventory of Chemicals)
Philippines	PICCS (Philippines Inventory of Chemicals and Chemical Substances)

Section 16 – Other Information

Emergency Response Guide (ERG) Number | 120 (UN 2187)

NFPA

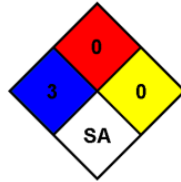
Health Hazard	3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
Fire Hazard	0 - Materials that will not burn.
Reactivity	0 - Normally stable, even under fire exposure conditions, and are not reactive with water.
Specific Hazard	SA - This denotes gases which are simple asphyxiants.

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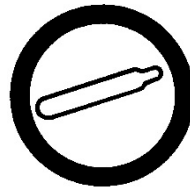


HMIS Rating

Health	3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given
Flammability	0 Minimal Hazard
Physical	2 Moderate Hazard

Canada WHMIS

Classification	A – Compressed gas
Class	2 – Gases
Division	2.2 – Non-flammable, non-toxic gases



Internal Use/Information Purposes Only

Date of Issue:	December 2015
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