



1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFIER: Carbon Dioxide

GENERAL USE: This product is used for tertiary oil recovery efforts

SYNONYMS: Carbonic Anhydride, Carbonic Acid Gas,

MANUFACTURER:
Dakota Gasification Company
420 County Road 26
Beulah, North Dakota 58523-9400
(701) 873-6677

EMERGENCY TELEPHONE NUMBERS:
Dakota Gasification (701) 873-6600

2. COMPOSITION / INFORMATION ON INGREDIENTS

<u>INGREDIENTS</u>	<u>WT. %</u>	<u>CAS Registry #</u>
Carbon Dioxide	94-97	124-38-9
Hydrogen Sulfide	0.80 – 2.0	7783-06-4

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):
EXPOSURE LIMITS 8 hrs. TWA (ppm)

<u>Substance</u>	<u>OSHA PEL</u>	<u>ACGIH TLV</u>
Carbon Dioxide	5,000 ppm	5,000 ppm
Hydrogen Sulfide	No PEL Established Ceiling of 20 ppm; 10 min. Peak of 50 ppm once per 8-hr shift	10 ppm - TLV 15 ppm - STEL

3. HAZARDS IDENTIFICATION / EMERGENCY OVERVIEW

Hydrogen sulfide, a component within this product, is found in concentrations exceeding 8000 ppm or at levels considered lethal. Although hydrogen sulfide is a small component of this product, it represents a severe threat to health and safety. Hydrogen sulfide is a toxic, irritating, and asphyxiant gas. Exposures in the range of 500-800 PPM hydrogen sulfide will lead to rapid loss of consciousness, respiratory paralysis, coma and death. Respiratory paralysis can be almost immediate at concentrations above 600-800 PPM and a single breath at slightly higher concentrations can cause unconsciousness. Death due to respiratory paralysis will follow unless the victim is removed to fresh air and resuscitation quickly administered. The severity of the effects of exposure to hydrogen sulfide varies with both length of exposure and concentration and also among individuals.

Hydrogen sulfide has a strong odor of "rotten eggs" at concentrations as low as 0.1 PPM. The odor will change to a "sickening sweet odor" as levels rise above 50-200 PPM. Exposure above

100 PPM may rapidly deaden the sense of smell, reportedly in as little as 2-15 minutes, particularly at higher concentrations. Above 200 PPM, the loss of smell is very rapid. Users should beware that in enclosed spaces where concentrations may be relatively constant that it is possible to "get use to" the smell of hydrogen sulfide or lose it completely. Rising concentrations may not be noticed in such cases.

Carbon dioxide does not support life and may produce immediately hazardous atmospheres. Carbon dioxide is an asphyxiant, a potent respiratory stimulant, and both a stimulant and depressant of the central nervous system. Exposure to carbon dioxide above 10% can result in unconsciousness in 1 minute or less.

POTENTIAL HEALTH EFFECTS: (Exposure to Carbon Dioxide and Hydrogen Sulfide)

EYE CONTACT: Eye irritation may result from exposure to hydrogen sulfide levels above 5 ppm. Levels above 50 ppm may cause conjunctivitis or reddening of the eyes, pain, tearing and appearance of halos around lights. Repeated or prolonged exposure to low concentrations of hydrogen sulfide may result in gradual onset of a scratchy, irritated sensation, with tearing, conjunctivitis, pain and blurred vision.

Eye contact with gaseous carbon dioxide may result in frostbite type injury. Carbon dioxide may form carbonic acid in the presence of water causing a corrosive injury if splashed or sprayed into the eye.

SKIN CONTACT: No evidence exists to suggest that skin absorption of hydrogen sulfide or carbon dioxide is an ordinary route of entry in humans, even at exposure concentrations and durations encountered in handling relatively large outdoor leaks. Skin or mouth contact with pure gaseous carbon dioxide may result in frostbite. Both carbon dioxide and hydrogen sulfide may produce acidic liquids if contacting water. This corrosive liquid may cause skin burns and irritation.

INHALATION: See the Emergency Overview section above

4. FIRST AID MEASURES

EYES: Immediately wash the eyes with large amounts of water, occasionally lifting upper and lower eyelids until no evidence of chemical remains. If frostbite is present, warm water may be preferred. Seek medical attention.
If contact with liquefied gas occurs and if eyes are affected, wash them thoroughly with clear water for at least 15 minutes. Hot and cold compresses may aid in the control of pain. Seek medical attention following exposure.

SKIN: Wash the affected area using a mild soap and rinse for at least 15 minutes. In case of frostbite, warm affected skin in warm water at a temperature of 107 degrees F. If warm water is unavailable or impractical to use, gently wrap affected part in blankets and slowly warm allowing circulation to return. Seek medical care if the skin becomes inflamed or blistered.

INGESTION: Ingestion of gas is unlikely. It is unlikely that emergency treatment will be required. If adverse effects occur, treat symptomatically and supportively. Seek medical attention.

INHALATION: Remove the victim from the contaminated area while protecting yourself from exposure by wearing a self-contained breathing apparatus. Put a similar respirator on the victim. If breathing has stopped, perform artificial respiration and continue until breathing is restored. Do not delay or cease administration of resuscitation to any victim whose breathing has stopped, as seconds are important. After natural breathing is restored, treat for shock; keep victim warm

and at rest until assistance arrives. If the victim is conscious but coughing give oxygen to breathe until assistance arrives.

5. FIRE FIGHTING MEASURES

- FLASH POINT: Not established for this product. CO₂ will not burn.
- AUTO-IGNITION TEMPERATURE: Not established for this product.
- FIRE AND EXPLOSION HAZARDS: Not flammable
- UPPER EXPLOSIVE / FIRE LIMITS: Not flammable
- LOWER EXPLOSIVE / FIRE LIMITS: Not flammable
- EXTINGUISHING MEDIA: Carbon dioxide is an extinguishing agent for Class B and Class C fires. Use agents suitable for surrounding fires.
- SPECIAL FIRE FIGHTING PROCEDURES: Not applicable.
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6. ACCIDENTAL RELEASE MEASURES

- SPILL OR LEAK PROCEDURES: The major components in this product are heavier than air. These components will remain in low spots without assisted ventilation. Keep unprotected persons well away and upwind from an area of hazardous concentrations. No one should enter a leak area without proper respiratory protection, even to attempt a rescue. There is a great risk of the rescue personnel themselves being overcome by gas, which will only compound the rescue problem. Work in the buddy system whenever working with a known or suspected leak. Isolate leak area immediately for at least 1,000 feet in all directions. Consider downwind evacuation for at least 0.2-1.0 miles. Carbon dioxide in small quantities may vaporize leaving "snow" (a combination of dry ice and water vapor where atmospheric moisture is present). Ventilate well and avoid contact with cold vapors or dry ice.
- CHARACTERISTICS UPON RELEASE TO THE ATMOSPHERE: Carbon dioxide is pipelined as a dense gas. Upon release, part of the product may become a gas and part of it may form solid flakes that resemble snow. These flakes will sublime (e.g., change directly from solid to gas) fairly rapidly. The solid flakes of carbon dioxide will be very cold. Contact with these flakes or with the escaping gas near the point of release may result in frostbite. A release of carbon dioxide alone is not particularly hazardous except in areas where it is allowed to concentrate. A release of this particular stream presents greater danger due to toxic hydrogen sulfide.
- REPORTABLE RELEASE QUANTITY: DOT 49 CFR 195.50 Requires reporting of loss of 50 bbls or 8 m³ of Carbon dioxide.
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7. HANDLING AND STORAGE

- STORAGE TEMPERATURE: Not Applicable

SHELF LIFE: Not Applicable
SPECIAL SENSITIVITY: None identified
HANDLING / STORAGE PRECAUTIONS: This product is not handled by personnel nor is it stored.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

RECOMMENDED WORK / HYGIENE PROCEDURES: Work upwind of leaks, wear respiratory protection listed below.

EYE PROTECTION REQUIREMENTS: If contacting liquid from gas lines, be aware the moisture may be highly acidic. Protect your eyes with goggles if a splash or drip hazard exists.

HAND PROTECTION REQUIREMENTS: If contacting liquid from gas lines, be aware the moisture may be highly acidic. Wear chemical gloves suitable for acids.

PROTECTIVE CLOTHING REQUIREMENTS: If contacting liquid from gas lines, be aware the moisture may be highly acidic. Wear rain slickers or an acid suit if a liquid hazard exists.

RESPIRATORY REQUIREMENTS: The major components of gas are simple asphyxiants or highly toxic hydrogen sulfide. Airline or self-contained breathing apparatus are required where exposure is possible.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: A gas.

ODOR: The major components are typically odorless. However, pure carbon dioxide may have an acidic, irritating, sharp odor. The presence of hydrogen sulfide may give gas a rotten egg type odor at first. Hydrogen sulfide does suppress the ability to smell in higher, dangerous concentrations.

PHYSICAL STATE: A supercritical fluid, a very dense gas

pH: Acidic, may range from 2.0 to 3.7

VAPOR PRESSURE: Not Established

VAPOR DENSITY: Carbon dioxide has a vapor density of 1.5 at 78.2°F, air = 1

MELTING POINT: -70.6°F @ 4000 MMHG

BOILING POINT: -109°F (Sublimes)

SPECIFIC GRAVITY: 1.522@ 21 C

EVAPORATION RATE: Not Applicable

MOLECULAR WEIGHT: 44.01 – Carbon Dioxide

CHEMICAL FAMILY: Oxide of carbon, carbonate

10. STABILITY AND REACTIVITY

INSTABILITY CONDITIONS: Not Established. Carbon Dioxide is considered stable

INCOMPATIBILITIES: Violent reaction with ammonia and amines. Contact with chemically active metals such as sodium or potassium may cause fire. Dry carbon dioxide can be handled with most common structural materials. Moist carbon dioxide is corrosive by its formation of carbonic acid. For these applications, 316, 309 and 310 stainless steels may be used as well as Hastelloy® A, B, and C and Monel®. Ferrous nickel alloys are slightly corroded.

DECOMPOSITION: Temperatures above 1700°C may cause decomposition and the release of oxygen and highly toxic carbon monoxide.

HAZARDOUS POLYMERIZATION: Has not been reported to occur under normal temperatures and pressures.

11. TOXICOLOGICAL INFORMATION

ROUTES OF ENTRY: Since this product is a gas, inhalation is the principal route of entry. Skin contact with liquids contacting gas may cause corrosive injuries. But, it is not a major toxic hazard.

EFFECTS OF ACUTE EXPOSURE: This is a component gas made up principally of carbon dioxide and hydrogen sulfide (see Composition/Ingredient section). The hydrogen sulfide component is the component of concern toxicologically.

At low concentrations the primary manifestations of hydrogen sulfide toxicity are eye inflammation with associated intense intolerance to light, tearing and blurred vision. Affected individuals may observe rings or halos around lights. Loss of corneal reflexes may follow. The onset of eye inflammation may be delayed for 12 to 24 hours following exposure. There is no specific antidote for hydrogen sulfide eye irritation. Symptoms can be relieved with the use of an antibiotic ointment and patching for 24 hours. Recovery after exposure usually occurs spontaneously in 1 to 2 days.

Hydrogen sulfide tends to be more irritating to the lungs than the upper respiratory tract with the possibility of pulmonary edema occurring after exposure to 250-600 PPM for less than an hour. Lower respiratory tract irritation can occur and reactive airway disease has been described after acute hydrogen sulfide exposure.

Exposures to high levels of hydrogen sulfide, typically above 1800 PPM may result in sudden collapse and respiratory paralysis, frequently followed by grand mal seizures. Such exposures can result in heart arrhythmia or a heart attack. Consumption of alcohol 24 hours prior to exposure may enhance toxicological effects.

SYMPTOMS: Exposures of 250-1000 PPM of hydrogen sulfide may result in the rapid onset of symptoms of fatigue, intense anxiety, vertigo, headache, and nausea, in addition to chest and nose pain and cough.

Exposure to lower concentrations of carbon dioxide may cause headache, sweating, rapid breathing, increased heartbeat, shortness of breath, dizziness, mental depression, visual disturbances, and shaking.

CHRONIC EFFECTS / CARCINOGENICITY: Repetitive exposures to hydrogen sulfide have an effect on both heme synthesis and on brain metabolism. Hydrogen sulfide inhibits heme synthetase in vitro at levels of 1 mmol/liter. In a study of workers exposed to 0.05-5.2 PPM of H₂S, heme synthetase was found to be depressed in 33% and erythrocyte protoporphyrin to be depressed in 54%. Mice exposed to 100 PPM of hydrogen sulfide for 2 hours a day at 4 day intervals for a total of 4 exposures developed cumulative inhibition of cerebral cytochrome C oxidase and RNA synthesis. Guinea pigs exposed to 20 PPM of hydrogen sulfide for one hour per day for 11 days developed decreases in CNS phospholipids and cholesterol as well as evidence of lipid peroxidation with marked increases in malonaldehyde.

No reports associate carbon dioxide or hydrogen sulfide with carcinogenesis, mutagenesis, or teratogenesis.

12. ECOLOGICAL INFORMATION

The cold temperature of gas leaks may freeze plants and animals. High hydrogen sulfide levels may asphyxiate anything in close proximity to a leak. Carbon dioxide does not contain any Class I or Class II ozone-depleting chemicals. Carbon dioxide is not listed as a marine pollutant by DOT.

13. DISPOSAL CONSIDERATIONS

Depending on local conditions and regulations, product may be safely disposed of to flare, to process, or by wet processing, scrubbing or venting. A large quantity of material in need of emergency disposal is hazardous due to the hydrogen sulfide content and may require disposal by flaring, which should be done with the consent of local air quality officials.

14. TRANSPORTATION INFORMATION

This product is shipped via pipeline. Typical transportation information does not generally apply since material is usually not carried by rail or truck transport. When this material is shipped the following transportation information applies:

Compressed gas, n.o.s. (contains Carbon Dioxide, Hydrogen Sulfide), UN1956, 2.2

15. REGULATORY INFORMATION

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

OSHA (Occupational Safety and Health Administration):

29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals: Requires facilities to develop a process safety management program based on Threshold Quantities of highly hazardous chemicals.

Hydrogen Sulfide **is** listed in Appendix A as a highly hazardous chemical

Carbon Dioxide **is not** listed in Appendix A as a highly hazardous chemical

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act of 1980 (40 CFR Part 302):

Reportable Quantity (RQ): 55,735 ft³ of product (2% hydrogen sulfide)

SARA: Superfund Amendment and Reauthorization Act:

Section 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of extremely hazardous substances (40 CFR 355):

Threshold Planning Quantity (TPQ): None-Carbon Dioxide

Threshold Planning Quantity (TPQ): 500 pounds-Hydrogen sulfide

Extremely Hazardous Substances (40 CFR 355): No-Carbon Dioxide

Yes-Hydrogen sulfide

Section 311/312: Require submission of Material Safety Data Sheets (MSDSs) and chemical inventory reporting with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: yes

DELAYED: No

PRESSURE: Yes

REACTIVITY: No

FIRE: No

Section 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Carbon dioxide does not require reporting under Section 313

Hydrogen sulfide requires reporting under Section 313

40 CFR 68: Risk Management Program for Chemical Accidental Release

Prevention: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Carbon dioxide is not listed as a regulated substance

Hydrogen sulfide is listed as a regulated substance with a 10,000 lb threshold quantity

TSCA: Toxic Substances Control Act:

Carbon dioxide is listed on the TSCA inventory

Hydrogen sulfide is listed on the TSCA inventory

LIABILITY DISCLAIMER

The information contained in this Material Safety Data Sheet (MSDS) is believed to be correct since it was obtained from sources we believe are reliable. However no representation, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications, hazards connected with the use of the material, or the results to be obtained from the use thereof. User assumes all risks and liability of any use, processing or handling of any material, variations in methods, conditions and equipment used to store, handle, or process the material and hazards connected with the use of the material are solely the responsibility of the user and remain at his sole discretion.

Compliance with all applicable federal, state, and local laws and regulations remains the responsibility of the user, and the user has the responsibility to provide a safe work place to examine all aspects of its operation and to determine if or where precautions, in addition to those described herein, are required.