



The enclosed sheets are for the Rofin-Sinar DC-025 laser gas. Since the gas bottle supplied by Rofin-Sinar Inc. is a special proprietary mix, the MSDS sheets are supplied for each gas consisting of:

1. Nitrogen
2. Carbon Dioxide
3. Carbon Monoxide
4. Oxygen
5. Xenon
6. Helium.

Material Safety Data Sheets



MG116625

Page 001 of 007

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
3 GREAT VALLEY PARKWAY
MALVERN, PENNSYLVANIA 19355
PHONE: 610-695-7400
FAX: 610-695-7596

EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SUBSTANCE: NITROGEN, COMPRESSED GAS
TRADE NAMES/SYNONYMS:
DIATOMIC NITROGEN; DINITROGEN; NITROGEN; NITROGEN-14; NITROGEN GAS; STCC
4904565; UN 1066; N2; MG116625; RTECS QW9700000
CHEMICAL FAMILY: inorganic, gas
CREATION DATE: May 07 1990
REVISION DATE: Dec 08 1998

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: NITROGEN, COMPRESSED GAS
CAS NUMBER: 7727-37-9
EC NUMBER (EINECS): 231-783-9
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=0 REACTIVITY=0
EC CLASSIFICATION (CALCULATED): No classification assigned.
EMERGENCY OVERVIEW:
PHYSICAL DESCRIPTION: Odorless, tasteless, colorless, inert gas.
MAJOR HEALTH HAZARDS: difficulty breathing
PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat.
POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: nausea, vomiting, symptoms of drunkenness, tingling sensation, suffocation, convulsions, coma
LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:

SHORT TERM EXPOSURE: no information on significant adverse effects
LONG TERM EXPOSURE: no information on significant adverse effects

EYE CONTACT:

SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: no information on significant adverse effects

INGESTION:

SHORT TERM EXPOSURE: no information on significant adverse effects
LONG TERM EXPOSURE: no information is available

CARCINOGEN STATUS:

OSHA: N
NTP: N
IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.
SKIN CONTACT: Wash if needed. If frostbite, freezing, or cryogenic burns occur, warm affected area in warm water. If this is not available, gently wrap affected parts in blankets. Allow circulation to return naturally. Get medical attention immediately.
EYE CONTACT: Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.
INGESTION: It is unlikely that emergency treatment will be required. Get medical attention, if needed.
NOTE TO PHYSICIAN: For inhalation, consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Containers may rupture or explode if exposed to heat.
EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical
Large fires: Use regular foam or flood with fine water spray.

MG116625

Page 002 of 007

FIRE FIGHTING: Move container from fire area if it can be done without risk.
Cool containers with water spray until well after the fire is out. Stay away
from the ends of tanks. Withdraw immediately in case of rising sound from
venting safety device or any discoloration of tanks due to fire. For tank,
rail car or tank truck, evacuation radius: 800 meters (1/2 mile).

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Stop leak if possible without personal risk. Keep unnecessary people away,
isolate hazard area and deny entry. Stay upwind and keep out of low areas.

MG116625 Page 003 of 007

SECTION 7 HANDLING AND STORAGE

Store and handle in accordance with all current regulations and standards.
Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Keep separated from
incompatible substances.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

NITROGEN, COMPRESSED GAS:

No occupational exposure limits established.

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with
applicable exposure limits.

EYE PROTECTION: For the gas: Eye protection not required, but recommended. For
the liquid: Wear splash resistant safety goggles. Contact lenses should not
be worn. Provide an emergency eye wash fountain and quick drench shower in
the immediate work area.

CLOTHING: For the gas: Protective clothing is not required. For the liquid:
Wear appropriate protective, cold insulating clothing.

GLOVES: Wear insulated gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory
protection may be needed. Respiratory protection is ranked in order from
minimum to maximum. Consider warning properties before use.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a
pressure-demand or other positive-pressure mode in combination with a
separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless, tasteless, colorless, inert gas.

MOLECULAR WEIGHT: 28.0134

MOLECULAR FORMULA: N₂

BOILING POINT: -321 F (-196 C)

FREEZING POINT: -346 F (-210 C)

VAPOR PRESSURE: 760 mmHg @ -196 C

VAPOR DENSITY (air=1): 0.967

SPECIFIC GRAVITY: Not applicable

DENSITY: 1.2506 g/L

WATER SOLUBILITY: 1.6% @ 20 C

PH: Not applicable

VOLATILITY: 100%

ODOR THRESHOLD: Not available

MG116625 Page 004 of 007

EVAPORATION RATE: Not applicable

VISCOSITY: 0.01787 cP @ 27 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

SOLVENT SOLUBILITY:

Soluble: liquid ammonia

Slightly Soluble: alcohol

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Protect from physical damage and heat. Containers may
rupture or explode if exposed to heat.

INCOMPATIBILITIES: metals, oxidizing materials

NITROGEN:

LITHIUM: May ignite in the gas.

MAGNESIUM: Violent reaction with the liquid on ignition.

NEODYMIUM: Vigorous reaction.

OZONE: Mixtures of the gases may be explosive.

TITANIUM: Will burn in nitrogen atmosphere.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: oxides of nitrogen

POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

HEALTH EFFECTS:

INHALATION:

NITROGEN: Nitrogen inhaled under increased atmospheric pressure, (>1.5 atmospheres), may dissolve in the fat-containing brain cells, and act as an anesthetic, causing narcosis. Persons who have been exposed to increased pressure for a time and who are suddenly released from the pressure may develop decompression sickness. Repeated exposure, without complete decompression, may result in decompression sickness. See information on simple asphyxiants.

ACUTE EXPOSURE:

SIMPLE ASPHYXIANTS: The symptoms of asphyxia depend on the rapidity with which the oxygen deficiency develops and how long it continues. In sudden acute asphyxia, unconsciousness may be immediate. With slow development there may be rapid respiration and pulse, air hunger, dizziness, reduced awareness, tightness in the head, tingling sensations, incoordination, faulty judgement, emotional instability, and rapid fatigue. As the asphyxia progresses, nausea, vomiting, collapse, unconsciousness, convulsions, deep coma and death are possible.

CHRONIC EXPOSURE:

MGII6625 Page 005 of 007

SIMPLE ASPHYXIANTS: No data available.

SKIN CONTACT:

ACUTE EXPOSURE:

NITROGEN: No adverse effect have been reported from the gas.

CHRONIC EXPOSURE:

NITROGEN: No adverse effects have been reported.

EYE CONTACT:

ACUTE EXPOSURE:

NITROGEN: May cause irritation if sprayed directly into the eyes.

CHRONIC EXPOSURE:

NITROGEN: No adverse effects have been reported.

INGESTION:

ACUTE EXPOSURE:

NITROGEN: Ingestion of a gas is unlikely.

CHRONIC EXPOSURE:

NITROGEN: No data available.

SECTION 12 ECOLOGICAL INFORMATION

Not available

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:

Nitrogen, compressed-UN1066

U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:

2.2

U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:

Nonflammable gas

U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:

EXCEPTIONS: 49 CFR 173.306

NON-BULK PACKAGING: 49 CFR 173.302

BULK PACKAGING: 49 CFR 173.314, 315

U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: 75 kg

MGII6625 Page 006 of 007

CARGO AIRCRAFT ONLY: 150 kg

LAND TRANSPORT ADR/RID:

SUBSTANCE NAME: Nitrogen, compressed

UN NUMBER: UN1066

ADR/RID CLASS: 2

ITEM NUMBER: 1(a)/1A

WARNING SIGN/LABEL: 2/2; 13

HAZARD ID NUMBER: 20

AIR TRANSPORT IATA/ICAO:

CORRECT TECHNICAL NAME: Nitrogen, compressed

UN/ID NUMBER: UN1066

IATA/ICAO CLASS: 2.2

LABEL: Nonflammable gas

MARITIME TRANSPORT IMDG:

CORRECT TECHNICAL NAME: Nitrogen, compressed

UN/ID NUMBER: UN1066

IMDG CLASS: 2(2.2)

EmS No.: 2-04
MFAG Table No.: none
MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not listed.
CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N
SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: N
FIRE: N
REACTIVE: N
SUDDEN RELEASE: Y
OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS:

California Proposition 65: N

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 231-783-9

GERMAN REGULATIONS:

WATER HAZARD CLASS (WGK): 0 (Official German Classification)

MG116625

Page 007 of 007

SECTION 16 OTHER INFORMATION

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Material Safety Data Sheets



MGIO4260

Page 001 of 008

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
3 GREAT VALLEY PARKWAY
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PHONE: 610-695-7400
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EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SUBSTANCE: CARBON DIOXIDE, GAS
TRADE NAMES/SYNONYMS:
CARBONIC ACID GAS; CARBONIC ANHYDRIDE; CARBON DIOXIDE; CARBON OXIDE; STCC
4904535; UN 1013; CO₂; MGIO4260; RTECS FF6400000
CHEMICAL FAMILY: oxides of carbon
CREATION DATE: May 04 1990
REVISION DATE: Sep 10 1998

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: CARBON DIOXIDE, GAS
CAS NUMBER: 124-38-9
EC NUMBER (EINECS): 204-696-9
PERCENTAGE: 100

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=0 REACTIVITY=0
EC CLASSIFICATION (CALCULATED): No classification assigned.

EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: Colorless, odorless gas, with a slight acidic taste.

MAJOR HEALTH HAZARDS: difficulty breathing

PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: ringing in the ears, nausea, irregular heartbeat,
headache, drowsiness, dizziness, tingling sensation, visual disturbances,
suffocation, convulsions, coma

LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:

SHORT TERM EXPOSURE: blisters, frostbite

LONG TERM EXPOSURE: no information on significant adverse effects

EYE CONTACT:

SHORT TERM EXPOSURE: irritation, blurred vision

LONG TERM EXPOSURE: no information on significant adverse effects

MGIO4260

Page 002 of 008

INGESTION:

SHORT TERM EXPOSURE: frostbite

LONG TERM EXPOSURE: no information is available

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: When safe to enter area, remove from exposure. Use a bag valve
mask or similar device to perform artificial respiration (rescue breathing)
if needed. Keep warm and at rest. Get medical attention immediately.

SKIN CONTACT: Wash if needed. If frostbite, freezing, or cryogenic burns
occur, warm affected area in warm water. If this is not available, gently
wrap affected parts in blankets. Allow circulation to return naturally. Get
medical attention immediately.

EYE CONTACT: It is unlikely that emergency treatment will be required. Wash
with large amounts of water or normal saline until no evidence of chemical
remains (at least 15-20 minutes). Get medical attention immediately.

INGESTION: It is unlikely that emergency treatment will be required. Get
medical attention, if needed.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk.
Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile). Use extinguishing agents appropriate for surrounding fire. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Do not get water directly on material. Reduce vapors with water spray. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Consider downwind evacuation if material is leaking.

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

MG104260 Page 003 of 008

Do not touch spilled material. Stop leak if possible without personal risk. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering.

SECTION 7 HANDLING AND STORAGE

Cylinder temperature should not exceed 125 F (52 C).
29 CFR Subpart "H"-Hazardous Materials.
National Fire Protection Association publication #55, "Standard for the Storage, Use and Handling of Compressed and Liquified Gases in Portable Cylinders".
Compressed Gas Association publication P-1, "Safe Handling of Compressed Gases in Containers".
Store and handle in accordance with current regulations and standards:
OSHA 29 CFR 1910.101

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

CARBON DIOXIDE, GAS:

CARBON DIOXIDE:

5000 ppm (9000 mg/m3) OSHA TWA
10000 ppm (18000 mg/m3) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)
30000 ppm (54000 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)
5000 ppm (9000 mg/m3) ACGIH TWA
30000 ppm (54000 mg/m3) ACGIH STEL
5000 ppm (9000 mg/m3) NIOSH recommended TWA 10 hour(s)
30000 ppm (54000 mg/m3) NIOSH recommended STEL
9000 mg/m3 (5000 ml/m3) DFG MAK 4 times/shift
9000 mg/m3 (5000 ml/m3) EC MAK 4 times/shift
5000 ppm (9150 mg/m3) UK OES TWA
15000 ppm (27400 mg/m3) UK OES STEL
MEASUREMENT METHOD: Gas collection bag; Gas chromatography with thermal conductivity detector; NIOSH III # S249

VENTILATION: Based on available information, additional ventilation is not required. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Eye protection not required, but recommended.

CLOTHING: For the gas: Protective clothing is not required. For the liquid:

Wear appropriate protective, cold insulating clothing.

GLOVES: Protective gloves are not required, but recommended.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

40,000 ppm

Any supplied-air respirator.

Any self-contained breathing apparatus with a full facepiece.

MG104260 Page 004 of 008

Escape -

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Colorless, odorless gas, with a slight acidic taste.

MOLECULAR WEIGHT: 44.01

MOLECULAR FORMULA: C-O2

BOILING POINT: Not available

FREEZING POINT: -71 F (-57 C) @ 4000 mmHg

SUBLIMATION POINT: -110 F (-79 C)

VAPOR PRESSURE: 43700 mmHg @ 21 C

VAPOR DENSITY (air=1): 1.5

SPECIFIC GRAVITY (water=1): 1.522 @ 21 C

WATER SOLUBILITY: soluble

PH: acidic in solution
VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable
SOLVENT SOLUBILITY:
Soluble: alcohol, acetone, hydrocarbons, organic solvents

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.
CONDITIONS TO AVOID: Protect from physical damage and heat. Containers may rupture or explode if exposed to heat. Avoid contact with water or moisture.
INCOMPATIBILITIES: combustible materials, oxidizing materials, metal salts, reducing agents, metal carbide, metals, bases
CARBON DIOXIDE:
ACRYLALDEHYDE: Exothermic polymerization.
BARIUM PEROXIDE: Incandescent reaction.
CESIUM OXIDE: Ignition.
DIETHYL MAGNESIUM: Ignition.
ETHYLENEIMINE: Explosive polymerization.
HYDRAZINE: Decomposition.
METAL ACETYLIDES: Ignition or incandescence.
METAL HYDRIDES: Reduction reaction.
METALS: Dusts of many metals suspended in carbon dioxide atmospheres are ignitable and explosive; some bulk metals will burn in the gas at elevated temperatures.
POTASSIUM: Mixtures of the solids are impact-sensitive.
POTASSIUM-SODIUM ALLOY: Mixtures of the solids are impact-sensitive.
SODIUM: Mixtures of the solids are impact-sensitive.
SODIUM PEROXIDE: Highly exothermic reaction; may be explosive in the presence of metals.
POLYMERIZATION: Will not polymerize.

MGI04260 Page 005 of 008

SECTION 11 TOXICOLOGICAL INFORMATION

CARBON DIOXIDE, GAS:
TOXICITY DATA:
9 pph/5 minute(s) inhalation-human LCLo; 90000 ppm/5 minute(s) inhalation-mammal LCLo; 10000 ppm/24 hour(s)-30 day(s) continuous inhalation-rat TCLo; 27000 ppm/24 hour(s)-30 day(s) continuous inhalation-rabbit TCLo
ACUTE TOXICITY LEVEL: Insufficient Data.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: heart or cardiovascular disorders, respiratory disorders
REPRODUCTIVE EFFECTS DATA:
6 pph inhalation-rat TCLo/24 hour(s) 10 day(s) pregnant female continuous; 6 pph inhalation-rat TCLo/24 hour(s) 10 day(s) pregnant female continuous; 55 pph inhalation-mouse TCLo/2 hour(s) 3 day(s) male; 55 pph inhalation-mouse TCLo/4 hour(s) 6 day(s) male; 2 pph inhalation-mouse TCLo/8 hour(s) 10 day(s) pregnant female continuous; 13 pph inhalation-rabbit TCLo/4 hour(s) 9-12 day(s) pregnant female continuous
HEALTH EFFECTS:
INHALATION:
ACUTE EXPOSURE:
CARBON DIOXIDE: In the solid or liquid form carbon dioxide is very volatile, readily releasing the gas. At concentrations from 2-10% it may cause acidic taste, dyspnea, headache, vertigo, nausea, labored breathing, weakness, drowsiness, mental confusion, and increase in blood pressure, pulse, and respiratory rate. Exposure to 10% for a few minutes has been reported to cause visual disturbances, tinnitus, tremors, profuse perspiration, restlessness, paresthesias, general feeling of discomfort, loss of consciousness, and coma. Concentrations of 25-30% may cause coma and convulsions within one minute. Tachycardia and arrhythmias are possible. Concentrations of 50% may cause symptoms of hypocalcemia including carpopedal spasms. Excessive carbon dioxide for a time period of not more than 5 minutes was reported to cause effects on vision with constriction of visual fields, enlargement of blind spots, photophobia, loss of convergence and accommodation, and deficient dark adaptation as well as headache, insomnia, and personality changes, largely depression and irritability. Even when there is sufficient oxygen present to prevent simple asphyxiation by carbon dioxide, high concentrations may cause adverse effects by interfering with its normal elimination from the body. Initially, exposure to increased carbon dioxide concentrations results in a compensatory increase in both rate and depth of ventilation. Beyond a certain point, however, this may reverse to hypoventilation resulting in respiratory acidosis. Death from asphyxia may occur if the concentration and duration of exposure are sufficient. Reproductive effects have been reported in animals.

CHRONIC EXPOSURE:

CARBON DIOXIDE: It has been reported that persons may tolerate 1.5% in inhaled air for prolonged periods without adverse effects, but calcium/phosphorus metabolism may be affected with serum levels of calcium and urinary phosphorus progressively falling. At 2% concentration, deepened respiration may occur. At 3% impairment of performance has been noted. It has, however, been demonstrated that the development of tolerance may occur during prolonged exposure to low levels. Reproductive effects have been reported in animals.

SKIN CONTACT:

ACUTE EXPOSURE:

CARBON DIOXIDE: No adverse effects have been reported from exposure to the gas. Due to rapid evaporation, the liquid or solid may cause frostbite with redness, tingling and pain or numbness. In more severe cases, the skin may become hard and white and develop blisters.

CHRONIC EXPOSURE:

CARBON DIOXIDE: No adverse effects are expected from exposure at low levels.

EYE CONTACT:

ACUTE EXPOSURE:

CARBON DIOXIDE: At high concentrations in air, carbon dioxide may cause a stinging sensation of the eyes. 200,000 ppm of the gas may cause irritation. Due to rapid evaporation, the liquid or solid may cause frostbite with redness, pain, and blurred vision.

CHRONIC EXPOSURE:

CARBON DIOXIDE: No adverse effects are expected from exposure to low levels.

INGESTION:

ACUTE EXPOSURE:

CARBON DIOXIDE: Ingestion of a gas is unlikely. If the liquid or solid is swallowed, frostbite damage to the lips, mouth and mucous membranes may occur.

CHRONIC EXPOSURE:

CARBON DIOXIDE: No data available.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

FISH TOXICITY: 150000 ug/L 48 day(s) (Mortality) Brown trout (Salmo trutta)

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:

Carbon dioxide-UN1013

U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:

2.2

U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:

Nonflammable gas

U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:

EXCEPTIONS: 49 CFR 173.306

NON-BULK PACKAGING: 49 CFR 173.302, 304

BULK PACKAGING: 49 CFR 173.302, 314, 315

U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: 75 kg

CARGO AIRCRAFT ONLY: 150 kg

LAND TRANSPORT ADR/RID:

SUBSTANCE NAME: Carbon dioxide

UN NUMBER: UN1013

ADR/RID CLASS: 2

ITEM NUMBER: 5(a)/2A

WARNING SIGN/LABEL: 2/2; 13

HAZARD ID NUMBER: 20

AIR TRANSPORT IATA/ICAO:

CORRECT TECHNICAL NAME: Carbon dioxide

UN/ID NUMBER: UN1013

IATA/ICAO CLASS: 2.2

LABEL: Nonflammable gas

MARITIME TRANSPORT IMDG:

CORRECT TECHNICAL NAME: Carbon dioxide

UN/ID NUMBER: UN1013

IMDG CLASS: 2(2.2)

EmS No.: 2-09

MFAG Table No.: 615

MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not listed.
CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N

MG104260 Page 008 of 008

SARA SECTION 313 (40CFR372.65): N
SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):

ACUTE: Y
CHRONIC: N
FIRE: N
REACTIVE: N
SUDDEN RELEASE: Y

OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS:

California Proposition 65: N

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 204-696-9

GERMAN REGULATIONS:

WATER HAZARD CLASS (WGK): 0 (Official German Classification)

SECTION 16 OTHER INFORMATION

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Material Safety Data Sheets



MGIO4290

Page 001 of 010

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
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PHONE: 610-695-7400
FAX: 610-695-7596

EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SUBSTANCE: CARBON MONOXIDE
TRADE NAMES/SYNONYMS:
CARBON OXIDE; CARBON OXIDE (CO); STCC 4905709; UN 1016; CO; MGIO4290; RTECS FG3500000
CHEMICAL FAMILY: inorganic, gas
CREATION DATE: May 04 1990
REVISION DATE: Sep 10 1998

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: CARBON MONOXIDE
CAS NUMBER: 630-08-0
EC NUMBER (EINECS): 211-128-3
EC INDEX NUMBER: 006-001-00-2
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=0

EC CLASSIFICATION (ASSIGNED):

F+ Extremely Flammable

T Toxic

Reproductive Toxin Category 1

R 12-23-48/23-61

EC Classification may be inconsistent with independently-researched data.

EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: Odorless, tasteless, colorless gas.

MAJOR HEALTH HAZARDS: No significant target effects reported.

PHYSICAL HAZARDS: Flammable gas. May cause flash fire.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: reproductive effects, blisters, nausea, vomiting, chest pain, headache, drowsiness, dizziness, fainting, hearing loss, dilated

MGIO4290 Page 002 of 010

pupils, blindness, suffocation, lung congestion, blood disorders, kidney damage, liver enlargement, liver damage, reproductive effects, convulsions, coma

LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:

SHORT TERM EXPOSURE: blisters, frostbite

LONG TERM EXPOSURE: no information is available

EYE CONTACT:

SHORT TERM EXPOSURE: frostbite, blurred vision

LONG TERM EXPOSURE: no information is available

INGESTION:

SHORT TERM EXPOSURE: frostbite

LONG TERM EXPOSURE: no information is available

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.

SKIN CONTACT: Wash if needed. If frostbite, freezing, or cryogenic burns occur, warm affected area in warm water. If this is not available, gently wrap affected parts in blankets. Allow circulation to return naturally. Get medical attention immediately.

EYE CONTACT: It is unlikely that emergency treatment will be required. Wash with large amounts of water or normal saline until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

INGESTION: It is unlikely that emergency treatment will be required. Get

medical attention, if needed.
NOTE TO PHYSICIAN: For inhalation, consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe explosion hazard. Vapor/air mixtures are explosive. Containers may rupture or explode if exposed to heat. Vapors or gases may ignite at distant ignition sources and flash back.

Vapors are only slightly lighter than air and may travel to a source of ignition and flash back.

EXTINGUISHING MEDIA: Let burn unless leak can be stopped immediately. Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk.

MGIO4290 Page 003 of 010

Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Stop flow of gas.

LOWER FLAMMABLE LIMIT: 12.5%

UPPER FLAMMABLE LIMIT: 74%

AUTOIGNITION: 1128 F (609 C)

SECTION 6 ACCIDENTAL RELEASE MEASURES

WATER RELEASE:

Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering.

SECTION 7 HANDLING AND STORAGE

Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Keep separated from incompatible substances.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

CARBON MONOXIDE:

50 ppm (55 mg/m3) OSHA TWA

35 ppm (40 mg/m3) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

200 ppm (229 mg/m3) OSHA ceiling (vacated by 58 FR 35338, June 30, 1993)

25 ppm (29 mg/m3) ACGIH TWA

35 ppm (40 mg/m3) NIOSH recommended TWA 8 hour(s)

200 ppm (229 mg/m3) NIOSH recommended ceiling

33 mg/m3 (30 ml/m3) DFG MAK 4 times/shift

50 ppm (58 mg/m3) UK OES TWA

300 ppm (349 mg/m3) UK OES STEL

MEASUREMENT METHOD: Gas collection bag; Electrochemical analysis; NIOSH III # S340

VENTILATION: Provide local exhaust or process enclosure ventilation system.

MGIO4290 Page 004 of 010

Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: For the gas: Eye protection not required, but recommended. For the liquid: Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: For the gas: Protective clothing is not required. For the liquid: Wear appropriate protective, cold insulating clothing.

GLOVES: Wear insulated gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

350 ppm

Any supplied-air respirator.

875 ppm

Any supplied-air respirator.

1200 ppm

Any air-purifying respirator with a full facepiece and a canister providing protection against this substance.

End of service life indicator required (ESLI).

Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
Escape -
Any air-purifying respirator with a full facepiece and a canister providing protection against this substance.
End of service life indicator required (ESLI).
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless, tasteless, colorless gas.

MOLECULAR WEIGHT: 28.01

MOLECULAR FORMULA: C-O

BOILING POINT: -314 F (-192 C)

FREEZING POINT: -326 F (-199 C)

VAPOR PRESSURE: 760 mmHg @ -191 C

VAPOR DENSITY (air=1): 0.968

SPECIFIC GRAVITY: Not applicable

DENSITY: 1.250 g/L @ 0 C

WATER SOLUBILITY: 2.3% @ 20 C

PH: Not applicable

VOLATILITY: Not applicable

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not applicable

MG104290

Page 005 of 010

VISCOSITY: 0.01657 cP @ 0 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

SOLVENT SOLUBILITY:

Soluble: alcohol, benzene, acetic acid, ethyl acetate, chloroform, cuprous chloride solutions

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition.

Minimize contact with material. Avoid inhalation of material or combustion by-products. Keep out of water supplies and sewers.

INCOMPATIBILITIES: oxidizing materials, halogens, metal oxides, metals, combustible materials

CARBON MONOXIDE:

BARIUM PEROXIDE: Violent reaction.

BROMINE PENTAFLUORIDE: Violent reaction and possible ignition.

BROMINE TRIFLUORIDE: Explosion hazard.

CESIUM MONOXIDE: Ignites in the presence of moisture or when heated.

CHLORINE: Violent reaction.

CHLORINE DIOXIDE: Explodes.

CHLORINE TRIFLUORIDE: Explosive reaction.

COPPER (POWDER) + WATER: Explosive complex.

COPPER(II)PERCHLORATE + WATER: Explosive complex.

DINITROGEN OXIDE: Fire and explosion hazard.

FLUORINE + OXYGEN: May explode above 30 C.

IODINE HEPTAFLUORIDE: Ignition.

IRON(III) OXIDE: Possible explosion hazard.

LITHIUM: Forms compound which detonates violently on contact with water.

NITROGEN TRIFLUORIDE: Explosive reaction upon ignition.

OXIDIZERS (STRONG): Fire and explosion hazard.

OXYGEN (LIQUID): Forms explosive mixture.

OXYGEN DIFLUORIDE: Explodes when sparked.

PEROXODISULFURYL DIFLUORIDE: Explosive reaction above 20 C.

POTASSIUM: Forms explosive compound.

SILVER(I) OXIDE: Extremely exothermic reaction.

SODIUM: Forms explosive, shock-sensitive compound.

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: oxides of carbon

POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

CARBON MONOXIDE:

TOXICITY DATA:

600 mg/m3/10 minute(s) inhalation-human TClO; 4000 ppm/30 minute(s)

MG104290

Page 006 of 010

inhalation-man LClO; 650 ppm/45 minute(s) inhalation-man TClO; 5000 ppm/5

minute(s) inhalation-human LClO; 1807 ppm/4 hour(s) inhalation-rat LC50;

2444 ppm/4 hour(s) inhalation-mouse LC50; 4000 ppm/46 minute(s)

inhalation-dog LCLo; 4000 ppm inhalation-rabbit LCLo; 5718 ppm/4 hour(s)
inhalation-guinea pig LC50; 5000 ppm/5 minute(s) inhalation-mammal LCLo;
1334 ppm inhalation-wild bird LC50; 1800 ppm/1 hour(s)-14 day(s)
intermittent inhalation-rat TCLo; 30 mg/m³/8 hour(s)-10 week(s) intermittent
inhalation-rat TCLo; 96 ppm/24 hour(s)-90 day(s) continuous inhalation-rat
TCLo; 250 ppm/5 hour(s)-20 day(s) intermittent inhalation-rat TCLo; 5983
mg/kg/18 week(s) intermittent subcutaneous-rat TDLo; 200 ppm/24 hour(s)-90
day(s) continuous inhalation-monkey TCLo; 200 mg/m³/3 hour(s)-13 week(s)
intermittent inhalation-rabbit TCLo; 50 ppm/24 hour(s)-8 week(s) continuous
inhalation-rabbit TCLo; 200 mg/m³/5 hour(s)-4 week(s) intermittent
inhalation-guinea pig TCLo; 200 ppm/24 hour(s)-90 day(s) continuous
inhalation-guinea pig TCLo

ACUTE TOXICITY LEVEL:

Moderately Toxic: inhalation

TARGET ORGANS: blood

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: blood system disorders, heart or
cardiovascular disorders, hormonal disorders, respiratory disorders

MUTAGENIC DATA:

miconucleus test - mouse inhalation 1500 ppm 10 minute(s); sister chromatid
exchange - mouse inhalation 2500 ppm 10 minute(s)

REPRODUCTIVE EFFECTS DATA:

150 ppm inhalation-rat TCLo/24 hour(s) 1-22 day(s) pregnant female
continuous; 150 ppm inhalation-rat TCLo/24 hour(s) 1-22 day(s) pregnant
female continuous; 1 mg/m³ inhalation-rat TCLo/24 hour(s) 72 day(s) pre
pregnancy continuous; 150 ppm inhalation-rat TCLo/24 hour(s) 0-20 day(s)
pregnant female continuous; 75 ppm inhalation-rat TCLo/24 hour(s) 0-20
day(s) pregnant female continuous; 65 ppm inhalation-mouse TCLo/24 hour(s)
7-18 day(s) pregnant female continuous; 250 ppm inhalation-mouse TCLo/7
hour(s) 6-15 day(s) pregnant female continuous; 125 ppm inhalation-mouse
TCLo/24 hour(s) 7-18 day(s) pregnant female continuous; 8 pph
inhalation-mouse TCLo/1 hour(s) 8 day(s) pregnant female continuous; 8 pph
inhalation-mouse TCLo/1 hour(s) 8 day(s) pregnant female continuous; 180 ppm
inhalation-rabbit TCLo/24 hour(s) 1-30 day(s) pregnant female continuous

ADDITIONAL DATA: Alcohol may enhance the toxic effects.

HEALTH EFFECTS:

INHALATION:

ACUTE EXPOSURE:

CARBON MONOXIDE: Carbon monoxide is not detectable by odor and headache
should be taken as a warning that a dangerous concentration is being
inhaled. In sudden exposures to high concentrations, weakness and
dizziness may be the only symptoms preceding collapse. The amount of
carboxyhemoglobin formed in the blood is dependent on concentration and
duration of exposure, ambient temperature, physical exertion, health, and
individual metabolism. Symptoms are usually not noticeable until the
carboxyhemoglobin level reaches 10%. At 10-40%, symptoms may include
increasingly severe headache, dyspnea on exertion, decreased manual
dexterity, impaired judgement and memory, irritability, emotional
instability, dizziness, fatigue, drowsiness, confusion, nausea, vomiting,
palpitations, and impaired vision and hearing. With continuing exposure,
there is a progressive worsening of all symptoms. At 40-60%, anginal pain,
incoordination, hallucinations, lethargy, syncope and collapse, and

MGI04290 Page 007 of 010

increased respiration and pulse may occur. At 60-80% there may be
decreased respiration, blood pressure and pulse, and deepening coma with
intermittent convulsions and incontinence of urine and feces. Rarely,
there may be a pink or red skin discoloration, but cyanosis or pallor is
more common. Other reported signs and symptoms include increased
temperature, dilated pupils, perspiration, muscle spasms, hyperreflexia,
aching limbs, and retinal hemorrhage or venous engorgement. Above 70-80%,
rapid death from respiratory or cardiac arrest usually occurs. Death may
also be caused by myocardial or cerebral infarction. Cerebral edema may
also occur. In non-fatal cases or when death is not immediate, primary or
secondary effects of tissue hypoxia and some atypical reactions may
develop. There may be myocarditis, pulmonary edema, bronchopneumonia,
pancreatitis, hepatomegaly, liver and kidney damage, albuminuria,
glycosuria, and oliguria. Hemolytic anemia, thrombocytopenic purpura,
polycythemia and leukocytosis have been reported. Rhabdomyolysis with
myoglobinuria and acute renal failure are possible, especially with
pressure injury. Erythema, edema and blisters may develop, especially over
pressure areas. Eye effects may include retrobulbar neuritis with
neuroretinal edema and partial or complete, temporary or permanent
blindness. Temporary or permanent hearing loss may also occur. Complete
recovery is the usual course. However, signs and symptoms of nerve or
brain injury with neuropathies and various motor and mental defects, some
of which resemble multiple sclerosis or parkinsonism, may develop several
days to weeks after apparent recovery, especially from prolonged hypoxic
coma. The onset may be sudden with numerous possible effects, including
dementia, deterioration of neurological status and sometimes slowly
resolving or permanent disability or death. A study of 63 patients 3 years
after carbon monoxide poisoning indicated that 13% showed gross

neuropsychiatric damage; 33% showed deterioration of personality; and 43% reported memory impairment. Carbon monoxide readily crosses the placental barrier. Acute non-lethal intoxication may result in miscarriage or permanent neurologic sequelae such, as cerebral palsy, in the newborn.

CHRONIC EXPOSURE:

CARBON MONOXIDE: Although carbon monoxide is not a cumulative poison, chronic exposure to low to moderate levels may result in repeated bouts of oxygen deprivation and resultant effects including cardiovascular or central nervous system damage. Reported signs and symptoms include polycythemia, lassitude, malaise, anorexia, nausea, vomiting, headache, dizziness, ataxia, syncope, glycosuria, weakness of the limbs, joint and neuromuscular pain, muscle spasm, loss of sensation in the fingers, positive Romberg's sign, auditory and visual disturbances and impaired vigilance. Irritability, personality changes, impaired memory and difficulty concentrating are also possible. The development of atherosclerosis may be facilitated. The development of congestive heart failure may be indicated by dyspnea, anginal pain and cardiac irregularities. Relatively long and severe exposure may cause cerebral congestion and edema resulting in long-lasting mental or nervous damage. During pregnancy, prolonged exposure to low levels, as in smoking, has been associated with smaller babies and increased neonatal mortalities. Rats exposed prenatally to low levels had offspring that exhibited signs of functional deficit in the central nervous system; minor skeletal anomalies were noted in mice. Other reproductive effects have been reported in animals.

MG104290 Page 008 of 010

SKIN CONTACT:

ACUTE EXPOSURE:

CARBON MONOXIDE: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, tingling and pain or numbness. In more severe cases, the skin may become hard and white and blisters may develop.

CHRONIC EXPOSURE:

CARBON MONOXIDE: No data available.

EYE CONTACT:

ACUTE EXPOSURE:

CARBON MONOXIDE: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, pain and blurred vision.

CHRONIC EXPOSURE:

CARBON MONOXIDE: No data available.

INGESTION:

ACUTE EXPOSURE:

CARBON MONOXIDE: Ingestion of a gas is unlikely. If liquid is swallowed, frostbite damage to the lips, mouth and mucous membranes may occur.

CHRONIC EXPOSURE:

CARBON MONOXIDE: No data available.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

FISH TOXICITY: 75000 ug/L 1 day(s) LC100 (Mortality) Orangespotted sunfish (Lepomis humilis)

SECTION 13 DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:

Carbon monoxide, compressed.-UN1016

U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:

2.3

U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:

Poison gas; Flammable gas

MG104290 Page 009 of 010

U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:

EXCEPTIONS: None

NON-BULK PACKAGING: 49 CFR 173.302

BULK PACKAGING: 49 CFR 173.314, 315

U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: Forbidden

CARGO AIRCRAFT ONLY: 25 kg

LAND TRANSPORT ADR/RID:

SUBSTANCE NAME: Carbon monoxide/Carbon monoxide, compressed

UN NUMBER: UN1016

ADR/RID CLASS: 2

ITEM NUMBER: 1(bt)/1TF

WARNING SIGN/LABEL: 6.1; 3/6.1; 3; 13
HAZARD ID NUMBER: 236/263
AIR TRANSPORT IATA/ICAO:
CORRECT TECHNICAL NAME: Carbon monoxide
UN/ID NUMBER: UN1016
IATA/ICAO CLASS: 2.3
LABEL: Toxic gas; Flammable gas
MARITIME TRANSPORT IMDG:
CORRECT TECHNICAL NAME: Carbon monoxide
UN/ID NUMBER: UN1016
IMDG CLASS: 2(2.3)
SUBSIDIARY RISK LABEL: Flammable gas
EmS No.: 2-01
MFAG Table No.: 616
MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not listed.
CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N
SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: N
FIRE: Y
REACTIVE: N
SUDDEN RELEASE: Y
OSHA PROCESS SAFETY (29CFR1910.119): N
STATE REGULATIONS:
California Proposition 65: Y
Known to the state of California to cause the following:
Carbon monoxide

MG104290 Page 010 of 010

Developmental toxicity (Jul 01, 1989)

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 211-128-3
EC RISK AND SAFETY PHRASES:
R 12 Extremely flammable.
R 23 Toxic by inhalation.
R 48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R 61 May cause harm to unborn child.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.

GERMAN REGULATIONS:

WATER HAZARD CLASS (WGK): 0 (Official German Classification)

SECTION 16 OTHER INFORMATION

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Material Safety Data Sheets



MG112831

Page 001 of 009

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
3 GREAT VALLEY PARKWAY
MALVERN, PENNSYLVANIA 19355
PHONE: 610-695-7400
FAX: 610-695-7596

EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SUBSTANCE: OXYGEN, COMPRESSED GAS
TRADE NAMES/SYNONYMS:
OXYGEN; DIOXYGEN; MOLECULAR OXYGEN; OXYGEN MOLECULE; PURE OXYGEN; STCC
4904350; UN 1072; O2; MG112831; RTECS RS2060000
CHEMICAL FAMILY: inorganic, gas
CREATION DATE: May 07 1990
REVISION DATE: Sep 10 1998

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: OXYGEN, COMPRESSED GAS
CAS NUMBER: 7782-44-7
EC NUMBER (EINECS): 231-956-9
EC INDEX NUMBER: 008-001-00-8
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=0 REACTIVITY=0

EC CLASSIFICATION (ASSIGNED):

O Oxidizing

R 8

EC Classification may be inconsistent with independently-researched data.

EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless, gas.

MAJOR HEALTH HAZARDS: No significant target effects reported.

PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat. May
ignite combustibles.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, asthma, irregular heartbeat,
dizziness, tingling sensation, dilated pupils, blindness, lung congestion,
blood disorders, convulsions

MG112831

Page 002 of 009

LONG TERM EXPOSURE: chest pain, lung damage

SKIN CONTACT:

SHORT TERM EXPOSURE: blisters, frostbite

LONG TERM EXPOSURE: no information on significant adverse effects

EYE CONTACT:

SHORT TERM EXPOSURE: irritation, blurred vision

LONG TERM EXPOSURE: no information on significant adverse effects

INGESTION:

SHORT TERM EXPOSURE: frostbite

LONG TERM EXPOSURE: no information is available

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: Remove from exposure immediately. Use a bag valve mask or similar
device to perform artificial respiration (rescue breathing) if needed. Get
medical attention.

SKIN CONTACT: Wash if needed. If frostbite, freezing, or cryogenic burns
occur, warm affected area in warm water. If this is not available, gently
wrap affected parts in blankets. Allow circulation to return naturally. Get
medical attention immediately.

EYE CONTACT: Wash eyes immediately with large amounts of water, occasionally
lifting upper and lower lids, until no evidence of chemical remains. Get
medical attention immediately.

INGESTION: It is unlikely that emergency treatment will be required. Get
medical attention, if needed.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials. Containers may rupture or explode if exposed to heat.
EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical
Large fires: Use regular foam or flood with fine water spray.
FIRE FIGHTING: Move container from fire area if it can be done without risk.
Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Use extinguishing agents appropriate for surrounding fire. Cool containers with water. Apply water from a protected location or from a safe distance.
MG112831 Page 003 of 009

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Stop leak if possible without personal risk. Avoid contact with combustible materials. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering.

SECTION 7 HANDLING AND STORAGE

Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.104.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

OXYGEN, COMPRESSED GAS:

No occupational exposure limits established.

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: For the gas: Eye protection not required, but recommended. For the liquid: Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: For the gas: Protective clothing is not required. For the liquid: Wear appropriate protective, cold insulating clothing.

GLOVES: Wear insulated gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.

Any chemical cartridge respirator with organic vapor cartridge(s).

Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).

Any air-purifying respirator with a full facepiece and an organic vapor canister.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

MG112831 Page 004 of 009

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless, gas.

MOLECULAR WEIGHT: 31.9988

MOLECULAR FORMULA: O2

BOILING POINT: -297 F (-183 C)

FREEZING POINT: -360 F (-218 C)

VAPOR PRESSURE: 760 mmHg @ -183 C

VAPOR DENSITY (air=1): 1.1

SPECIFIC GRAVITY: Not applicable

DENSITY: 1.309 g/L @ 25 C

WATER SOLUBILITY: 3.2% @ 25 C

PH: Not applicable

VOLATILITY: Not applicable

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not applicable

VISCOSITY: 0.02075 cP @ 25 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

SOLVENT SOLUBILITY:

Soluble: alcohol

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid contact with combustible materials. Protect from physical damage and heat. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: combustible materials, halo carbons, metals, bases, reducing agents, amines, metal salts, oxidizing materials

OXYGEN:

ACETALDEHYDE: Rapid oxidation progressing to explosion.

ACETYLENE: Mixtures of the gases may explode on heating or compression; the liquids form a powerful explosive.

POLY(ACRYLONITRILE-BUTADIENE): Forms impact-sensitive mixture with the liquid.

SEC-ALCOHOLS: Forms explosive peroxides.

ALKALI METALS: Ignition.

ALKALINE-EARTH METALS: Ignition.

ALKALINE-EARTH PHOSPHIDES: Incandescence on heating.

ALLYLIC COMPOUNDS: May form explosive peroxides.

ALUMINUM BOROHYDRIDE: Explosive reaction.

AMMONIA: Possible explosion.

BERYLLIUM BOROHYDRIDE: Explosive reaction.

BORON ARSENOTRIBROMIDE: Ignites on contact with the gas.

BORON TRICHLORIDE: Vigorous reaction on sparking.

BUTEN-3-YNE: Forms explosive peroxides.

CARBON: May ignite in the gas; forms explosive mixtures with the liquid.

CARBON DISULFIDE: Possible ignition.

MGI12831 Page 005 of 009

CARBON MONOXIDE (LIQUID): Forms explosive mixture with the liquid.

CHLOROTRIFLUOROETHYLENE: Forms explosive peroxides.

COMBUSTIBLE MATERIALS: The flammability of combustible compounds greatly increases with an increase in oxygen concentration; some materials may become spontaneously combustible or explosive. Contact of combustible compounds with liquid oxygen is likely to result in a dangerous explosion.

CYANOGEN (LIQUID): Forms explosive mixture with the liquid.

CYCLOHEXANE-1,2-DIONE BIS(PHENYLHYDRAZONE): Forms explosive compound.

CYCLOOCTATETRAENE: May form explosive peroxides.

DIBORANE: Explosive mixture on heating.

DIBORON TETRAFLUORIDE: Explosive mixture.

DIMETHYLKETENE: Forms explosive peroxide.

DIMETHYL SULFIDE: Explosive reaction above 210 C.

DIOXANE: May form explosive peroxides.

ETHERS: May form explosive peroxides.

FLAMMABLE MATERIALS: The flammability of materials greatly increases as the oxygen concentration increases; some compounds may become spontaneously combustible or explosive. Contact with liquid oxygen is likely to result in dangerous explosions.

FLUORINE + HYDROGEN: Explosive mixture.

HALOGENATED HYDROCARBONS: Many halogenated hydrocarbons ignite or explode with the gas under pressure; contact with the liquid may result in a dangerous explosion.

HYDRAZINE: Forms explosive mixtures.

HYDROCARBONS: Mixtures with the gas may ignite or explode particularly under pressure or when heated; contact with the liquid is likely to result in a dangerous explosion.

HYDROGEN: Explosive mixture, particularly in the presence of a catalyst.

HYDROGEN SULFIDE: Explosive mixture.

LITHIATED DIALKYLNITROSAMINES: May form explosive compounds.

LITHIUM HYDRIDE (POWDER): Very powerful explosive with the liquid.

METALS: Many metals ignite or explode in the gas, particularly if heated or in powder form. Contact of metal powders with the liquid is likely to result in a dangerous explosion.

METAL HALIDES: Ignition.

METAL HYDRIDES: Ignition or explosion.

METHANE (LIQUID): Forms explosive mixture with the liquid.

METHOXYCYCLOOCTATETRAENE: Forms explosive compound.

NICKEL CARBONYL: Ignites or explodes at low pressure.

NITROGEN (LIQUID): Explosive if subjected to radiation.

NON-METAL HYDRIDES: May ignite or explode.

OXYGEN DIFLUORIDE: Explosive mixture.

PHENYLDICHLOROAMINE: Explosive reaction.

PHOSPHINE: Forms explosive mixture.

PHOSPHOROUS: Vigorous reaction.

PHOSPHOROUS TRIBROMIDE: Explosive reaction.

PHOSPHOROUS TRIFLUORIDE: Explosive reaction.

PHOSPHOROUS TRIOXIDE: Ignition.

POLY(CYANOETHYLSILOXANE): Forms impact sensitive mixture with the liquid.

POLY(DIMETHYLSILOXANE): Forms impact sensitive mixture with the liquid.

POLYSTYRENE: Forms impact-sensitive mixture with the liquid.
POLYMERS: Contact with the liquid may result in rapid, hazardous oxidation
MGII2831 Page 006 of 009
with possible explosions.
POTASSIUM CARBONYL: Violent reaction.
POTASSIUM PEROXIDE: Violent reaction.
PROPYLENE OXIDE: Explosive mixture.
SILANE + CHLORINE: Explosive mixture.
SILANES: Ignition or explosion.
STYRENE: Forms explosive peroxide.
TEFLON (POLYTETRAFLUOROETHYLENE): Ignites at high temperature and reduced pressure.
TETRABORON DECAHYDRIDE: Explosive mixture.
TETRAFLUOROETHYLENE: Forms explosive peroxides.
TETRAFLUOROHYDRAZINE: Explosion in the presence of organic matter.
TETRAHYDROFURAN: Forms explosive peroxides.
TETRAPHOSPHORUS HEXAOXIDE: Ignition.
TRIRHENIUM CHLORIDE: May form explosive chlorine oxides on heating.
VINYL COMPOUNDS: May form explosive peroxides.
POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

OXYGEN, COMPRESSED GAS:

TOXICITY DATA:

100 pph/14 hour(s) inhalation-human TCLo

MUTAGENIC DATA:

cytogenetic analysis - human lymphocyte 40 pph 4 day(s); cytogenetic analysis - hamster ovary 20 pph 3 day(s)-continuous; cytogenetic analysis - hamster lung 80 pph; sister chromatid exchange - hamster ovary 20 pph; mutation in mammalian somatic cells - hamster lung 95 pph 24 hour(s); cytogenetic analysis - chicken embryo 80 pph

REPRODUCTIVE EFFECTS DATA:

12 pph inhalation-woman TCLo/10 minute(s) 26-39 week(s) pregnant female continuous; 10 pph inhalation-rat TCLo/12 hour(s) 22 day(s) pregnant female continuous; 10 pph inhalation-rat TCLo/9 hour(s) 22 day(s) pregnant female continuous; 10 pph inhalation-mouse TCLo/24 hour(s) 8 day(s) pregnant female continuous

ADDITIONAL DATA: Toxic action is greatly enhanced by exercise or by presence of moderate amounts of carbon dioxide.

HEALTH EFFECTS:

INHALATION:

ACUTE EXPOSURE:

OXYGEN: Pure oxygen, especially if not properly humidified, may cause mucous membrane irritation and pulmonary edema after 24 hours. Air normally contains 20-21% oxygen. As exposure to higher concentrations and/or greater than atmospheric pressure continues symptoms of toxicity may develop and increase in severity. Respiratory system effects may include a progressive decrease in vital capacity, tightness in the chest and discomfort, coughing, congestion, tracheobronchitis, pneumonia, edema, atelectasis and increased depth of respiration, rapid panting or asthma-like attacks, apnea in inspiratory position, fibroblastic proliferation, and hyperplasia of alveolar cells. Cardiovascular system effects may include bradycardia, hyperthermia or hypothermia and

MGII2831 Page 007 of 009

peripheral vasoconstriction. The nervous system may be affected with mood changes, nausea, dizziness, slowing of mental processes, malaise, hilarity, apprehension, paresthesias including tingling of fingers and toes, fasciculation of the lips and face, muscular twitching, visual and auditory hallucinations, general convulsions and epileptic seizures, loss of consciousness and collapse. At increased atmospheric pressures, vision may be affected. Symptoms may include photophobia, amblyopia, mydriasis, bilateral progressive constriction of visual field, impaired central vision, constriction of retinal vasculature, and possible loss of vision. However, no change in the visual fields or visual acuity was found after breathing pure oxygen for four and one-half hours at normal atmospheric pressures. Animal studies indicate exposure to oxygen under high pressure has caused hemolytic anemia. In pregnant women exposed to 100% oxygen for 20 minutes, the response was a fetal cardiac rate which decreased and became variable.

CHRONIC EXPOSURE:

OXYGEN: Inhalation of pure oxygen for periods up to 16 hours per day for many days at atmospheric pressure has caused no observed injury to man. Administration at atmospheric pressures at concentrations of 60% and 80% may be followed by adverse effects, including severe cough, acute chest pain associated with a decrease in vital capacity, intra-alveolar edema and atelectasis. It is possible that prolonged low-level injury may produce severe fibrotic changes in the lungs. However, after a human was exposed to high concentrations of oxygen for 150 days, severe irreversible retinal atrophy occurred. Dogs exposed to pure oxygen for 48 hours were

found to develop retinal and choroidal detachments. Reproductive effects have been reported in animal studies.

SKIN CONTACT:

ACUTE EXPOSURE:

OXYGEN: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, tingling and pain or numbness. In more severe cases, the skin may become hard and white and develop blisters.

CHRONIC EXPOSURE:

OXYGEN: No adverse effects have been reported.

EYE CONTACT:

ACUTE EXPOSURE:

OXYGEN: May cause irritation if not properly humidified. Due to rapid evaporation, the liquid may cause frostbite with redness, pain and blurred vision.

CHRONIC EXPOSURE:

OXYGEN: No adverse effects have been reported.

INGESTION:

ACUTE EXPOSURE:

OXYGEN: Ingestion of a gas is unlikely. If the liquid is swallowed, frostbite damage of the lips, mouth and mucous membranes may occur.

CHRONIC EXPOSURE:

OXYGEN: No data available.

MGI12831 Page 008 of 009

SECTION 12 ECOLOGICAL INFORMATION

Not available

SECTION 13 DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:
Oxygen, compressed-UN1072
U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:
2.2
U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:
Nonflammable gas; Oxidizer
U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.306
NON-BULK PACKAGING: 49 CFR 173.302
BULK PACKAGING: 49 CFR 173.314, 315
U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:
PASSENGER AIRCRAFT OR RAILCAR: 75 kg
CARGO AIRCRAFT ONLY: 150 kg
LAND TRANSPORT ADR/RID:
SUBSTANCE NAME: Oxygen, compressed
UN NUMBER: UN1072
ADR/RID CLASS: 2
ITEM NUMBER: 1(a)/10
WARNING SIGN/LABEL: 2; 05/2; 05; 13
HAZARD ID NUMBER: 20/25
AIR TRANSPORT IATA/ICAO:
CORRECT TECHNICAL NAME: Oxygen, compressed
UN/ID NUMBER: UN1072
IATA/ICAO CLASS: 2.2
LABEL: Nonflammable gas; Oxidizer
MARITIME TRANSPORT IMDG:
CORRECT TECHNICAL NAME: Oxygen, compressed
UN/ID NUMBER: UN1072
IMDG CLASS: 2(2.2)
SUBSIDIARY RISK LABEL: Oxidizer

MGI12831 Page 009 of 009

EmS No.: 2-04
MFAG Table No.: none
MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:
TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not listed.
CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: N
CHRONIC: N
FIRE: Y
REACTIVE: N
SUDDEN RELEASE: Y
OSHA PROCESS SAFETY (29CFR1910.119): N
STATE REGULATIONS:
California Proposition 65: N
EUROPEAN REGULATIONS:
EC NUMBER (EINECS): 231-956-9
EC RISK AND SAFETY PHRASES:
R 8 Contact with combustible material may cause fire.
S 2 Keep out of reach of children.
S 17 Keep away from combustible material.
GERMAN REGULATIONS:
WATER HAZARD CLASS (WGK): 0 (Official German Classification)

SECTION 16 OTHER INFORMATION

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Material Safety Data Sheets



MGI25130

Page 001 of 006

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
3 GREAT VALLEY PARKWAY
MALVERN, PENNSYLVANIA 19355
PHONE: 610-695-7400
FAX: 610-695-7596

EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SUBSTANCE: XENON
TRADE NAMES/SYNONYMS:
XENON ATOM; STCC 4904595; UN 2036; XE; MGI25130; RTECS ZE1280000
CHEMICAL FAMILY: inorganic, gas
CREATION DATE: May 07 1990
REVISION DATE: Sep 10 1998

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: XENON
CAS NUMBER: 7440-63-3
EC NUMBER (EINECS): 231-172-7
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=0 REACTIVITY=0
EC CLASSIFICATION (CALCULATED): No classification assigned.

EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless gas.
MAJOR HEALTH HAZARDS: difficulty breathing
PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat.
POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: nausea, vomiting, symptoms of drunkenness, suffocation, convulsions, coma
LONG TERM EXPOSURE: no information is available

SKIN CONTACT:

SHORT TERM EXPOSURE: no information is available
LONG TERM EXPOSURE: no information is available

EYE CONTACT:

SHORT TERM EXPOSURE: no information is available
LONG TERM EXPOSURE: no information is available

INGESTION:

SHORT TERM EXPOSURE: no information on significant adverse effects

LONG TERM EXPOSURE: no information is available

CARCINOGEN STATUS:

OSHA: N
NTP: N
IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: Remove from exposure immediately. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Get medical attention.

SKIN CONTACT: Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention, if needed.

EYE CONTACT: Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION: It is unlikely that emergency treatment will be required. Get medical attention, if needed.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Containers may rupture or explode if exposed to heat.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk.

Cool containers with water spray until well after the fire is out. Stay away

MGI25130

Page 002 of 006

from the ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile).

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Stop leak if possible without personal risk. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

MGI25130 Page 003 of 006

SECTION 7 HANDLING AND STORAGE

Cylinder temperature should not exceed 125 F (52 C).

29 CFR Subpart "H"-Hazardous Materials.

National Fire Protection Association publication #55, "Standard for the Storage, Use and Handling of Compressed and Liquified Gases in Portable Cylinders".

Compressed Gas Association publication P-1, "Safe Handling of Compressed Gases in Containers".

Store and handle in accordance with current regulations and standards:

OSHA 29 CFR 1910.101

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

XENON:

No occupational exposure limits established.

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Protective clothing is not required.

GLOVES: Protective gloves are not required, but recommended.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless gas.

MOLECULAR WEIGHT: 131.30

MOLECULAR FORMULA: Xe

BOILING POINT: -162 F (-108 C)

FREEZING POINT: -170 F (-112 C)

VAPOR PRESSURE: 760 mmHg @ -108 C

VAPOR DENSITY (air=1): 4.561

SPECIFIC GRAVITY: Not applicable

DENSITY: 5.8878 g/L

WATER SOLUBILITY: 0.108%

MGI25130 Page 004 of 006

PH: Not applicable

VOLATILITY: Not applicable

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not applicable

VISCOSITY: 0.02324 cP @ 27 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Protect from physical damage and heat. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: halogens

XENON:

CATALYSTS: Interaction may be explosive in the presence of finely divided nickel fluoride or silver difluoride, or nickel(III) oxide, silver(I) oxide, or if initiated by heating.

FLUORINE: Interaction may be explosive in the presence of finely divided nickel fluoride or silver difluoride, or nickel(III) oxide silver(I) oxide, or if initiated by heating.

POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

HEALTH EFFECTS:

INHALATION:

ACUTE EXPOSURE:

XENON: May act as a simple asphyxiant by displacing oxygen. At high concentrations the gas may cause narcosis and anesthesia. Concentrations of simple asphyxiants above 33% may cause rapid respiration, dyspnea, reduced mental alertness and muscular coordination. At higher levels, faulty judgement, depressed sensations, emotional instability and rapid fatigue may occur. As the asphyxia progresses, there may be nausea, vomiting, prostration, unconsciousness, convulsions, deep coma, and death.

CHRONIC EXPOSURE:

XENON: No data available.

SKIN CONTACT:

ACUTE EXPOSURE:

XENON: No data available.

CHRONIC EXPOSURE:

XENON: No data available.

EYE CONTACT:

MG125130 Page 005 of 006

ACUTE EXPOSURE:

XENON: No data available.

CHRONIC EXPOSURE:

XENON: No data available.

INGESTION:

ACUTE EXPOSURE:

XENON: Ingestion of a gas is unlikely.

CHRONIC EXPOSURE:

XENON: No data available.

SECTION 12 ECOLOGICAL INFORMATION

Not available

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:

Xenon, compressed.-UN2036

U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:

2.2

U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:

Nonflammable gas

U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:

EXCEPTIONS: 49 CFR 173.306

NON-BULK PACKAGING: 49 CFR 173.302

BULK PACKAGING: None

U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: 75 kg

CARGO AIRCRAFT ONLY: 150 kg

LAND TRANSPORT ADR/RID:

SUBSTANCE NAME: Xenon/Xenon, compressed

UN NUMBER: UN2036

ADR/RID CLASS: 2

ITEM NUMBER: 5(a)/1A

WARNING SIGN/LABEL: 2/2; 13

HAZARD ID NUMBER: 20

MG125130 Page 006 of 006

AIR TRANSPORT IATA/ICAO:

CORRECT TECHNICAL NAME: Xenon

UN/ID NUMBER: UN2036

IATA/ICAO CLASS: 2.2

LABEL: Nonflammable gas

MARITIME TRANSPORT IMDG:

CORRECT TECHNICAL NAME: Xenon

UN/ID NUMBER: UN2036

IMDG CLASS: 2(2.2)

EmS No.: 2-09

MFAG Table No.: none

MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CERCLA SECTION 103 (40CFR302.4): N

SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N
SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: N
FIRE: N
REACTIVE: N
SUDDEN RELEASE: Y
OSHA PROCESS SAFETY (29CFR1910.119): N
STATE REGULATIONS:
California Proposition 65: N
EUROPEAN REGULATIONS:
EC NUMBER (EINECS): 231-172-7

SECTION 16 OTHER INFORMATION

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Material Safety Data Sheets



MGII0640

Page 001 of 007

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
3 GREAT VALLEY PARKWAY
MALVERN, PENNSYLVANIA 19355
PHONE: 610-695-7400
FAX: 610-695-7596
SUBSTANCE: HELIUM
TRADE NAMES/SYNONYMS:
HELIUM GAS; HELIUM COMPRESSED; HELIUM-4; ATOMIC HELIUM; STCC 4904540; UN 1046;
HE; MGII0640; RTECS MH6520000
CHEMICAL FAMILY: inorganic, gas
CREATION DATE: May 04 1990
REVISION DATE: Sep 10 1998

EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: HELIUM
CAS NUMBER: 7440-59-7
EC NUMBER (EINECS): 231-168-5
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=0 REACTIVITY=0
EC CLASSIFICATION (CALCULATED): No classification assigned.
EMERGENCY OVERVIEW:
PHYSICAL DESCRIPTION: Odorless, colorless, tasteless, inert gas.
MAJOR HEALTH HAZARDS: difficulty breathing
PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat.
POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: nausea, vomiting, dizziness, tingling sensation,
suffocation, convulsions, coma
LONG TERM EXPOSURE: no information on significant adverse effects
SKIN CONTACT:
SHORT TERM EXPOSURE: blisters, frostbite
LONG TERM EXPOSURE: no information is available
EYE CONTACT:
SHORT TERM EXPOSURE: frostbite, blurred vision
LONG TERM EXPOSURE: no information is available
INGESTION:

MGII0640

Page 002 of 007

SHORT TERM EXPOSURE: frostbite
LONG TERM EXPOSURE: no information is available
CARCINOGEN STATUS:
OSHA: N
NTP: N
IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.
SKIN CONTACT: Wash if needed. If frostbite, freezing, or cryogenic burns occur, warm affected area in warm water. If this is not available, gently wrap affected parts in blankets. Allow circulation to return naturally. Get medical attention immediately.
EYE CONTACT: It is unlikely that emergency treatment will be required. Wash with large amounts of water or normal saline until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.
INGESTION: It is unlikely that emergency treatment will be required. Get medical attention, if needed.
NOTE TO PHYSICIAN: For inhalation, consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Negligible fire hazard. Containers may rupture or explode if exposed to heat.
EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical
Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk.
Cool containers with water spray until well after the fire is out. Stay away
from the ends of tanks. Withdraw immediately in case of rising sound from
venting safety device or any discoloration of tanks due to fire. For tank,
rail car or tank truck, evacuation radius: 800 meters (1/2 mile).

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Stop leak if possible without personal risk. Keep unnecessary people away,
isolate hazard area and deny entry. Stay upwind and keep out of low areas.

MG110640 Page 003 of 007

SECTION 7 HANDLING AND STORAGE

Cylinder temperature should not exceed 125 F (52 C).

29 CFR Subpart "H"-Hazardous Materials.

National Fire Protection Association publication #55, "Standard for the
Storage, Use and Handling of Compressed and Liquified Gases in Portable
Cylinders".

Compressed Gas Association publication P-1, "Safe Handling of Compressed Gases
in Containers".

Store and handle in accordance with current regulations and standards:

OSHA 29 CFR 1910.101

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

HELIUM:

No occupational exposure limits established.

VENTILATION: Based on available information, additional ventilation is not
required. Ensure compliance with applicable exposure limits.

EYE PROTECTION: For the gas: Eye protection not required, but recommended. For
the liquid: Wear splash resistant safety goggles. Contact lenses should not
be worn. Provide an emergency eye wash fountain and quick drench shower in
the immediate work area.

CLOTHING: For the gas: Protective clothing is not required. For the liquid:
Wear appropriate protective, cold insulating clothing.

GLOVES: Wear insulated gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory
protection may be needed. Respiratory protection is ranked in order from
minimum to maximum. Consider warning properties before use.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a
pressure-demand or other positive-pressure mode in combination with a
separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless, inert gas.

MOLECULAR WEIGHT: 4.0026

MOLECULAR FORMULA: HE

BOILING POINT: -452 F (-269 C)

FREEZING POINT: -458 F (-272 C) @ 26 atm

VAPOR PRESSURE: 1719 mmHg @ -268 C

VAPOR DENSITY (air=1): 0.138

MG110640 Page 004 of 007

SPECIFIC GRAVITY: Not applicable

DENSITY: 0.1785 g/L @ 0 C

WATER SOLUBILITY: 0.94% @ 0 C

PH: Not applicable

VOLATILITY: Not applicable

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not applicable

VISCOSITY: 0.02012 cP @ 26.8 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

SOLVENT SOLUBILITY:

Insoluble: alcohol

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Protect from physical damage and heat. Containers may
rupture or explode if exposed to heat.

INCOMPATIBILITIES:

HELIUM:

No data available.

POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

HEALTH EFFECTS:

INHALATION:

Do not breathe gas.

HELIUM: Inhalation of mixtures of helium and oxygen may cause distorted speech, increased loss of body heat, and gas emboli at the junction of skin and subcutaneous fat or body fat and blood vessels. See information on simple asphyxiants.

ACUTE EXPOSURE:

SIMPLE ASPHYXIANTS: The symptoms of asphyxia depend on the rapidity with which the oxygen deficiency develops and how long it continues. In sudden acute asphyxia, unconsciousness may be immediate. With slow development there may be rapid respiration and pulse, air hunger, dizziness, reduced awareness, tightness in the head, tingling sensations, incoordination, faulty judgement, emotional instability, and rapid fatigue. As the asphyxia progresses, nausea, vomiting, collapse, unconsciousness, convulsions, deep coma and death are possible.

CHRONIC EXPOSURE:

SIMPLE ASPHYXIANTS: No data available.

SKIN CONTACT:

ACUTE EXPOSURE:

MGII10640 Page 005 of 007

HELIUM: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, tingling and pain or numbness. In more severe cases, the skin may become hard and white and develop blisters.

CHRONIC EXPOSURE:

HELIUM: No data available.

EYE CONTACT:

ACUTE EXPOSURE:

HELIUM: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, pain, and blurred vision.

CHRONIC EXPOSURE:

HELIUM: No data available.

INGESTION:

ACUTE EXPOSURE:

HELIUM: Ingestion of a gas is unlikely. If liquid is swallowed, frostbite damage to the lips, mouth and mucous membranes may occur.

CHRONIC EXPOSURE:

HELIUM: No data available.

SECTION 12 ECOLOGICAL INFORMATION

Not available

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:

Helium, compressed-UN1046

U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:

2.2

U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:

Nonflammable gas

U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:

EXCEPTIONS: 49 CFR 173.306

NON-BULK PACKAGING: 49 CFR 173.302

BULK PACKAGING: 49 CFR 173.302, 314

MGII10640 Page 006 of 007

U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: 75 kg

CARGO AIRCRAFT ONLY: 150 kg

LAND TRANSPORT ADR/RID:

SUBSTANCE NAME: Helium, compressed

UN NUMBER: UN1046

ADR/RID CLASS: 2

ITEM NUMBER: 1(a)/1A

WARNING SIGN/LABEL: 2/2; 13

HAZARD ID NUMBER: 20

AIR TRANSPORT IATA/ICAO:

CORRECT TECHNICAL NAME: Helium, compressed

UN/ID NUMBER: UN1046

IATA/ICAO CLASS: 2.2

LABEL: Nonflammable gas

MARITIME TRANSPORT IMDG:

CORRECT TECHNICAL NAME: Helium, compressed
UN/ID NUMBER: UN1046
IMDG CLASS: 2(2.2)
EmS No.: 2-04
MFAG Table No.: none
MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not listed.
CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N
SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: N
FIRE: N
REACTIVE: N
SUDDEN RELEASE: Y
OSHA PROCESS SAFETY (29CFR1910.119): N
STATE REGULATIONS:
California Proposition 65: N
EUROPEAN REGULATIONS:
EC NUMBER (EINECS): 231-168-5

SECTION 16 OTHER INFORMATION

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MGI10640 Page 007 of 007
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Material Safety Data Sheets



MG111120

Page 001 of 008

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MG INDUSTRIES
3 GREAT VALLEY PARKWAY
MALVERN, PENNSYLVANIA 19355
PHONE: 610-695-7400
FAX: 610-695-7596
SUBSTANCE: HYDROGEN
TRADE NAMES/SYNONYMS:
HYDROGEN GAS; HYDROGEN COMPRESSED; HYDROGEN (H2); DIHYDROGEN; STCC 4905746; UN 1049; H2; MG111120; RTECS MW8900000
CHEMICAL FAMILY: inorganic, gas
CREATION DATE: May 04 1990
REVISION DATE: Sep 10 1998

EMERGENCY CONTACT:
CHEMTREC:
1-800-424-9300

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: HYDROGEN
CAS NUMBER: 1333-74-0
EC NUMBER (EINECS): 215-605-7
EC INDEX NUMBER: 001-001-00-9
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=4 REACTIVITY=0

EC CLASSIFICATION (ASSIGNED):

F+ Extremely Flammable
R 12

EC Classification may be inconsistent with independently-researched data.

EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless gas.

MAJOR HEALTH HAZARDS: difficulty breathing

PHYSICAL HAZARDS: Flammable gas. May cause flash fire.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: nausea, vomiting, dizziness, tingling sensation, suffocation, convulsions, coma

LONG TERM EXPOSURE: no information on significant adverse effects

SKIN CONTACT:

SHORT TERM EXPOSURE: blisters, frostbite

LONG TERM EXPOSURE: no information is available

EYE CONTACT:

SHORT TERM EXPOSURE: frostbite, blurred vision

LONG TERM EXPOSURE: no information is available

INGESTION:

SHORT TERM EXPOSURE: frostbite

LONG TERM EXPOSURE: no information is available

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

SECTION 4 FIRST AID MEASURES

INHALATION: When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.

SKIN CONTACT: Wash if needed. If frostbite, freezing, or cryogenic burns occur, warm affected area in warm water. If this is not available, gently wrap affected parts in blankets. Allow circulation to return naturally. Get medical attention immediately.

EYE CONTACT: It is unlikely that emergency treatment will be required. Wash with large amounts of water or normal saline until no evidence of chemical remains (at least 15-20 minutes). Get medical attention immediately.

INGESTION: It is unlikely that emergency treatment will be required. Get medical attention, if needed.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES

MG111120

Page 002 of 008

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Severe explosion hazard.
Vapor/air mixtures are explosive. Containers may rupture or explode if exposed to heat. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical
Large fires: Flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk.
Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety

MG111120 Page 003 of 008

device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 500 meters (1/3 mile). Consider downwind evacuation if material is leaking. Stop flow of gas.

LOWER FLAMMABLE LIMIT: 4.0%

UPPER FLAMMABLE LIMIT: 75%

AUTOIGNITION: 932 F (500 C)

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Do not touch spilled material. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering.

SECTION 7 HANDLING AND STORAGE

Cylinder temperature should not exceed 125 F (52 C).

29 CFR Subpart "H"-Hazardous Materials.

National Fire Protection Association publication #55, "Standard for the Storage, Use and Handling of Compressed and Liquefied Gases in Portable Cylinders".

Compressed Gas Association publication P-1, "Safe Handling of Compressed Gases in Containers".

Store and handle in accordance with current regulations and standards:

OSHA 29 CFR 1910.101. Store in a cool, dry place. Ventilation required.

Store outside or in a detached building.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

HYDROGEN:

No occupational exposure limits established.

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: For the gas: Eye protection not required, but recommended. For

MG111120 Page 004 of 008

the liquid: Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: For the gas: Protective clothing is not required. For the liquid:

Wear appropriate protective, cold insulating clothing.

GLOVES: Wear insulated gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION: Odorless, colorless, tasteless gas.

MOLECULAR WEIGHT: 2.0

MOLECULAR FORMULA: H2
BOILING POINT: -423 F (-253 C)
FREEZING POINT: -434 F (-259 C)
VAPOR PRESSURE: 760 mmHg @ -253 C
VAPOR DENSITY (air=1): 0.07
SPECIFIC GRAVITY: Not applicable
DENSITY: 0.08987 g/L @ 0 C
WATER SOLUBILITY: 1.82% @ 20 C
PH: Not applicable
VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable
VISCOSITY: 0.008957 cP @ 26.8 C
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable
SOLVENT SOLUBILITY:
Slightly Soluble: alcohol, ether

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.
CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition.
Minimize contact with material. Containers may rupture or explode if exposed to heat.
INCOMPATIBILITIES: metals, oxidizing materials, metal oxides, combustible materials, halogens, metal salts, halo carbons
HYDROGEN:

MG111120 Page 005 of 008

ALKALINE METALS: Ignition at elevated temperatures.
CALCIUM CARBONATE + MAGNESIUM (POWDER): Explosion on heating.
CHLORINE DIOXIDE: Detonates when sparked or on contact with platinum sponge.
COPPER (II) OXIDE: Violent explosion when heated.
DICHLORINE OXIDE: Detonates on ignition.
DIFLUORODIAZENE: Explosive reaction above 90 C.
DINITROGEN OXIDE: Sensitizes hydrogen-oxygen mixtures.
DINITROGEN TETRAOXIDE: Sensitizes hydrogen-oxygen mixtures.
DIOXANE + NICKEL (CATALYST): Explosive reaction above 200 C.
FLUORINE PERCHLORATE: Ignition.
HALOGENS: Ignition or explosive reaction.
INTERHALOGENS: Ignition or explosive reaction.
ISOPROPYL ALCOHOL + PALLADIUM: Ignition.
NITROANISOLE + NICKEL (CATALYST): Explosion.
NITROGEN (LIQUID) + ALKENES: May form explosive products.
NITROGEN OXIDE: Sensitizes hydrogen-oxygen mixtures.
NITROGEN TRIFLUORIDE: Explosive reaction on ignition.
NITROSYL CHLORIDE: Causes ignition in hydrogen-oxygen mixtures.
NITRYL FLUORIDE: Explosion @ 200-300 C.
OXIDIZERS: Ignition or explosion.
OXYGEN: Flammable, explosive mixtures, particularly in the presence of a catalyst.
OXYGEN DIFLUORIDE: Explodes if ignited.
OZONE (SOLID): Highly explosive mixtures with liquid hydrogen.
PALLADIUM(II) OXIDE: Incandesces on contact.
PALLADIUM TRIFLUORIDE: Reduces with incandescence.
1-PENTOL: Explosive reaction on heating.
POLY(CARBON MONOFLUORIDE): Deflagration above 400 C.
1,1,1-TRIS(AZIDOMETHYL)ETHANE + CATALYST: Possible explosion.
1,1,1-TRIS(HYDROXYMETHYL)NITROMETHANE + CATALYST: Possible explosion.
UNSATURATED HYDROCARBONS: Hydrogenation of unsaturated hydrocarbons in the presence of a catalyst may proceed with explosive violence if conditions are not properly controlled.
XENON HEXAFLUORIDE: Violent reaction.
POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

HEALTH EFFECTS:

INHALATION:

HYDROGEN: See information on simple asphyxiants.

ACUTE EXPOSURE:

SIMPLE ASPHYXIANTS: The symptoms of asphyxia depend on the rapidity with which the oxygen deficiency develops and how long it continues. In sudden acute asphyxia, unconsciousness may be immediate. With slow development there may be rapid respiration and pulse, air hunger, dizziness, reduced awareness, tightness in the head, tingling sensations, incoordination, faulty judgement, emotional instability, and rapid fatigue. As the asphyxia progresses, nausea, vomiting, collapse, unconsciousness, convulsions, deep coma and death are possible.

MG111120 Page 006 of 008

CHRONIC EXPOSURE:

SIMPLE ASPHYXIANTS: No data available.

SKIN CONTACT:
ACUTE EXPOSURE:
HYDROGEN: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, tingling and pain or numbness. In more severe cases, the skin may become hard and white and develop blisters.
CHRONIC EXPOSURE:
HYDROGEN: No data available.
EYE CONTACT:
ACUTE EXPOSURE:
HYDROGEN: No adverse effects have been reported from the gas. Due to rapid evaporation, the liquid may cause frostbite with redness, pain and blurred vision.
CHRONIC EXPOSURE:
HYDROGEN: No data available.
INGESTION:
ACUTE EXPOSURE:
HYDROGEN: Ingestion of a gas is unlikely. If liquid is swallowed, frostbite damage to the lips, mouth and mucous membranes may occur.
CHRONIC EXPOSURE:
HYDROGEN: No data available.

SECTION 12 ECOLOGICAL INFORMATION

Not available

SECTION 13 DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101 SHIPPING NAME-UN NUMBER:
Hydrogen, compressed-UN1049
U.S. DOT 49 CFR 172.101 HAZARD CLASS OR DIVISION:
2.1
U.S. DOT 49 CFR 172.101 AND SUBPART E LABELING REQUIREMENTS:
Flammable gas

MG111120 Page 007 of 008

U.S. DOT 49 CFR 172.101 PACKAGING AUTHORIZATIONS:
EXCEPTIONS: 49 CFR 173.306
NON-BULK PACKAGING: 49 CFR 173.302
BULK PACKAGING: 49 CFR 173.302, 314
U.S. DOT 49 CFR 172.101 QUANTITY LIMITATIONS:
PASSENGER AIRCRAFT OR RAILCAR: Forbidden
CARGO AIRCRAFT ONLY: 150 kg
LAND TRANSPORT ADR/RID:

SUBSTANCE NAME: Hydrogen, compressed
UN NUMBER: UN1049
ADR/RID CLASS: 2
ITEM NUMBER: 1(b)/1F
WARNING SIGN/LABEL: 3/3; 13
HAZARD ID NUMBER: 23

AIR TRANSPORT IATA/ICAO:
CORRECT TECHNICAL NAME: Hydrogen, compressed
UN/ID NUMBER: UN1049
IATA/ICAO CLASS: 2.1
LABEL: Flammable gas

MARITIME TRANSPORT IMDG:
CORRECT TECHNICAL NAME: Hydrogen, compressed
UN/ID NUMBER: UN1049
IMDG CLASS: 2(2.1)
EmS No.: 2-02
MFAG Table No.: none
MARINE POLLUTANT: N

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:
TSCA INVENTORY STATUS: Y
TSCA 12(b) EXPORT NOTIFICATION: Not listed.
CERCLA SECTION 103 (40CFR302.4): N
SARA SECTION 302 (40CFR355.30): N
SARA SECTION 304 (40CFR355.40): N
SARA SECTION 313 (40CFR372.65): N
SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: N
FIRE: Y

REACTIVE: N
SUDDEN RELEASE: N
OSHA PROCESS SAFETY (29CFR1910.119): N
STATE REGULATIONS:
California Proposition 65: N
EUROPEAN REGULATIONS:
EC NUMBER (EINECS): 215-605-7

MG111120 Page 008 of 008

EC RISK AND SAFETY PHRASES:

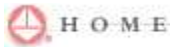
R 12 Extremely flammable.
S 2 Keep out of reach of children.
S 9 Keep container in a well-ventilated place.
S 16 Keep away from sources of ignition - No smoking.
S 33 Take precautionary measures against static discharges.

GERMAN REGULATIONS:

WATER HAZARD CLASS (WGK): 0 (Official German Classification)

SECTION 16 OTHER INFORMATION

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