# Hydrogen Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 13 April 1977<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Hydrogen, or Liquid Hydrogen (in cryogenic liquid state) | CHEMICAL NAME AND SYNONYMS<br>Hydrogen |
| | FORMULA<br>$H_2$ MW: 2.016 | CHEMICAL FAMILY<br>Flammable Gas CAS #1333-74-0 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

Hydrogen is a simple asphyxiant and has no threshold limit value (TLV). Hydrogen is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Hydrogen is nontoxic and classified as a simple asphyxiant. Symptoms of anoxia occur only when gas concentrations are within the flammable range and the mixture has not ignited. DO NOT ENTER AREAS WITHIN THE FLAMMABLE RANGE DUE TO THE IMMEDIATE FIRE AND EXPLOSION HAZARD. Contact of skin with liquid hydrogen or cold gas vapors can cause cryogenic (extremely low temperature) burns and freeze tissues.

TOXICOLOGICAL PROPERTIES

Hydrogen is nontoxic and classified as a simple asphyxiant, but is extremely flammable. The amount of hydrogen gas necessary to reduce oxygen concentrations below life support levels is well within the flammable range. Do not enter areas containing flammable mixtures due to the immediate fire and explosion hazard.

RECOMMENDED FIRST AID TREATMENT

If cryogenic liquid or cold boil-off gas contacts worker's skin or eyes, frozen tissue should be flooded or soaked with tepid water (105-115F; 41-46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician. First degree burns (reddening only, as sunburn), or second degree burns (blistering) which are the result of fire exposure and are localized to a portion of an extremity or other small area of the body may be immersed in cool water for 10-15 minutes to relieve pain. Do NOT immerse the whole body in a cold bath. All thermal injuries except the most minor and localized burns should be referred promptly for medical care. Burned areas should be covered with the cleanest available material, such as a clean sheet, prior to transport. Do NOT use burn ointments or greasy materials on burns which show more than localized reddening. Persons suffering from lack of oxygen should be moved to areas with normal atmosphere. Assisted respiration and supplemental oxygen should be given if the victim is not breathing.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A (gas at normal temperatures) | 932F (500C) | In air @ 1 atm | 4.0% | 74.2% |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| Dry Chemical, carbon dioxide, or Halon | GROUP Class I, Group B |

SPECIAL FIRE FIGHTING PROCEDURES

Shut off source of hydrogen. When possible, allow fire to burn itself out. Spray water on adjoining equipment to keep it cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Hydrogen can burn with almost an invisible flame of low thermal radiation. People have unknowingly walked into hydrogen flames Easily ignited; minimum ignition energy is low (0.2MJ) and flammable range is wide. Flame propagates at rapid rate. Potential explosion hazard from reignition if fire is extinguished without shutting off hydrogen source. Hydrogen gas is buoyant and can accumulate in the upper sections of enclosed spaces.

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 423.0F (– 252.8C) | @ 1 atm – 434.5F (– 259.2C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 68F (20C), 1 atm 1.82% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.005229 | @ 68F (20C), 1 atm 0.0696 | @ boiling point, 1 atm 4.432 | @ boiling point, 1 atm 0.071 |

APPEARANCE AND ODOR

Both liquid and gaseous hydrogen are colorless and odorless.

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | Sources of ignition, sparks, flames, hot objects. |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

Oxidizing materials. Some steels are susceptible to hydrogen attack or embrittlement at high temperature and pressure.

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

DO NOT ENTER areas containing flammable mixtures of hydrogen in air. Avoid contact of skin with liquid hydrogen or cold boil-off gas. Ventilate enclosed areas to prevent formation of flammable or oxygen-deficient atmospheres. See “VENTILATION” below. Eliminate all potential sources of ignition. Move a leaking compressed gas cylinder out of doors if leak is small. Consult **Welsco, Inc.** for additional assistance.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual gaseous hydrogen in cylinders. Return cylinders to **Welsco, Inc.** with positive residual pressure, cylinder valve tightly closed, and valve cap in place. Do not dispose of liquid hydrogen – contact **Welsco, Inc.** for assistance.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas or vapor is present | As necessary | Mechanical ventilation must meet National Electric Code (NEC) requirements for Class I, Group B |
| | MECHANICAL (General) | OTHER |
| | As necessary | Only as necessary |

PROTECTIVE GLOVES

(Liquid) Loose-fitting of impermeable materials, such as leather. Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling compressed gas cylinders. Use safety glasses or goggles when handling liquid.

OTHER PROTECTIVE EQUIPMENT

None

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Hydrogen or Hydrogen, Compressed; (Liquid) Hydrogen, refrigerated liquid.
DOT Hazard Class: Flammable Gas.
DOT Shipping Label: Flammable Gas.
I.D. Number: UN 1049 (Hydrogen or Hydrogen, Compressed); UN 1966 (Liquid Hydrogen).

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid hydrogen with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Compressed gas cylinders contain hydrogen at extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent back flow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Store liquid containers and cylinders in well-ventilated areas. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. Cylinder storage of hydrogen should be segregated from oxidizers such as oxygen, fluorine, etc. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Gaseous hydrogen containers meet DOT specifications or American Society of Mechanical Engineers (ASME) codes. Liquid hydrogen is stored in vacuum-insulated containers meeting DOT specifications or ASME codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Liquid hydrogen in exposed piping can actually cause air to condense and liquefy. The nitrogen in this liquid can evaporate more rapidly, leaving an oxygen enriched liquid behind. Utilize oxygen-compatible insulating materials and minimize exposed piping surface areas. Use only metals and materials compatible with extremely low temperatures. Avoid use of carbon steel and other metals which become brittle in low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the written permission of the owner is a violation of Federal Law. The atmosphere in areas in which hydrogen gas may be vented and collect should be tested with a portable or continuous flammable gas analyzer.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Nitrogen Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | | |
|---|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | | |
| ISSUE DATE | Issued: 13 April 1977 | TRADE NAME AND SYNONYMS<br>Nitrogen, or LIN (in cryogenic liquid state) | CHEMICAL NAME AND SYNONYMS<br>Nitrogen |
| REVISIONS | Rev: 1 December 2009 | FORMULA<br>$N_2$ MW: 28.01 | CHEMICAL FAMILY<br>Inert gas CAS #7727-37-9 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA: None established. ACGIH: Simple Asphyxiant. Nitrogen is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Nitrogen is odorless and nontoxic, but may produce suffocation by diluting the concentration of oxygen in air below levels necessary to support life. PERSONNEL, **INCLUDING RESCUE WORKERS**, SHOULD NOT ENTER AREAS WHERE THE OXYGEN CONCENTRATION IS BELOW 19.5% UNLESS PROVIDED WITH A SELF-CONTAINED BREATHING APPARATUS OR AIRLINE RESPIRATOR. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death. Death may result from errors in judgement, confusion, or loss of consciousness which prevents self-rescue. At low oxygen concentrations unconsciousness and death may occur in seconds without warning. Extensive tissue damage or burns can result from exposure to liquid nitrogen or cold nitrogen vapors.

TOXICOLOGICAL PROPERTIES

Nitrogen is a simple asphyxiant and constitutes 78% of the air we breathe. Nitrogen does not support life and may produce immediately hazardous atmospheres through the displacement of oxygen. Nitrogen under high pressure can produce narcosis even though oxygen sufficient for life is present.

RECOMMENDED FIRST AID TREATMENT

Persons suffering from lack of oxygen should move to areas with normal atmospheres. SEL-CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts a worker's skin or eyes, frozen tissues should be flooded or soaked with tepid water (105-115F; 41-46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | Non-flammable | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| N/A | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS

Cylinders exposed to high heat or flame may vent rapidly.

## PHYSICAL DATE

| BOILING POINT (ºF) | FREEZING POINT (ºF) |
|---|---|
| @ 1 atm – 320.5F (– 195.8C) | @ 1 atm – 346.0F (– 210.0C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 68F (20C), 1 atm 1.52% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 70F (2.1C), 1 atm 0.005229 | @ 68F (20C), 1 atm 0.967 | @ boiling point, 1 atm 50.47 | @ boiling point, 1 atm 0.88 |

APPEARANCE AND ODOR

Both liquid and gaseous nitrogen are colorless and odorless

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| Inert | UNSTABLE | | None |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

None

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Avoid contact of skin with liquid nitrogen or its cold boil-off gas. Flush liquid nitrogen spill with water to disperse. Ventilate enclosed areas to prevent formation of oxygen-deficient atmospheres caused by the evaporation of liquid nitrogen or the release of gaseous nitrogen.

WASTE DISPOSAL METHOD

Allow liquid nitrogen to evaporate in a well ventilated outdoor location remote from work areas. Vent nitrogen gas slowly to a well ventilated outdoor location remote from work areas. Do not attempt to dispose of residual nitrogen in compressed gas cylinders. Return cylinders to **Welsco, Inc.** with residual pressure, the cylinder valve tightly closed and valve caps in place.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Use self-contained breathing apparatus in oxygen-deficient atmospheres. Caution! Respirators will not function. Use may result in asphyxiation.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas is present | As necessary | As necessary |
| | MECHANICAL (General) | OTHER |
| | As necessary | Vents should be situated to avoid higher than normal concentration of nitrogen in work areas. |

PROTECTIVE GLOVES

(LIN) Loose-fitting gloves of impermeable materials, such as leather. Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

(LIN) Chemical goggles or safety glasses. Safety glasses are recommended when handling high-pressure cylinders.

OTHER PROTECTIVE EQUIPMENT

None

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Nitrogen or Nitrogen, Compressed; (LIN) Nitrogen, refrigerated liquid.
DOT Hazard Class: Nonflammable Gas.
DOT Shipping Label: Nonflammable Gas.
I.D. Number: UN 1066 (Nitrogen or Nitrogen, Compressed); UN 1977 (LIN).

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid nitrogen or cold boil-off gas with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Compressed gas cylinders contain nitrogen at extremely high pressure and should be handled with care. Use a pressure-reducing regulator and pressure relief devices when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent back flow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

It is recommended that liquid cylinders be stored outside and the gas or liquid piped to the use point. However, if liquid cylinders are to be stored or transported in an enclosed area, it is essential that the area be well ventilated. In case of poor natural ventilation, forced ventilation should be installed. Keep cylinders away from source of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Replace the cylinder cap when the cylinder is not in use. Avoid exposure to areas where salt or other corrosive chemicals are present. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Gaseous nitrogen containers meet DOT specifications or American Society of Mechanical Engineers (ASME) codes. Liquid nitrogen is stored in vacuum-insulated containers meeting DOT specifications or ASME codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Liquid nitrogen is a cryogenic liquid. Materials of construction must be selected for compatibility with extremely low temperatures. Avoid use of carbon steel and other materials which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the written permission of the owner is a violation of Federal Law. If oxygen-deficient atmospheres are suspected or can occur, use oxygen monitoring equipment to test for oxygen deficient atmospheres.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Carbon Dioxide Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

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|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 1 November 1977<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Carbon Dioxide (Gas)<br>Dry Ice (Solid Only) | CHEMICAL NAME AND SYNONYMS<br>Carbon Dioxide, Carbonic Anhydride<br>Carbonic Acid Gas |
| | FORMULA<br>$CO_2$ MW: 44.01 | CHEMICAL FAMILY<br>Nonmetallic Oxides CAS #124-38-9 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA TWA = 10,000 ppm. ACGIH TWA = 5,000 ppm; OSHA/ACGIH STEL = 30,000 ppm.
Carbon Dioxide is not listed by IARC, NTP, or OSHA as a carcinogen.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Carbon dioxide does not support life and may produce immediately hazardous atmospheres. At a concentration in excess of 1.5% carbon dioxide may produce hyperventilation, headaches, visual disturbances, tremor, loss of consciousness and death. Symptoms of exposure in the concentration ranges of 1.5-5% may be highly variable, but typically symptoms of carbon dioxide intoxication include the following:

| CO Concentration | Symptoms |
|---|---|
| 3-6% | Headache, dyspnea, perspiration |
| 6-10% | Headache, dyspnea, perspiration, tremors, visual disturbance, unconsciousness |
| Over 10% | Unconsciousness |

If the concentration of carbon dioxide exceeds 10%, unconsciousness can occur without warning, preventing self-rescue. At much higher concentrations, carbon dioxide displaces the oxygen in air below levels necessary to support life.

TOXICOLOGICAL PROPERTIES

Carbon dioxide is a minor but important constituent of the atmosphere, averaging about 0.03% or 300 ppm by volume. At higher concentrations it affects the respiratory rate. Additional symptoms are described above.

RECOMMENDED FIRST AID TREATMENT

Persons suffering from the toxic effect of carbon dioxide should be moved to areas with normal atmosphere. SELF-CONTAINED BREATHING APPARATUS MAY BE NECESSARY TO PREVENT TOXIC EXPOSURE OR ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. Frozen tissues should be flooded or soaked with tepid water (105-115F; 41-46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| Carbon dioxide is an extinguishing agent for Class B & C fires. | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS

N/A

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 109.3F (– 78.5C) | @ 76 psia – 69.9F (– 56.6C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| @ 68F (20C) 831 psia (56.5 atm) | @ 68F (20C), 1 atm 87.8% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.115 | @ 68F (20C), 1 atm 1.53 | @ – 35F (– 37C), 11 atm 68.74 | solid @ – 110F (– 79C), 1 atm 1.56 |

APPEARANCE AND ODOR

Carbon dioxide is colorless and odorless as gas or liquid. It is stored in containers under its own vapor pressure. If the pressure is suddenly relieved, the liquid rapidly cools as it evaporates and sublimes, forming dry ice at – 109.3F (– 78.5C).

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | None |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

If moisture is present, materials must resist carbonic acid.

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Carbon dioxide in small quantities will vaporize leaving behind carbon dioxide “snow” (a combination of dry ice and water ice where atmospheric moisture is present). Ventilate indoor areas well to avoid hazardous carbon dioxide concentrations. Ventilate well and avoid contact with cold vapors or dry ice. Carbon dioxide is a heavy gas and will remain in low spots without assisted ventilation.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual carbon dioxide in compressed gas cylinders. Return cylinders to **Welsco, Inc.** with residual pressure, the cylinder valve tightly closed, and the valve cap in place. When disposing of bulk quantities of carbon dioxide from refrigerated storage tanks, always dispose of carbon dioxide outside, in a well ventilated location away from work areas, where vapors can disperse. Vent to the atmosphere slowly since rapid depressurization of the container will cause the formation of solid carbon dioxide (dry ice) internally, requiring longer periods to vaporize.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Use self-contained breathing apparatus in oxygen-deficient atmospheres or where carbon dioxide exceeds 1.5%.
CAUTION! Air purifying respirators will not function. Their use may result in asphyxiation.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas or vapors are present. | May be useful at point sources of $CO_2$ vapors | As necessary |
| | MECHANICAL (General) | OTHER |
| | Where low lying areas are not naturally ventilated. | Vents should be situated to avoid higher than normal concentration of carbon dioxide in work areas. |

PROTECTIVE GLOVES

Use loose-fitting gloves of impermeable materials, such as leather when working with cold liquid, solid, or vapor.

EYE PROTECTION

Safety glasses are recommended when handling high-pressure cylinders and in areas where vapors are discharges.

OTHER PROTECTIVE EQUIPMENT

None

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Carbon Dioxide. DOT Hazard Class: Nonflammable Gas. DOT Shipping Label: Nonflammable Gas.
I.D. Number: UN 1013

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid $CO_2$ , cold vapors, or carbon dioxide “snow” with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Compressed gas cylinders contain gaseous and liquid carbon dioxide at extremely high pressure. and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent backflow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Store liquid containers and cylinders in well-ventilated areas. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. Store carbon dioxide cylinders with the valve end up. See Compressed GasAssociation Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Carbon dioxide containers meet Department of Transportation (DOT) specifications or American Society of Mechanical Engineers (ASME) codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

In applications where temperatures less than –20F (–29C) are expected, avoid the use of carbon steel and other materials which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without permission of the owner is a violation of Federal Law. The atmosphere in areas in which $CO_2$ gas may be vented and collect should be tested with a portable or continuous monitoring $CO_2$ gas analyzer.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Argon
# Material Safety
# Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 13 April 1977<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Argon, or LAR (in cryogenic liquid state) | CHEMICAL NAME AND SYNONYMS<br>Argon |
| | FORMULA<br>Ar MW: 39.95 | CHEMICAL FAMILY<br>Inert Gas CAS #7440-37-1 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

Argon is a simple asphyxiant and has no threshold limit value (TLV). Argon is not listed as a carcinogen by NTP, IARC, or OSHA

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Argon is odorless and nontoxic, but may produce suffocation by diluting the concentration of oxygen in air below levels necessary to support life. PERSONNEL, **INCLUDING RESCUE WORKERS**, SHOULD NOT ENTER AREAS WHERE THE OXYGEN CONCENTRATION IS BELOW 19.5% UNLESS PROVIDED WITH A SELF-CONTAINED BREATHING APPARATUS OF AIRLINE RESPIRATOR. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death. Death may result from errors in judgment, confusion, or loss of consciousness which prevents self-rescue. At low oxygen concentrations unconsciousness and death may occur in seconds without warning. Extensive tissue damage or burns can result from exposure to liquid argon or cold vapors.

TOXICOLOGICAL PROPERTIES

Argon is nontoxic but can act as a simple asphyxiant by displacing the amount of oxygen in the air necessary to support life.

RECOMMENDED FIRST AID TREATMENT

Persons suffering from lack of oxygen should be moved to areas with normal atmospheres. SELF-CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts a worker's skin or eyes, frozen tissues should be flooded or soaked with tepid water (105 - 115F; 41 - 46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | Non-flammable | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| N/A | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS

Cylinders exposed to high heat or flame may vent rapidly.

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 302.6F (– 185.9C) | @ 1 atm – 308.9F (– 189.4C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 68F (20C), 1 atm 3.35% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.104 | @ 68F (20C), 1 atm 1.38 | @ boiling point, 1 atm 87.40 | @ boiling point, 1 atm 1.40 |

APPEARANCE AND ODOR

Both liquid and gaseous hydrogen are colorless and odorless

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | None |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

None

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Avoid contact of skin with liquid argon or its cold boil-off gas. Flush liquid argon spill with water to disperse. Ventilate enclosed areas to prevent formation of oxygen-deficient atmosphere caused by the evaporation of liquid argon or the release of gaseous argon. Argon is heavier than air and may tend to collect in low areas if ventilation is not adequate.

WASTE DISPOSAL METHOD

Allow liquid argon to evaporate in a well ventilated outdoor location remote from work areas. Vent argon gas slowly to a well ventilated outdoor location remote from work areas. Do not attempt to dispose of residual argon in compressed gas cylinders. Return cylinders to **Welsco, Inc.** with residual pressure, cylinder valve tightly closed and valve caps in place.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Use self-contained breathing apparatus in oxygen-deficient atmosphere. Caution! Respirators will not function. Use may result in asphyxiation.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas or vapors are present | As necessary | Only as necessary |
| | MECHANICAL (General) | OTHER |
| | As necessary | Vents should be situated to avoid higher than normal concentration of argon in work areas. |

PROTECTIVE GLOVES

(LAR) Loose-fitting of impermeable materials, such as leather. Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling high-pressure cylinders. Chemical goggles or safety glasses should be used when handling LAR.

OTHER PROTECTIVE EQUIPMENT

None

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Argon, or Argon, Compressed; (LAR) Argon, refrigerated liquid.
DOT Hazard Class: Nonflammable Gas.
DOT Shipping Label: Nonflammable Gas.
I.D. Number: UN 1006 (Argon or Argon, Compressed); UN 1951 (LAR).

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid argon with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Compressed gas cylinders contain argon at extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent back flow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Store liquid containers and cylinders in well-ventilated areas. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Gaseous argon containers meet DOT specifications or American Society of Mechanical Engineers (ASME) codes. Liquid argon is stored in vacuum-insulated containers meeting DOT specifications or ASME codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Liquid argon is a cryogenic liquid. Materials of construction must be selected for compatibility with extremely low temperatures. Avoid use of carbon steel and other materials which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without written permission of the owner is a violation of Federal Law. If oxygen-deficient atmospheres are suspected or can occur, use oxygen monitoring equipment to test for oxygen deficient atmospheres.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Carbon Monoxide Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 13 April 1977<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Carbon Monoxide | CHEMICAL NAME AND SYNONYMS<br>Carbon Monoxide |
| | FORMULA<br>CO MW: 28.01 | CHEMICAL FAMILY<br>Nonmetallic oxides CAS #630-08-0 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA TWA = 35 ppm; Ceiling = 200 ppm. ACGIH TWA = 50 ppm; STEL = 400 ppm. NIOSH: IDLH = 1500 ppm.
Carbon Monoxide is not listed by IARC, NTP, or OSHA as a carcinogen.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Symptoms of exposure to carbon monoxide include headache, palpitations (pounding heart), dizziness, weakness, confusion, and nausea. LOSS OF CONSCIOUSNESS AND DEATH MAY RESULT FROM CONTINUED OR MORE INTENSE EXPOSURE. Low levels of carbon monoxide in air which are not immediately hazardous to life may impair the reaction time or sensory perception. Chronic exposure to low levels of carbon monoxide may adversely affect the cardiovascular system. Carbon monoxide is colorless, tasteless, and odorless, and is detectable only by specific techniques or instrumentation. For these reasons precautions are required when hazardous concentrations are possible. The primary route of entry is inhalation.

TOXICOLOGICAL PROPERTIES

Carbon monoxide is the only commonly used industrial gas which is both highly toxic and odorless. Carbon monoxide is a chemical asphyxiant which exerts its effects by combining with hemoglobin, the oxygen-transport pigment of the blood. Since the affinity of carbon monoxide for hemoglobin is approximately 300 times the affinity of oxygen for this pigment, carbon monoxide combines preferentially with hemoglobin small amounts of the gas can pose a serious hazard. The carbon monoxide-hemoglobin bond is reversible, and the gas is gradually released if uncontaminated air is breathed.

RECOMMENDED FIRST AID TREATMENT

Avoid hazardous exposure of rescue personnel. Persons overcome by carbon monoxide should be moved away from the contamination and into fresh air. For persons who are not breathing, assisted ventilation is required. Oxygen should be administered to persons who are unconscious or not breathing. Seek medical attention promptly. Keep victim warm.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A (gas at normal temperatures) | 1128F (609C) | In air @ 1 atm | 12.5% | 74% |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| Dry Chemical, carbon dioxide, or Halon | GROUP Class I, Group C |

SPECIAL FIRE FIGHTING PROCEDURES

Turn off source of carbon monoxide. When possible, allow fire to burn itself out. Spray water on adjoining equipment to keep it cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS

A potential explosion hazard exists if a carbon monoxide fire is extinguished without turning off the carbon monoxide source do to the possibility of reignition.

## PHYSICAL DATE

| BOILING POINT (ºF) | FREEZING POINT (ºF) |
|---|---|
| @ 1 atm – 312.7F (– 191.5C) | @ 1 atm – 337.1F (– 205.1C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 68F (20C), 1 atm 2.32% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.0728 | @ 68F (20C), 1 atm 0.968 | @ boiling point, 1 atm 49.5 | @ boiling point, 1 atm 0.793 |

APPEARANCE AND ODOR

Carbon monoxide is colorless and odorless

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | Do not expose to heat or flame. |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

Reacts with oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate area immediately. Do not enter contaminated area without positive pressure type self-contained breathing apparatus. Remove all sources of ignition, sparks and flames. Ventilate area to dispose of carbon monoxide concentration. Contact **Welsco, Inc.** for assistance.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual gaseous carbon monoxide in cylinders. Return cylinders to **Welsco, Inc.** with positive pressure in cylinder, cylinder valve tightly closed, and valve cap in place.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Positive pressure-type, self-contained breathing apparatus is recommended for emergency use. Caution! In some cases, carbon monoxide concentration may be within the flammable range.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where carbon monoxide is used or stored. | As necessary | Mechanical ventilation must meet National Electric Code (NEC) requirements for Class I, Group C |
| | MECHANICAL (General) | OTHER |
| | As necessary | Only as necessary |

PROTECTIVE GLOVES

Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling compressed gas cylinders.

OTHER PROTECTIVE EQUIPMENT

None

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Carbon Monoxide
DOT Hazard Class: 2.3
DOT Shipping Label: Poison Gas, Flammable Gas.
I.D. Number: UN 1016

SPECIAL HANDLING RECOMMENDATIONS

USE ONLY IN WELL VENTILATED AREAS. Carbon monoxide gas cylinders contain gas at high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to low pressure piping systems. Secure cylinders when in use. Never expose a cylinder to heat. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Storage of carbon monoxide cylinders outdoors is preferred. Enclosed storage area must be well ventilated. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Keep carbon monoxide cylinder storage areas away from storage of oxygen and other oxidizers. Storage areas should be free of combustible material Avoid exposure to areas where salt or other corrosive materials are present. Consult Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Gaseous carbon monoxide is transported in containers meeting DOT specifications. Permanent storage vessels for carbon monoxide meet American Society of Mechanical Engineers (ASME) codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law. The atmosphere in areas in which CO gas may be vented and collect should be tested with a portable or continuous monitoring CO gas analyzer.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Helium
# Material Safety
# Data Sheet

NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 13 April 1977<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Helium, or Liquid Helium | CHEMICAL NAME AND SYNONYMS<br>Helium |
| | FORMULA<br>He MW: 4.003 | CHEMICAL FAMILY<br>Inert Gas CAS #7440-59-7 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA: None established. ACGIH: Simple Asphyxiant. Helium is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Helium is odorless and nontoxic, but may produce suffocation by diluting the concentration of oxygen in air below levels necessary to support life. PERSONNEL, **INCLUDING RESCUE WORKERS**, SHOULD NOT ENTER AREAS WHERE THE OXYGEN CONCENTRATION IS BELOW 19.5%, UNLESS PROVIDED WITH A SELF-CONTAINED BREATHING APPARATUS OR AIRLINE RESPIRATOR. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death. Death may result from errors in judgement, confusion, or loss of consciousness which prevents self-rescue. At low oxygen concentrations unconsciousness and death occur in seconds without warning. Extensive tissue damage or burns can result from exposure to liquid helium or cold helium vapors.

TOXICOLOGICAL PROPERTIES

Helium is nontoxic but can act as a simple asphyxiant by displacing the amount of oxygen in air necessary to support life.

RECOMMENDED FIRST AID TREATMENT

Persons suffering from lack of oxygen should be moved to areas with normal atmospheres. Self-contained BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts worker's skin or eyes, frozen tissue should be flooded or soaked with tepid water (105-115F; 41-46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| N/A | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

N/A.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Cylinder(s) exposed to intense heat or fire may vent rapidly or explode.

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 452.1F (– 268.9C) | @ 367 psia – 458.0F (– 272.0C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 68F (20C), 1 atm 0.861% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 32F (0C), 1 atm 0.01114 | @ 32F (0C), 1 atm 0.138 | @ boiling point, 1 atm 7.798 | @ boiling point, 1 atm 0.125 |

APPEARANCE AND ODOR

Helium is colorless and odorless in both gaseous and liquid states.

# REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | None |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

None

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

# SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Avoid contact of skin with liquid helium or its cold boil-off gas. Flush liquid spill with water to disperse. Ventilate enclosed areas to prevent formation of oxygen-deficient atmospheres caused by evaporation of liquid helium or the release of gaseous helium.

WASTE DISPOSAL METHOD

Allow liquid helium to evaporate in a well-ventilated location remote from work areas. Vent helium gas slowly to a well-ventilated outdoor location remote from work areas. Do not attempt to dispose of residual helium in compressed gas cylinders. Return cylinders to **Welsco, Inc.** with residual pressure, the cylinder valve tightly closed and valve cap in place.

# SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Use self-contained breathing apparatus in oxygen-deficient atmosphere. Caution! Air purifying respirators will not function. Their use may result in asphyxiation.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas is present | As necessary | Only as necessary |
| | MECHANICAL (General) | OTHER |
| | As necessary | Vents should be situated to avoid higher than normal concentration of helium in work areas. |

PROTECTIVE GLOVES

Loose-fitting gloves of impermeable material, such as leather are recommended when handling liquid. Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling high-pressure cylinders. Use chemical goggles or a face shield with safety glasses when handling liquid.

OTHER PROTECTIVE EQUIPMENT

None

# SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Helium or Helium, Compressed; (Liquid) Helium, refrigerated liquid.; DOT Hazard Class: Nonflammable Gas. DOT Shipping Label: Nonflammable Gas.; I.D. Number: UN 1046 (Helium or Helium, Compressed); UN 1963 (Liquid Helium).

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid helium or cold boil-off gas with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Compressed gas cylinders contain helium at extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent back flow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Store liquid containers and cylinders in well-ventilated areas. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or corrosive chemicals are present. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Gaseous helium containers meet DOT specifications or American Society of Mechanical Engineers (ASME) codes. Liquid helium is stored in vacuum-insulated containers meeting DOT specifications or ASME codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Liquid helium in exposed piping can actually cause air to condense and liquefy. The nitrogen in this liquid can evaporate more rapidly, leaving an oxygen enriched liquid behind. Utilize oxygen-compatible insulating materials and minimize exposed piping surface areas. Use only metals and materials compatible with extremely low temperatures. Avoid use of carbon steel and other metals which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the written permission of the owner is a violation of Federal Law. If oxygen-deficient atmospheres are suspected or can occur, use oxygen monitoring equipment to test for oxygen-deficient atmospheres.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Nitrous Oxide Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 7 April 1978<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Nitrous oxide | CHEMICAL NAME AND SYNONYMS<br>Nitrous oxide, dinitrogen monoxide, nitrogen monoxide |
| | FORMULA<br>$N_2O$ MW: 44.02 | CHEMICAL FAMILY<br>Flammable Gas CAS #1333-74-0 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA: None established. ACGIH: TWA = 50 ppm. Nitrous Oxide is not listed as a carcinogen by NTP, IARC or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

If nitrous oxide dilutes the oxygen content of the air sufficiently, air hunger, headaches, dizziness, nausea, vomiting, bewilderment and loss of consciousness or death may occur. When inhaled in high concentrations for a few seconds, nitrous oxide affects the central nervous system and produces a type of hysteria, hence the name, “laughing gas.” Contact with cold liquid or cold gaseous nitrous oxide can cause cryogenic-type burns and freeze tissues.

TOXICOLOGICAL PROPERTIES

Nitrous oxide acts as a simple asphyxiant by displacing the amount of oxygen in air necessary to support life. Current scientific evidence suggests that chronic exposure to low concentrations of anesthetic agents increases the risk of spontaneous abortion and congenital anomalies in children born to female workers and to male workers. The extent to which such phenomena may be due specifically to nitrous oxide, as opposed to other anesthetic gases, is presently unknown. The National Institute for Occupational Safety and Health (NIOSH) recommends maximum occupational airborne concentrations for nitrous oxide of 25 parts per million for anesthetic administration and 50 parts per million in dental offices.

RECOMMENDED FIRST AID TREATMENT

Persons suffering from lack of oxygen should be moved to an area with normal atmosphere. SELF-CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. Recovery is usually rapid. Treat symptomatically thereafter. Frozen tissues due to contact with liquid nitrous oxide should be flooded or soaked with tepid water (105–115F; 41–46C). DO NOT USE HOT WATER. Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| N/A | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

Nitros oxide is nonflammable, but supports and accelerates combustion of flammables. To fight fires, turn off source of nitrous oxide and fight like conventional fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Nitrous oxide is nonflammable but supports and accelerates combustion of flammables. Some nonflammables in air will burn in the presence of nitrous oxide.

## PHYSICAL DATE

| BOILING POINT (ºF) | FREEZING POINT (ºF) |
|---|---|
| @ 1 atm – 127.2F (– 88.5C) | @ 1 atm – 131.5F (– 90.9C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| @ 81.3F (27.4C) 882 psia (60 atm) | @ 75F (24C), 1 atm 60.8% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.1151 | @ 68F (20C), 1 atm 1.53 | @ – 128F (– 89C), 1 atm 76.54 | @ – 128F (– 89C), 1 atm 1.23 |

APPEARANCE AND ODOR

Colorless gas with slightly sweet odor.

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | Avoid situations of extreme heat. Little decomposition of the pure gas occurs at temperatures below 1200F (648C). |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

See “OTHER RECOMMENDATIONS OR PRECAUTIONS” below. Nitrous oxide is a mild oxidizer. Avoid contact with flammable or combustible materials, especially oil and grease.

HAZARDOUS DECOMPOSITION PRODUCTS

Nitrous oxide decomposes into elemental nitrogen and oxygen under extreme heat. Under these conditions, nitrous oxide is explosive.

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | X | None |
| | WILL NOT OCCUR | | |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Leaking cylinders should be moved outdoors or to a well-ventilated area such as an exhaust fume hood. Remove all flammable or combustible material from the area if possible.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual gaseous nitrous oxide in cylinders. Return to **Welsco, Inc.** for disposal. Always return cylinders under slight positive pressure with the cylinder valve tightly closed, and valve cap in place.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Use self-contained breathing apparatus in oxygen-deficient atmospheres. Caution! Air purifying respirators will not function. Their use may result in asphyxiation.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas is present | As necessary | Only as necessary |
| | MECHANICAL (General) | OTHER |
| | As necessary | Only as necessary |

PROTECTIVE GLOVES

Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling high-pressure cylinders.

OTHER PROTECTIVE EQUIPMENT

None

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Nitrous Oxide or Nitrous Oxide, Compressed.
DOT Hazard Class: Nonflammable Gas.
DOT Shipping Label: Nonflammable Gas.
I.D. Number: UN 1070

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Cleanliness and compatibility of materials in contact with nitrous oxide are essential. Open nitrous oxide valves slowly. Compressed gas cylinders contain gas with extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent backflow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Store nitrous oxide in well-ventilated areas. Do not store cylinders of nitrous oxide within twenty feet of flammable or combustible materials, especially oil and grease. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Never lubricate valves or cylinder caps. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Nitrous oxide is shipped in compressed gas cylinders meeting DOT specifications. Bulk liquid nitrous oxide is shipped in vessels meeting DOT specifications and stored in refrigerated, insulated vessels meeting American Society of Mechanical Engineers (ASME) codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Nitrous oxide should not be used with plastic materials containing plasticizers, including some Nylon materials. Some plasticizers have been found to be soluble in nitrous oxide. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law, The atmosphere in areas where nitrous oxide may be vented and collect should be tested with a portable or continuous monitoring nitrous oxide gas analyzer.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Oxygen Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 13 April 1977<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Oxygen, LOX (Liquid only), GOX (Gas only) | CHEMICAL NAME AND SYNONYMS<br>Oxygen |
| | FORMULA<br>$O_2$ MW: 32.00 | CHEMICAL FAMILY<br>Oxidizing Gas CAS #7782-44-7 |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA and ACGIH: None established. Oxygen is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Oxygen is nontoxic under usual conditions of use and is necessary to support life. Liquid oxygen or cold gas will freeze tissues and can cause severe cryogenic (extremely low temperature) burns.

TOXICOLOGICAL PROPERTIES

Oxygen is nontoxic under usual conditions of use. Breathing pure oxygen at one atmosphere, however, may produce cough and chest pains within 8–24 hours. Concentrations of 60% may produce these symptoms in several days. At two atmospheres symptoms occur in 2–3 hours.

Partial pressure of oxygen in excess of two atmospheres may produce a variety of central nervous system manifestations including tingling of fingers and toes, visual and hearing disturbances, abnormal sensations, impaired coordination, confusion, muscle twitching, and seizures resembling those of epilepsy. Severe hazards may be present when confusion and impaired judgment lead to operational errors.

Infants exposed to oxygen levels in excess of 35–40% may suffer permanent visual impairment or blindness due to retrolental fibroplasia.

RECOMMENDED FIRST AID TREATMENT

If cryogenic liquid or cold boil-off gas contacts worker's skin or eyes, frozen tissue should be flooded or soaked with tepid water (105-115F; 41-46C). DO NOT USE HOT WATER. Burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| N/A | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

Oxygen is nonflammable, but supports and VIGOROUSLY ACCELERATES COMBUSTION of flammables. To fight fires, shut off sources of oxygen and fight like conventional fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Oxygen is nonflammable, but supports and VIGOROUSLY ACCELERATES COMBUSTION of flammables. Some materials which are noncombustible in air will burn in the presence of oxygen.

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 397.3F (– 183.0C) | @ 1 atm – 361.8F (– 218.8C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 77F (25C), 1 atm 3.16% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 70F (21.1C), 1 atm 0.08279 | @ 68F (20C), 1 atm 1.10 | @ boiling point, 1 atm 71.23 | @ boiling point, 1 atm 1.14 |

APPEARANCE AND ODOR

Gaseous oxygen is colorless and odorless. Liquid oxygen is pale blue and odorless.

# REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | Materials which burn in air will burn violently in atmosphere richer than approximately 25% oxygen. Some materials will burn in pure oxygen which are nonflammable in air. |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

All flammables, especially petroleum products, asphalt, other volatile flammables.

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

# SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Prevent liquid oxygen from contacting grease, oil, asphalt or combustibles. Ventilate area to evaporate and disperse oxygen. Flush area with large quantities of water. DO NOT ENTER areas of high oxygen concentration, which can saturate clothing and increase its flammability Avoid smoking and contact with sources of ignition after exposure to concentration of oxygen higher than the normal atmosphere.

WASTE DISPOSAL METHOD

Allow liquid oxygen to evaporate in a well ventilated outdoor area. Vent oxygen gas to outside location. Disposal site should be remote from work areas, open flames or sources of ignition and combustibles. Flushing with water will increase the vaporization rate of the liquid. Do not attempt to dispose of residual oxygen in compressed gas cylinders. Return cylinders to **Welsco, Inc.** with residual pressure, the cylinder valve tightly closed and valve cap in place.

# SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

N/A

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Prevent accumulation with natural or forced air. | As necessary | None normally required |
| | MECHANICAL (General) | OTHER |
| | As necessary | Vents should be situated to avoid higher than normal concentration of oxygen in work areas. |

PROTECTIVE GLOVES

(Liquid) Loose-fitting gloves of impermeable material, such as leather. (Gas) Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

(Liquid) Chemical goggles or safety glasses. (Gas) Safety glasses are recommended when handling high-pressure cylinders.

OTHER PROTECTIVE EQUIPMENT

N/A

# SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Oxygen or Oxygen, Compressed; (Liquid) Oxygen, refrigerated liquid.
DOT Hazard Class: Nonflammable Gas.; DOT Shipping Label: Oxidizer.; I.D. Number: UN 1072

SPECIAL HANDLING RECOMMENDATIONS

Prevent contact of liquid oxygen with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well ventilated areas. Cleanliness and compatibility of materials in contact with oxygen are essential especially internal parts of piping systems. Some elastomers (o-rings, valve seats, etc.) are not compatible with oxygen. Open oxygen valves slowly. Compressed gas cylinders contain oxygen at extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent backflow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Store liquid containers and cylinders in well-ventilated areas. Do not store cylinders of oxygen within twenty feet of flammable or combustible materials, especially oil or grease. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Never lubricate valves or cylinder caps. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Gaseous oxygen containers meet DOT specifications or American Society of Mechanical Engineers (ASME) codes. Liquid oxygen is stored in vacuum-insulated containers meeting DOT specifications and ASME codes.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Oxygen is not to be used as a substitute for compressed air. Applications such as cleaning, dusting, powering pneumatic tools, etc., are not safe due to lubricating oils and other materials present. Use only with equipment specifically designed and cleaned for oxygen service. Consult Compressed Gas Association Pamphlet G-4.1, “Cleaning Equipment for Oxygen Service,” for details. Liquid oxygen is cryogenic liquid. Materials of construction must be selected for compatibility with extremely low temperatures. Avoid use of carbon steel and other materials which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law. If oxygen concentrations exceeding 25% are suspected or can occur, use oxygen monitoring equipment to test for oxygen-enriched atmospheres.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Air
# Material Safety
# Data Sheet

NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | |
|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | |
| ISSUE DATE Issued: 15 March 1978<br>REVISIONS Rev: 1 December 2009 | TRADE NAME AND SYNONYMS<br>Air; Compressed Air; Compressed Air, Breathing Quality | CHEMICAL NAME AND SYNONYMS<br>Air |
| | FORMULA<br>Reconstituted air–approx. 79% $N_2$ 21% $O_2$<br>Compressed–78% $N_2$, 21% $O_2$, Balance: Other atmospheric gases | CHEMICAL FAMILY<br>N/A<br>(Air does not have a CAS#) |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

Air is nontoxic and no exposure limits have been established. Air is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Air is nontoxic and is necessary to support life. Inhalation of air at high pressures, such as pressures which may exist in hyperbaric chambers, can result in similar symptoms to those of exposure to oxygen. Inhalation of air at high pressures can also result in accumulation of nitrogen in the blood which may result in decompression sickness.

TOXICOLOGICAL PROPERTIES

Exposures to high pressures of air where partial pressure of oxygen is in excess of two atmospheres may produce a variety of central nervous system manifestations including tingling of fingers and toes, visual and acoustical disturbances, abnormal sensations, impaired coordination, confusion, muscle twitching, and epileptiform seizures. Severe hazards may be present when confusion and impaired judgment lead to operational errors. Exposure to high pressures may also result in nitrogen narcosis.

RECOMMENDED FIRST AID TREATMENT

Facilities at which air is breathed under pressure should be prepared to deal with illness related to a hyperbaric environment. Decompression equipment may be required.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| N/A | GROUP N/A |

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS

Compressed air at high pressure can accelerate the burning of materials which are combustible at atmospheric pressure.

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 317.9F (– 194.4C) | Range: – 351F to – 358F (– 213C to – 216C) (Because air is a mixture) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| N/A | @ 68F (20C), 1 atm 1.87% by volume |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.07520 | @ 68F (20C), 1 atm 1.00 | @ boiling point, 1 atm 54.56 | @ boiling point, 1 atm 0.874 |

APPEARANCE AND ODOR

Gaseous air is odorless and colorless.

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | | Avoid the use of oil in systems at full cylinder pressure. |
| | STABLE | X | |

INCOMPATIBILITY (Materials to avoid)

None

HAZARDOUS DECOMPOSITION PRODUCTS

None

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | None |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

No hazard.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual air in compressed gas cylinders. Return to **Welsco, Inc.** with the cylinder valve tightly closed, positive pressure in the cylinder, and valve cap in place.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

None

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| None | None | None |
| | MECHANICAL (General) | OTHER |
| | None | None |

PROTECTIVE GLOVES

Leather work gloves are recommended when handling compressed gas cylinders.

EYE PROTECTION

Safety glasses are recommended when handling high-pressure gas cylinders.

OTHER PROTECTIVE EQUIPMENT

Safety toe shoes are recommended when handling high-pressure cylinders.

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Air, Compressed.
DOT Hazard Class: Nonflammable Gas.
DOT Shipping Label: Nonflammable Gas.
I.D. Number: UN 1002.

SPECIAL HANDLING RECOMMENDATIONS

Compressed gas cylinders contain gas with extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent backflow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. Store compressed gas cylinders with the valve end up. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Compressed air cylinders meet DOT specifications.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Compressed gas cylinders should not be refilled except by qualified producers of a compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.

# Acetylene Material Safety Data Sheet

WELSCO
NORTH LITTLE ROCK, ARKANSAS 72113 PHONE: 501-771-1204

| | | | |
|---|---|---|---|
| EMERGENCY PHONE: *Emergency Response Telephone: 1-800-424-9300, use for chemical emergencies only* | | | |
| ISSUE DATE | Issued: 31 January 1978 | TRADE NAME AND SYNONYMS<br>Acetylene, Ethyne, Ethine | CHEMICAL NAME AND SYNONYMS<br>Acetylene, Ethyne, Ethine |
| REVISIONS | Rev: 1 December 2009 | FORMULA<br>$C_2H_2$ MW: 26.04 | CHEMICAL FAMILY<br>Alkynes |

## HEALTH HAZARD DATA

EXPOSURE LIMITS

Acetylene is classified as a simple asphyxiant and has no threshold limit value (TLV).

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Symptoms such as headaches, dizziness, shortness of breath, and loss of consciousness may occur if the gas is present in quantities sufficient to dilute the oxygen concentration in air. Symptoms of anoxia occur only when the gas concentrations are within the flammable range and the mixture has not ignited. (DO NOT ENTER AREAS WITHIN THE FLAMMABLE RANGE DUE TO THE IMMEDIATE FIRE AND EXPLOSION HAZARD.) Use a suitable flammable gas meter (explosimeter) calibrated for acetylene to measure concentrations of gas in the air.

TOXICOLOGICAL PROPERTIES

Acetylene is a simple asphyxiant, irritant, and anesthetic. About 100 mg per liter may be tolerated for 0.5–1.0 hour. There is no experimental evidence of chronic harmful effects.

RECOMMENDED FIRST AID TREATMENT

First degree and minor second degree thermal burns from fires should be immersed in cool water for 30 minutes. Major second and third degree burns should be covered in the cleanest material available. Seek immediate aid of a physician. Persons suffering from lack of oxygen should be moved to areas with normal atmosphere. Assisted respiration and supplemental oxygen should be given if the victim is not breathing.

## FIRE AND EXPLOSION HAZARD DATA

| FLASH POINT (Method used) | AUTO IGNITION TEMP | FLAMMABLE LIMITS | LEL | UEL |
|---|---|---|---|---|
| OF (– 18C) (CC) | 561F (305C) | In air @ 1 atm | 2.5% | 100% |

| EXTINGUISHING MEDIA | ELECTRICAL CLASSIFICATION |
|---|---|
| Carbon dioxide, dry chemical, Halon | GROUP Class I, Group A |

SPECIAL FIRE FIGHTING PROCEDURES

Stop gas flow and fight fire conventional. Use water spray to keep cylinders or other containers cool if exposed to fire. Keep personnel well away since containers can rupture violently when exposed to fire. For additional information, see Compressed Gas Association Safety Bulletin SB-4.

UNUSUAL FIRE AND EXPLOSION HAZARDS

ACETYLENE IS EXTREMELY FLAMMABLE AND EXPLOSIVE. IT MAY DECOMPOSE VIOLENTLY IN ITS FREE STATE UNDER PRESSURE IN EXCESS OF 15 PSIG. It burns with an intensely hot flame. Potential explosion hazard exists from reignition if fire is extinguished without shutting off acetylene source. Ignites very easily due to low minimum ignition energy; very wide flammable limits. Acetylene gas has an approximate specific gravity of 1.0 and tends to stay in pockets rather than dissipate.

## PHYSICAL DATE

| BOILING POINT (°F) | FREEZING POINT (°F) |
|---|---|
| @ 1 atm – 119.2F (– 84.0C) | @ 1 atm – 113.4F (– 80.8C) |
| VAPOR PRESSURE (psia) | SOLUBILITY IN WATER |
| @ 62.2F (16.8C) 590 psia (40 atm) | @ 64F (18C), 1 atm 1.0 CuFt/CuFt$H_2O$ |

| VAPOR DENSITY (lb/cu ft) | SPECIFIC GRAVITY (AIR = 1) | LIQUID DENSITY (lb/cu ft) | SPECIFIC GRAVITY ($H_2O$ = 1) |
|---|---|---|---|
| @ 68F (20C), 1 atm 0.0681 | @ 68F (20C), 1 atm 0.906 | @ – 116F (– 82C), 1 atm 36.76 | @ – 116F (– 82C), 1 atm 0.621 |

APPEARANCE AND ODOR

Pure acetylene is colorless and odorless. Impurities in carbide generated acetylene impart a characteristic garlic-like odor.

## REACTIVITY DATA

| STABILITY | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | UNSTABLE | X | Never utilize free gas outside the cylinder at pressures in excess of 15 psig. Avoid mechanical shocks to containers of acetylene. Never expose cylinders or acetylene systems to sources of heat. |
| | STABLE | | |

INCOMPATIBILITY (Materials to avoid)

Oxidizers such as oxygen, and halogens. Forms explosive compounds with copper, brass, copper salts, Hg and Hg salts, K, Ag and Ag salts, and $HNO_3$.

HAZARDOUS DECOMPOSITION PRODUCTS

Acetylene will decompose into elemental carbon and hydrogen under the above conditions.

| HAZARDOUS POLYMERIZATION | | | CONDITIONS TO AVOID |
|---|---|---|---|
| | MAY OCCUR | | |
| | WILL NOT OCCUR | X | |

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Ventilate area to prevent flammable mixture from forming. Remove sources of ignition, heat, sparks, etc. Avoid entering area of flammable atmosphere. Carefully remove cylinders with slow leaks to a remote outdoor location. Contact **Welsco, Inc.** for assistance.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual gaseous acetylene in cylinders. Return cylinders to **Welsco, Inc.** for disposal.

## SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Oxygen-deficient atmospheres are in the flammable range. DO NOT ENTER. Respirators will not function.

| VENTILATION | LOCAL EXHAUST | SPECIAL |
|---|---|---|
| Natural or mechanical where gas is present | | Mechanical ventilation for enclosed storage areas must meet National Electrical Code requirements for Class I, Group A |
| | MECHANICAL (General) | OTHER |

PROTECTIVE GLOVES

Ordinary leather work gloves recommended for cylinder handling. Welders gloves required for cutting and welding operations.

EYE PROTECTION

Safety glasses recommended when handling cylinders. Welders goggles, etc., required for cutting and welding.

OTHER PROTECTIVE EQUIPMENT

Leather sleeves, leather apron and other standard protective equipment for cutting and welding.

## SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

Acetylene shipments must be in accordance with Department of Transportation (DOT) regulations using the DOT “FLAMMABLE GAS” label. Consult DOT regulations for details on the shipping of hazardous materials.

SPECIAL HANDLING RECOMMENDATIONS

Use only in well ventilated areas. Acetylene gas cylinders contain gas at high pressure and should be handled with care. Use a pressure-reducing regulator set at less than 15 psig. Always keep acetylene cylinders upright and secure cylinders when in use. Never expose an acetylene cylinder to heat. Always open and close acetylene valves slowly. Return cylinders to **Welsco, Inc.** with positive pressure and cylinder valve closed. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Storage of 2500 cubic feet or less is permissible within buildings. Storage in excess of 2500 cubic feet must be outdoors or in well ventilated special rooms or buildings. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Keep acetylene cylinders storage areas away from storage of oxygen and other oxidizers. Storage areas should be free of combustible material. Avoid exposure to areas where salt or other corrosive chemicals are present. Store acetylene cylinders with the valve end up. See Compressed Gas Association Pamphlet P-1 and National Fire Protection Association Standard No. 51 for additional storage recommendations.

SPECIAL PACKAGING RECOMMENDATIONS

Acetylene is packaged in cylinders meeting DOT specification 8 or 8AL. The cylinder contains a porous filler saturated with acetone. The acetylene stored in the cylinder is dissolved in acetone. A full cylinder should not exceed 250 psig @ 70F.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Acetylene cylinders should be stored and used in an upright position. When using acetylene, close the cylinder valve before shutting off the regulator to permit the gas to bleed from the regulator. Avoid hazardous mixtures and sources of ignition. Formation of explosive copper acetylides can be avoided by using copper alloys proved successful through use in industry. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law.

*Various Government Agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.