# 1. PRODUCT IDENTIFICATION

## CHEMICAL NAME; CLASS: FLAMMABLE GAS MIXTURE

Containing Hydrogen (> 2.93%) and Argon (Balance)

**SYNONYMS:** Not Applicable  
**CHEMICAL FAMILY:** Not Applicable  
**FORMULA:** Not Applicable

**PRODUCT USE:** For general analytical/synthetic chemical uses.

**MANUFACTURED/SUPPLIED FOR:**

**ADDRESS:**  
9101-LBJ-FREEWAY, SUITE-800  
DALLAS, TX-75243

**EMERGENCY PHONE:**  
CHEMTREC: 1-800-424-9300

**BUSINESS PHONE:**

General MSDS Information 1-972-301-5200  
Fax on Demand: 1-800/231-1366

# 2. COMPOSITION and INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>ACGIH</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TLV</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>1333-74-0</td>
<td>&gt; 2.93%</td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>7440-37-1</td>
<td>Balance</td>
<td></td>
</tr>
</tbody>
</table>

There are no specific exposure limits for Hydrogen. Hydrogen is a simple asphyxiant (SA).

There are no specific exposure limits for Argon. Argon is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.

NE = Not Established.  
C = Ceiling Limit.  
See Section 16 for Definitions of Terms Used.

**NOTE:** All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.
3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This is a colorless, odorless, flammable gas mixture. This gas mixture poses a serious fire hazard when it is accidentally released. In addition, releases of this gas mixture may produce oxygen-deficient atmospheres; individuals in such atmospheres may be asphyxiated. Flame or high temperature impinging on a localized area of the cylinder of Hydrogen can cause the cylinder to rupture or burst without activating the cylinder’s relief devices. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: High concentrations of this gas mixture can cause an oxygen-deficient environment. It should be noted that before suffocation could occur, the lower flammability limit of Hydrogen in air would be exceeded; possibly causing an oxygen-deficient and explosive atmosphere. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of overexposure, death may occur. The effects associated with various levels of oxygen are as follows:

<table>
<thead>
<tr>
<th>CONCENTRATION OF OXYGEN</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.9% Oxygen:</td>
<td>Normal oxygen concentration in air.</td>
</tr>
<tr>
<td>15-19% Oxygen:</td>
<td>Decreased ability to perform tasks. May impair coordination and may induce early symptoms in persons with heart, lung, or circulatory problems.</td>
</tr>
<tr>
<td>12-15% Oxygen:</td>
<td>Breathing increases, especially in exertion. Pulse up. Impaired coordination, perception, and judgment.</td>
</tr>
<tr>
<td>10-12% Oxygen:</td>
<td>Breathing further increases in rate and depth, poor coordination and judgment, lips slightly blue.</td>
</tr>
<tr>
<td>8-10% Oxygen:</td>
<td>Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea (upset stomach), and vomiting.</td>
</tr>
<tr>
<td>6-8% Oxygen:</td>
<td>8 minutes, may be fatal in 50-100% of cases; 6 minutes, may be fatal in 25 to 50% of cases; 4-5 minutes, recovery with treatment.</td>
</tr>
<tr>
<td>4-6% Oxygen:</td>
<td>Coma in 40 seconds, followed by convulsion, breathing failure, death.</td>
</tr>
</tbody>
</table>

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects.

ACUTE: The most significant hazard associated with this gas mixture is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include ringing in ears, headaches, shortness of breath, wheezing, dizziness, indigestion, and nausea. At high concentrations, unconsciousness or death may occur.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to this gas mixture.

TARGET ORGANS: Respiratory system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

Remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).
5. FIRE-FIGHTING MEASURES

FLASH POINT: Not determined.

AUTOIGNITION TEMPERATURE [for Hydrogen]: 500°C (932°F)

FLAMMABLE LIMITS (in air by volume, %) [for Hydrogen]:

<table>
<thead>
<tr>
<th>Limit</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower (LEL)</td>
<td>4.0%</td>
</tr>
<tr>
<td>Upper (UEL)</td>
<td>75.0%</td>
</tr>
</tbody>
</table>

FIRE EXTINGUISHING MATERIALS: Extinguish Hydrogen fires by shutting-off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment.

An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited. Hydrogen burns with an almost invisible blue flame.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected cylinders of Hydrogen can be very dangerous. Exposure to fire could cause a catastrophic failure of the cylinder releasing the contents into a fireball and explosion of released gas. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the cylinder. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

- Explosion Sensitivity to Static Discharge: Static discharge may cause this gas to ignite explosively.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the cylinder or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation to prevent flammable or explosive mixture formation. Evacuation may be necessary. The North American Emergency Response Guidebook (Guide #115) recommends 0.5 miles.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. Minimum Personal Protective Equipment should be Level B: Self-Contained Breathing Apparatus. Locate and isolate the source of the leaking gas by shutting off the main source valve. Allow the gas to dissipate. Combustible gas concentration must be below 10% of the LEL of hydrogen (4.0%) prior to entry. Monitor the surrounding area for combustible gas levels and oxygen level. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area, away from sources of ignition, and allow the gas to be released there.

If gas is leaking incidentally from the cylinder or its valve, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen deficiency. Non-sparking tools should be used.

STORAGE AND HANDLING PRACTICES: Compressed gases can present significant safety hazards. Store cylinders away from heavily trafficked areas and emergency exits. Cylinders should be stored upright (with valve protection cap in place) and firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition, and direct sunlight. Keep storage area clear of materials that can burn.

Do not allow areas where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and gas production areas, elevators, building and room exits, or main aisles leading to exits. Protect cylinders against physical damage.

Keep the smallest amount on-site as is necessary. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time.
7. HANDLING and USE (Continued)

Cylinders should be separated from oxygen cylinders, or other oxidizers, by a minimum distance of 20 ft., or by a barrier of non-combustible material at least 5 ft. high, having a fire-resistance rating of at least 0.5 hours. Isolate from other incompatible chemicals (refer to Section 10, Stability and Reactivity).

Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Post “No Smoking or Open Flames” signs in storage or use areas. Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers).

Use a check valve in the discharge line to prevent hazardous backflow. Never tamper with pressure relief devices in valves and cylinders.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Use piping and equipment adequately designed to withstand pressures to be encountered. Do not heat cylinder by any means to increase the discharge rate of the gas mixture from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Leak check system with leak detection solution, never with flame. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into valve cap openings. Use an adjustable strap wrench to remove overly tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder part of an electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. Reinstall gas-tight dust cap on the cylinder outlet. Replace valve protection cap. Mark empty cylinders “EMPTY”.

NOTE: Use only DOT or ASME code cylinders designed for compressed gas storage. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner.

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections, DO NOT USE ADAPTERS:

- **THREADED**: CGA 350
- **PIN-INDEXED YOKE**: Not applicable.
- **ULTRA HIGH INTEGRITY**: Not assigned.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas before attempting repairs. Always use this gas mixture in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Provide natural or explosion-proof ventilation adequate to ensure Hydrogen does not reach its lower flammability limit of 4.0%. Local exhaust ventilation is preferred, because it prevents gas dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of flammable gas.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% (air-purifying respirators will not function) or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check for oxygen-deficient atmospheres. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: Wear gloves when handling cylinders of this gas mixture. Otherwise, wear glove protection appropriate to the specific operation for which this gas mixture is used.

BODY PROTECTION: Use body protection appropriate for task. Cotton clothing is recommended for use to prevent static electric build-up. Safety shoes are recommended when handling cylinders. Transfer of large quantities under pressure may require use of fire retardant clothing.
9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for the Argon component of this gas mixture.

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.103 lb/cu ft (1.650 kg/m³)
BOILING POINT @ 1 atm: -185.9 °C (-302°F)
FREEZING/MELTING POINT (@ 10 psig): -189.2°C (-308.9°F)
SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F): 1.38
SOLUBILITY IN WATER vol/vol @ 0°C (32°F); and 1 atm: 0.056
EVAPORATION RATE (nBuAc = 1): Not applicable.
ODOR THRESHOLD: Not applicable. Odorless.
VAPOR PRESSURE @ 21.1°C (70°F) (psig): Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for the Hydrogen component of this gas mixture.

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.00521 lb/ft³ (0.08342 kg/m³)
BOILING POINT @ 1 atm: -253.0°C (-423.0°F)
FREEZING/MELTING POINT @ 1 atm: -259°C (-434.6°F)
SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F): 0.069
SOLUBILITY IN WATER Vol/Vol @ 15.6°C (60°F): 0.019
EVAPORATION RATE (nBuAc = 1): Not applicable.
ODOR THRESHOLD: Not applicable.
VAPOR PRESSURE @ 21.1°C (70°F) psig: Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for this gas mixture.

APPEARANCE AND COLOR: Colorless, odorless gas mixture.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties for this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable.
DECOMPOSITION PRODUCTS: The components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Hydrogen (a component of this gas mixture) is incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride).
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

ARGON: There are no specific toxicology data for Argon. Argon is a simple asphyxiant, which acts to displace oxygen in the environment.

HYDROGEN: There are no specific toxicology data for Hydrogen. Hydrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC and therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.
IRRITANCY OF PRODUCT: Not applicable.
SENSITIZATION TO THE PRODUCT: The components of this gas mixture are not known to cause sensitization after prolonged or repeated exposures.
11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture and its components on the human reproductive system.

- Mutagenicity: No mutagenicity effects have been described for this gas mixture.
- Embryotoxicity: No embryotoxic effects have been described for this gas mixture.
- Teratogenicity: No teratogenicity effects have been described for this gas mixture.
- Reproductive Toxicity: No reproductive toxicity effects have been described for gas mixture.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to the components of this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: The main effect on animal life after releases of this gas mixture would be related to oxygen deficiency. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence of an adverse effect of this gas mixture on aquatic life is currently available.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual gas mixture to Air Liquide. Do not dispose of locally.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors, away from all sources of ignition.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gas, flammable, n.o.s (Hydrogen, Argon)

HAZARD CLASS NUMBER and DESCRIPTION: 2.1 (Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1954

PACKING GROUP: Not applicable.

DOT LABEL(S) REQUIRED: Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in personal automobiles presents serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.
15. REGULATORY INFORMATION

U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITIES (RQ): Not applicable.

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS:

• No component of this gas mixture is subject to the reporting requirements of CFR 29 1910.1000.
• This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
• Hydrogen is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 lbs (4,455 kg).
• Argon is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen is listed under this regulation in Table 3 as a Regulated Substance (Flammable Substance), in quantities of 10,000 lbs (4,554 kg) or greater.
• The regulations of 29 CFR 1910.119 (Process Safety Management of Highly Hazardous Chemicals) are not applicable to this gas mixture.

CALIFORNIA PROPOSITION 65: The components of this gas mixture are not on the California Proposition 65 lists.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Argon, Hydrogen.
California - Permissible Exposure Limits for Chemical Contaminants: Argon, Hydrogen.
Florida - Substance List: Argon, Hydrogen.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Argon, Hydrogen.

Michigan - Critical Materials Register: No.
Missouri - Employer Information/Toxic Substance List: Argon, Hydrogen.
New Jersey - Right to Know Hazardous Substance List: Argon, Hydrogen.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Rhode Island - Hazardous Substance List: Argon, Hydrogen.
Texas - Hazardous Substance List: No.
West Virginia - Hazardous Substance List: No.
Wisconsin - Toxic and Hazardous Substances: No.

CANADIAN REGULATIONS:

CANADIAN WHMIS REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

CANADIAN DSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists.
16. OTHER INFORMATION

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about gas mixtures can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Walney Road 5th floor, Chantilly, VA 20151-2923 Telephone: (703) 788-2700

P-1 “Safe Handling of Compressed Gases in Containers”
AV-1 “Safe Handling and Storage of Compressed Gases”
“Handbook of Compressed Gases”

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619/565-0302
Fax on Demand: 1-800/231-1366