



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS Standards and EC Standards

SECTION 1. PRODUCT IDENTIFICATION

PRODUCT NAME: HYDROGEN
CHEMICAL NAME: Hydrogen
FORMULA: H₂
SYNONYMS: Hydrogen, Compressed
MANUFACTURER: SPECTRA GASES, INC.
ADDRESS: 3434 Route 22 West
 Branchburg, NJ 08876, U.S.A.
PHONE: 908/252-9300
FAX: 908/252-0811
WEB SITE: www.spectra-gases.com
SPECTRA GASES EMERGENCY CONTACT: 800/932-0624 8:30am - 7:00pm (EST)
24 HOUR EMERGENCY CONTACT, CHEMTREC: 800/424-9300, 703/527-3887
PRODUCT USE: Various

SECTION 2. COMPOSITION and INFORMATION ON INGREDIENTS

COMPOSITION: Hydrogen
CAS NUMBER: 1333-74-0
EINECS NUMBER: 215-605-7
EXPOSURE LIMITS: (10,000 ppm = 1%)

OSHA PELs:

ACGIH TLVs:

NIOSH RELs:

There are no exposure limits for Hydrogen, Hydrogen is a simple asphyxiant.

SECTION 3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Hydrogen is a colorless, odorless, flammable gas, shipped under pressure. Hydrogen poses a serious fire hazard when it is accidentally released. The main health hazard associated with releases of this gas is asphyxiation, by displacement of oxygen. The gas poses a serious fire hazard when accidentally released. Flame or high temperature impinging on a localized area of the cylinder of this product can cause the cylinder to burst or rupture without activating the cylinder's relief devices. The gas is lighter than air, and may spread long distances or accumulate near ceiling. Distant ignition and flashback are possible. Provide adequate fire protection and respiratory protection during emergency response situations.

ROUTES OF ENTRY, SYMPTOMS OF ACUTE EXPOSURE: WARNING - If rescue personnel need to enter an area of release of Hydrogen, they should be equipped with Self-Contained Breathing Apparatus (SCBA) and fire-retardant gear. Although fire or explosion is most probable source of injury in a leak situation, it should also be noted that high concentration of this gas will create an oxygen-deficient atmosphere, creating the risk of asphyxiation. Acute overexposure to this gas may cause the following health effects:

EYE CONTACT: Release of a high-pressure gas may result in airborne objects.

INGESTION: Ingestion of this gas is not a likely route of industrial exposure.

INHALATION: High concentrations of this gas can cause an oxygen-deficient environment (it should be noted that before suffocation can occur, the lower flammability limit of Hydrogen will be reached). 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. The skin of a victim may have a blue color. Under some circumstances of over-exposure, death may occur, due to the displacement of oxygen. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION of OXYGEN

20.9% Oxygen:

15-19% Oxygen:

EXPOSURE SYMPTOM

Normal oxygen concentration in air.

Decreased ability to perform tasks. May impair coordination and may induce early symptoms in persons with heart, lung, or circulatory problems.

SECTION 3. HAZARD IDENTIFICATION (Continued)

CONCENTRATION

of OXYGEN

12-15% Oxygen:

10-12% Oxygen:

8-10% Oxygen:

6-8% Oxygen:

4-6% Oxygen:

EXPOSURE SYMPTOM (continued)

Breathing increases, especially in exertion. Pulse up. Impaired coordination, perception, and judgment.

Breathing further increases in rate and depth, poor coordination and judgment, lips slightly blue.

Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea (upset stomach), and vomiting.

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.

Coma in 40 seconds, followed by convulsion, breathing failure, death.

WARNING: Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

SKIN CONTACT: Not applicable.

OTHER HEALTH EFFECTS: Contact with rapidly expanding gases (which are released from under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain caused by frostbite can quickly subside, masking the injury. In addition, the sudden release of a pressurized gas (such as may occur in the event of a valve failure), presents a severe hazard of mechanical injury.

HMIS RATINGS: HEALTH: = 0; FLAMMABILITY: = 4; REACTIVITY: = 0;

PPE: Level B (see Section 8, Exposure Controls/Personal protective Equipment)

ROUTES OF ENTRY, SYMPTOMS OF CHRONIC EXPOSURE:

ROUTE OF ENTRY: Not Applicable

TARGET ORGANS: None.

SYMPTOMS: None.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None are anticipated.

CARCINOGENICITY: Hydrogen is not found on the FEDERAL OSHA Z LIST, NTP, CAL/OSHA, or IARC Carcinogenicity lists and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

SECTION 4. FIRST AID MEASURES

THERMAL BURNS: In the event personnel are burned as a result of a Hydrogen release, if burns are first degree or second degree with closed blisters, flush area with cold water until pain subsides. Apply loose, moist, sterile dressings, and bandage. Treat for shock. If burns are second degree with open blisters or third degree, apply loose, dry, sterile dressings and bandage. Treat for shock. Transport victim immediately to hospital or emergency center. Burns over an area of 20% or more of body are life-threatening, medical attention should be immediately sought.

EYE CONTACT: If mechanical injury occurs, cover eye with bandage and seek appropriate medical attention.

INGESTION: Ingestion is an unlikely route of exposure for this gas.

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

SKIN CONTACT: In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

NOTES TO PHYSICIANS: Administer oxygen, if necessary, and treat symptoms.

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT: Flammable gas.

AUTOIGNITION: 565.5°C (1050°F)

FLAMMABLE RANGE: Lower (LEL): 4.0%; Upper (UEL): 75.0%

NFPA RATINGS:

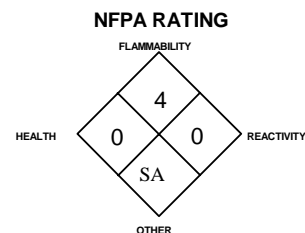
HEALTH: = 0

FLAMMABILITY: = 4

REACTIVITY: = 0

SPECIAL: Simple Asphyxiant

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



**See Section 16 for
Definition of Ratings**

SECTION 5. FIRE FIGHTING MEASURES (Continued)

SPECIAL FIRE-FIGHTING PROCEDURES: 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. Consider increasing ventilation to prevent flammable or explosive mixture formation. An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited.

UNUSUAL FIRE AND EXPLOSION HAZARDS: 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 MECHANICAL IMPACT: Not sensitive.

EXPLOSION SENSITIVITY TO STATIC DISCHARGE: Static discharge may cause this gas to ignite explosively. Due to low electrical conductivity, this substance can generate electrostatic charges during handling operations.

HAZARDOUS COMBUSTION PRODUCTS: None.

SECTION 6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: All releases of this gas pose a very serious hazard of fire. If any possibility of fire is suspected, personnel entering the area of a release should be fire-response personnel who are trained and equipped appropriately in the response to fires of flammable gases.

In the event of a leak of this product, operator should close the gas source if possible to do so safely. Evacuate area in the event of a significant release. The North American Emergency Response Guidebook (Guide #115) recommends 0.5 miles.

Only trained personnel should re-enter a contaminated area. Combustible gas concentration must be below 10% of the LEL (0.4%) prior to entry. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment. If it is not possible to close the source cylinder or otherwise stop the release, 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. Allow the gas, which is lighter than air, to dissipate. Monitor the surrounding area for combustible gas levels. Although the hazard due to combustible gas level is the greatest hazard due to the great potential for fire, monitoring of oxygen level should also be considered to prevent an oxygen-deficient atmosphere.

If leak was in user's gas handling equipment or system, safely vent high pressure before attempting repairs. If leak was from the cylinder, cylinder valve or the valve pressure relief device (PRD), contact your supplier.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained. Detection systems should be available to monitor for combustible gas levels.

SECTION 7. HANDLING AND STORAGE

STORAGE: Cylinders should be stored upright (with valve protection caps or plugs in place) and firmly secured to prevent falling or being knocked over. Cylinders should be stored in dry, well-ventilated areas. Protect from salt or other corrosive materials. Storage should be away from heavily traveled areas, walkways, elevators, platform edges or other objects or situations that could damage the cylinder wall. Do not store in a manner that will block emergency exits, fire extinguishers or other safety equipment. Do not allow storage temperature to exceed 125°F (52°C). Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. Store empty cylinders away from full cylinders. **NOTE:** Use only DOT or ASME code cylinders designed for compressed gas storage. Cylinders must not be recharged except by or with the consent of owner.

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

Use non-sparking ventilation systems, approved explosion-proof equipment, and appropriate electrical systems. Electrical equipment used in gas-handling operations, or located in storage areas, should be non-sparking or explosion proof.

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). **NOTE:** This gas is lighter than air and must not be allowed to accumulate in elevated locations

SECTION 7. HANDLING AND STORAGE (Continued)

HANDLING: Wearing contact lenses is not recommended when handling this gas. Cylinder valves should be inspected regularly for physical damage or corrosion (apparent by discoloration or rust). Care should be taken to inspect the following valve locations for corrosion: neck (where valve inserts into cylinder); bonnet nut (where handle attaches to valve body). Close valve after each use and when empty. Never tamper with pressure relief devices in valves and cylinders. The failure of a valve can result in violent release of the pressurized gas, creating a severe mechanical injury hazard.

Do not drag, roll, slide or drop cylinder. Use a suitable hand truck designed for cylinder movement. Never attempt to lift a cylinder by its cap. Secure cylinders at all times while in use. Use a pressure regulator to safely discharge product from cylinder. Use a check valve to prevent reverse flow into cylinder. Consideration should be made on the use of a flash arrestor on cylinders of Hydrogen, due to its extreme flammability. Once cylinder has been connected to properly purged process, open cylinder valve slowly and carefully. If user experiences any difficulty operating cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, etc.) into valve cap openings; doing so may damage valve, causing a leak to occur. Use an adjustable strap-wrench to remove over-tight or rusted caps.

Do not heat cylinders by any means to increase the discharge rate of product from the cylinder. Never apply flame or localized heat directly to any part of the cylinder. Cylinders should not be artificially cooled as certain types of steel undergo property changes when cryogenically cooled, thus making the cylinder unstable.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Relieve pressure before attempting repairs.

SPECIAL PRECAUTIONS All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a significant release. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, Inc. (telephone 703-412-0900) pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers*. Local regulations may require specific equipment for storage and use.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Forced explosion-proof ventilation systems for the general work area should be provided to ensure Hydrogen does not reach its lower flammability limit of 4.0%. 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 level is below 19.5%, or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, standards of Canada, the European Standard EN149, and EC member states.

EYE PROTECTION: Use approved safety goggles or safety glasses, as described in OSHA 29 CFR 1910.133 or by the European Standard EN166.

SKIN PROTECTION: Work (such as leather) gloves are recommended when handling cylinders of this gas. Wear gloves appropriate to the specific operation for which Hydrogen is used. Use triple gloves for spill response.

OTHER PROTECTIVE EQUIPMENT: Use body protection appropriate for task. Cotton or Nomex clothing is recommended to prevent static build-up. Safety shoes are recommended when handling cylinders. Transfer of large quantities under pressure may require fire-retardant clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

MOLECULAR WEIGHT: 4.032

GAS DENSITY @ 21.1°C (70°F): 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 at 20°C (68°F) and 1 atm: 0.019

SPECIFIC VOLUME @ 21.1°C (70°F): 190.8 lb/ft³ (11.99 m³/kg)

CRITICAL PRESSURE: 190.8 psia (1315 kPa abs)

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

ODOR THRESHOLD: Hydrogen is odorless.

APPEARANCE, ODOR AND STATE: Colorless, odorless gas.

WARNING PROPERTIES FOR THIS GAS: There are no warning properties in the event of a release. 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.

SECTION 10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.

CONDITIONS TO AVOID: Cylinders should not be exposed to temperatures in excess of 125°F (52°C).

MATERIALS WITH WHICH GAS IS INCOMPATIBLE: Hydrogen is incompatible with strong oxidizer such as chlorine, bromine, pentafluoride, oxygen, oxygen difluoride and nitrogen trifluoride. Hydrogen/Oxygen mixtures can explode on contact with a catalyst such as platinum.

REACTIVITY:

A) HAZARDOUS DECOMPOSITION PRODUCTS: None.

B) HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: There are no toxicology data for Hydrogen. Hydrogen is an asphyxiant because it can displace oxygen in the environment needed for breathing.

CARCINOGENICITY: Hydrogen has not been found to be carcinogenic.

IRRITANCY OF PRODUCT: Not applicable.

SENSITIZATION OF PRODUCT: Hydrogen is not a sensitizer.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Hydrogen on the human reproductive system.

Mutagenicity: Hydrogen has not been found to cause mutagenic effects in humans.

Embryotoxicity: Hydrogen has not been found to cause embryotoxic effects in humans.

Teratogenicity: Hydrogen has not been found to cause teratogenic effects in humans.

Reproductive Toxicity: Hydrogen has not been found to cause adverse reproductive effects in humans.

A mutagen is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical that 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 that causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance that interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Hydrogen.

SECTION 12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Hydrogen occurs naturally in the atmosphere. Hydrogen will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on plants would be related to oxygen-deficient environments or frost from rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: There is currently no evidence of adverse effects from exposure to Hydrogen on aquatic life.

MOBILITY: Hydrogen is inert and does not present a hazard of mobility.

PERSISTENCE AND BIODEGRADABILITY: Persistence: Hydrogen presents no hazard of persistence. Biodegradation: Hydrogen is fully biodegradable.

POTENTIAL TO BIOACCUMULATE: Hydrogen will not bioaccumulate.

OZONE-DEPLETION POTENTIAL: Hydrogen is not a Class I or Class II ozone depleting chemical (40 CFR Part 82).

SECTION 13. DISPOSAL CONSIDERATIONS

UNUSED PRODUCT / EMPTY CONTAINER: Do not dispose of unused product. Return residual product in cylinders to: Spectra Gases, Inc., 80 Industrial Drive, Alpha, NJ 08865 or Spectra Gases, Inc., 1261 Activity Drive, Vista, CA 92083.

DISPOSAL INFORMATION: Residual product in users's system may be incinerated. This shall be done in accordance with U.S. Federal, State and local regulations, regulations of the provinces of Canada or EC member states.

SECTION 14. TRANSPORT INFORMATION
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U.S. SHIPPING INFORMATION:

U.S. DOT PROPER SHIPPING NAME: Hydrogen, compressed
HAZARD CLASS NUMBER and DESCRIPTION: 2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1049
U.S. DOT SHIPPING LABEL(S) REQUIRED: Flammable Gas
PLACARD (When required): Flammable
SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position in a well-ventilated truck (never transport in passenger compartment of a vehicle). Ensure cylinder valve is properly closed, valve outlet cap has been reinstalled, and valve protection cap is secured before shipping cylinder.
CAUTION: Compressed gas cylinders shall not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with the owner's written consent is a violation of Federal law (49 CFR 173.301).
NAERG (NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK) #: 115

CANADIAN SHIPPING INFORMATION:

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as dangerous goods; use the above information for the preparation of Canadian Shipments.

INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):

IATA DESIGNATION: This gas is considered as dangerous goods, per the International Air Transport Association.
PROPER SHIPPING NAME: Hydrogen, compressed
HAZARD CLASS NUMBER and DESCRIPTION: 2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1049
HAZARD LABEL(S) REQUIRED: Flammable Gas
IATA ERG CODE: 10L

The following Packaging Information is applicable to this product:

PASSENGER AND CARGO AIRCRAFT				CARGO AIRCRAFT ONLY	
Limited Quantity		Packing Instruction	Max. Qty per Pkg	Packing Instruction	Max. Qty per Pkg
Packing Instruction	Max. Qty per Pkg				
////	////	Forbidden		200	150 kg

NOTE A1: Under IATA regulations, Compressed Hydrogen can only be shipped on passenger aircraft with the prior approval of appropriate authorities of the State of origin under the written conditions established by that authority. A copy of the document of approval, showing the quantity limitations and packing requirements, must accompany the consignment. The commodity may be carried on cargo aircraft in accordance with other provisions of IATA for the compound.

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):

IMO DESIGNATION: This gas is considered as dangerous goods, per the International Maritime Organization.
PROPER SHIPPING NAME: Hydrogen, compressed
HAZARD CLASS NUMBER and DESCRIPTION: 2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1049
HAZARD LABEL(S) REQUIRED: Flammable Gas
IMDG CODE: Page 41
STOWAGE CATEGORY: Category E - Clear of living quarters. "Separated from" chlorine.
MARINE POLLUTANT: Hydrogen is not designated by the IMO to be a Marine Pollutant.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This gas is considered by the Economic Commission for Europe to be dangerous goods.

Additional information is as follows:

SUBSTANCE IDENTIFICATION NO.: 1049
NAME OF SUBSTANCE: Hydrogen, compressed
HAZARD IDENTIFICATION NO.: 23
LABEL: 3
CLASS AND ITEM NUMBER: 2, 1°F

SECTION 15. REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS:**EPA - ENVIRONMENTAL PROTECTION AGENCY:**

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1990
(40 CFR Parts 117 and 302)

Reportable Quantity (RQ): Not Applicable

SARA TITLE III: Superfund Amendment and Reauthorization Act

SECTIONS 302/304: Emergency Planning and Notification (40 CFR Part 355)

Extremely Hazardous Substances: Hydrogen is not listed.

Threshold Planning Quantity (TPQ): Not Applicable

Reportable Quantity (RQ): Not Applicable

SECTIONS 311/312: Hazardous Chemical Reporting (40 CFR Part 370)

IMMEDIATE HEALTH: No

PRESSURE: Yes

DELAYED HEALTH: No

REACTIVITY: No

FIRE: Yes

SECTION 313: Toxic Chemical Release Reporting (40 CFR 372)

Releases of Hydrogen do not require reporting under Section 313.

CLEAN AIR ACT:

SECTION 112 (r): Risk Management Programs for Chemical Accidental Release
(40 CFR Part 68)

Threshold Planning Quantity (TPQ): 10,000 lbs (4,553 kg)

TSCA: Toxic Substances Control Act

Hydrogen is listed on the TSCA Inventory.

OSHA - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR Part 1910.119: Process Safety Management of Highly Hazardous Chemicals.

Threshold Planning Quantity (TPQ): 10,000 lbs (4,553 kg) [for all flammable gases, unless it is used as fuel]

U.S. STATE REGULATORY INFORMATION:

CALIFORNIA PROPOSITION 65: Hydrogen is not a listed substance which the State of California requires warning under this statute.

Hydrogen is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Hydrogen.

California - Permissible Exposure Limits for Chemical Contaminants: Hydrogen.

Florida - Substance List: Hydrogen.

Illinois - Toxic Substance List: Hydrogen.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Hydrogen.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Hydrogen.

Missouri - Employer Information/Toxic Substance List: Hydrogen.

New Jersey - Right to Know Hazardous Substance List: Hydrogen.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Pennsylvania - Hazardous Substance List: Hydrogen.

Rhode Island - Hazardous Substance List: Hydrogen.

Texas - Hazardous Substance List: No.

West Virginia - Hazardous Substance List: No.

Wisconsin - Toxic and Hazardous Substances: No.

CANADIAN FEDERAL REGULATIONS:

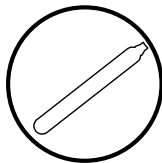
CANADIAN DSL INVENTORY STATUS: Hydrogen is listed on the Canadian DSL Inventory.

OTHER CANADIAN REGULATIONS: Hydrogen is categorized as a Controlled Product, Hazard Classes A, and B1 as per the Controlled Product Regulations. Hydrogen is not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas

Class B1: Flammable Gas



SECTION 15. REGULATORY INFORMATION (Continued)

EUROPEAN ECONOMIC COMMUNITY REGULATIONS:

EC LABELING AND CLASSIFICATION: Hydrogen meets the following definition of hazard class, per the European Community Council Directive 67/548/EEC.

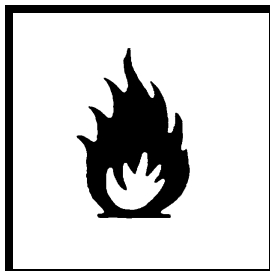
EC EINECS/ELINCS NUMBER: 215-605-7.

EC CLASSIFICATION: F+; (Extremely Flammable)

EC RISK PHRASES: Extremely flammable. [R:12]

EC SAFETY PHRASES: Keep container in well-ventilated place. Keep away from sources of ignition - No smoking. Take precautionary measures against static discharges. [S:9; S: 16; S: 33]

EUROPEAN COMMUNITY ANNEX II HAZARD SYMBOL: F+ (Extremely Flammable)



SECTION 16. OTHER INFORMATION

Information contained in this Material Safety Data Sheet is provided to our customers so they may comply with 29 CFR 1910.1200, Hazard Communication Standard, the Canadian WHMIS Standard, and the requirements of the European Community Directives. The intent of this Material Safety Data Sheet is to provide end users of this product with the health and physical hazards associated with possible exposure to this product. All statements, technical data and recommendations are based on readily available texts and data that Spectra Gases, Inc., believes to be reliable and accurate. Spectra Gases, Inc., makes no warranties, guarantees or representations of any kind with respect to this product or this data. It is the responsibility of the user to obtain and use the most recent version of this MSDS.

Further information about compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

<i>P-1</i>	<i>"Safe Handling of Compressed Gases in Containers"</i>
<i>AV-1</i>	<i>"Safe Handling and Storage of Compressed Gases"</i>
<i>G-5</i>	<i>"Hydrogen"</i>
	<i>"Handbook of Compressed Gases"</i>

For Definitions of Terms used in Spectra MSDSs, please see Spectra Gases, Inc. website: <http://www.spectragases.com> or contact your Customer Service Representative.

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 3519, La Mesa, CA 91944-3519
619/670-0609

1/8/02 Revision: Addition of Simple Asphyxiant "SA" to NFPA Ratings. Addition of IATA ERG Code.
7/12/06: updated Chemtrec phone #; removed definitions