Material Safety Data Sheet

Hydrogen (Gas)

1. **Product and company identification**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Hydrogen (Gas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonym</td>
<td>Hydrogen</td>
</tr>
<tr>
<td>Material uses</td>
<td>Various</td>
</tr>
<tr>
<td>CAS number</td>
<td>1333-74-0</td>
</tr>
<tr>
<td>Supplier/Manufacturer</td>
<td>Air Liquide Canada Inc.</td>
</tr>
<tr>
<td></td>
<td>1250, René-Lévesque West, Suite 1700</td>
</tr>
<tr>
<td></td>
<td>Montreal, QC</td>
</tr>
<tr>
<td></td>
<td>H3B 5E6</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.airliquide.ca">www.airliquide.ca</a></td>
</tr>
<tr>
<td></td>
<td>1-800-817-7697</td>
</tr>
<tr>
<td>Prepared by</td>
<td>IHS</td>
</tr>
<tr>
<td>In case of emergency</td>
<td>(514) 878-1667</td>
</tr>
</tbody>
</table>

2. **Hazards identification**

**Physical state**: Gas. [Compressed gas.]

**Color**: Colorless.

**Odor**: Odorless.

**Emergency overview**

**Signal word**: DANGER!

**Hazard statements**: FLAMMABLE GAS. MAY CAUSE FLASH FIRE. HIGH PRESSURE GAS. GAS REDUCES OXYGEN AVAILABLE FOR BREATHING. AT VERY HIGH CONCENTRATIONS, CAN DISPLACE THE NORMAL AIR AND CAUSE SUFFOCATION FROM LACK OF OXYGEN. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

**Precautions**: Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode. At very high concentrations, can displace the normal air and cause suffocation from lack of oxygen. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Do not enter storage areas and confined spaces unless adequately ventilated. Do not breathe gas. Avoid contact with skin and clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Keep container tightly closed.

**Routes of entry**: Dermal contact. Eye contact. Inhalation.

**Potential acute health effects**

**Inhalation**: At very high concentrations, can displace the normal air and cause suffocation from lack of oxygen.

**Ingestion**: As this product is a gas, refer to the inhalation section.

**Skin**: Contact with rapidly expanding gas may cause burns or frostbite.

**Eyes**: Contact with rapidly expanding gas may cause burns or frostbite.

**Potential chronic health effects**

**Chronic effects**: May cause target organ damage, based on animal data.

**Carcinogenicity**: No known significant effects or critical hazards.

**Mutagenicity**: No known significant effects or critical hazards.
2. Hazards identification

**Teratogenicity**: No known significant effects or critical hazards.

**Developmental effects**: No known significant effects or critical hazards.

**Fertility effects**: No known significant effects or critical hazards.

**Target organs**: May cause damage to the following organs: lungs.

**Over-exposure signs/symptoms**

- **Inhalation**: No specific data.
- **Ingestion**: No specific data.
- **Skin**: No specific data.
- **Eyes**: No specific data.
- **Medical conditions aggravated by over-exposure**: Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrogen</td>
<td>1333-74-0</td>
<td>100</td>
</tr>
</tbody>
</table>

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4. First aid measures

**Eye contact**: Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

**Skin contact**: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

**Inhalation**: Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

**Ingestion**: As this product is a gas, refer to the inhalation section.

**Protection of first-aiders**: No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

**Antidote information**

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Antidote information</th>
</tr>
</thead>
<tbody>
<tr>
<td>No antidote information known</td>
<td></td>
</tr>
</tbody>
</table>

**Notes to physician**: No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

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Hydrogen (Gas)

5. Fire-fighting measures

Flammability of the product: Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Extinguishing media

Suitable: Use an extinguishing agent suitable for the surrounding fire.

Not suitable: None known.

Special exposure hazards: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance.

Hazardous thermal decomposition products: No specific data.

Special protective equipment for fire-fighters: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6. Accidental release measures

Personal precautions: Accidental releases pose a serious fire or explosion hazard. Immediately contact emergency personnel. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8). If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. Never fix a leak while the system is under pressure. If leak is on container or container valve, contact the closest Air Liquide Canada location.

Environmental precautions: Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill: Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill: Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

7. Handling and storage

Handling: Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparkling tools. Valve protection caps must remain in
Hydrogen (Gas)

7. Handling and storage

place unless cylinder is secured with valve outlet piped to usage point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow to the cylinder. Do not tamper with (valve) safety device. Close valve after each use and when empty.

Storage

: Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 52°C/125°F. Cylinders must be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time. Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Protect from sunlight. Eliminate all ignition sources. Keep container tightly closed and sealed until ready for use.

8. Exposure controls/personal protection

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>List name</th>
<th>TWA (8 hours)</th>
<th>STEL (15 mins)</th>
<th>Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrogen</td>
<td>Simple asphyxiant.</td>
<td>ppm mg/m³ Other ppm mg/m³ Other ppm mg/m³ Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures

: If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to appropriate monitoring standards. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

Engineering measures

: Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Hygiene measures

: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Respiratory

: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. If operating conditions cause high gas concentrations to be produced or any recommended or statutory exposure limit is exceeded, use an air-fed respirator or self-contained breathing apparatus. The gas can cause asphyxiation without warning by replacing the oxygen in the air. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

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8. Exposure controls/personal protection

**Hands**: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

**Eyes**: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

**Skin**: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

**Environmental exposure controls**: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. Physical and chemical properties

**Physical state**: Gas. [Compressed gas.]

**Flash point**: Not applicable.

**Auto-ignition temperature**: 399.85 to 573.75°C (751.7 to 1064.8°F)

**Flammable limits**:
- Lower: 4%
- Upper: 74.5%

**Color**: Colorless.

**Odor**: Odorless.

**Molecular weight**: 2.02 g/mole

**Molecular formula**: H2

**pH**: Not available.

**Boiling/condensation point**: -253.15°C (-423.7°F)

**Melting/freezing point**: -259.15°C (-434.5°F)

**Critical temperature**: -240.1°C (-400.2°F)

**Relative density**: 0.07

**Density**: Not available.

**Vapor pressure**: Not available.

**Vapor density**: 0.07 [Air = 1]

**Odor threshold**: Not available.

**Evaporation rate**: Not available.

**Viscosity**: Not available.

**Solubility**: Insoluble in the following materials: cold water and hot water.

**Water solubility (g/l)**: 0.0016 g/l

**LogKow**: Not available.

5/1/2014.

Canada
10. Stability and reactivity

<table>
<thead>
<tr>
<th>Stability and reactivity</th>
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<tbody>
<tr>
<td>Chemical stability</td>
</tr>
<tr>
<td>Conditions to avoid</td>
</tr>
<tr>
<td>Incompatible materials</td>
</tr>
<tr>
<td>Hazardous decomposition products</td>
</tr>
<tr>
<td>Possibility of hazardous reactions</td>
</tr>
</tbody>
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11. Toxicological information

<table>
<thead>
<tr>
<th>Toxicological information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity</td>
</tr>
<tr>
<td>Chronic toxicity</td>
</tr>
<tr>
<td>Irritation/Corrosion</td>
</tr>
<tr>
<td>Sensitizer</td>
</tr>
<tr>
<td>Carcinogenicity</td>
</tr>
<tr>
<td>Mutagenicity</td>
</tr>
<tr>
<td>Teratogenicity</td>
</tr>
<tr>
<td>Reproductive toxicity</td>
</tr>
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</table>

12. Ecological information

<table>
<thead>
<tr>
<th>Ecological information</th>
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</thead>
<tbody>
<tr>
<td>Ecotoxicity</td>
</tr>
<tr>
<td>Aquatic ecotoxicity</td>
</tr>
<tr>
<td>Persistence/degradability</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
</tr>
<tr>
<td>Bioconcentration factor</td>
</tr>
<tr>
<td>Mobility</td>
</tr>
</tbody>
</table>

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12. Ecological information

Toxicity of the products of biodegradation: Not available.

Other adverse effects: No known significant effects or critical hazards.

13. Disposal considerations

Waste disposal: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Empty pressure vessels should be returned to the supplier. Waste packaging should be recycled.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14. Transport information

<table>
<thead>
<tr>
<th>Regulatory information</th>
<th>UN number</th>
<th>Proper shipping name</th>
<th>Classes</th>
<th>PG*</th>
<th>Label</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDG Classification</td>
<td>UN1049</td>
<td>HYDROGEN, COMPRESSED</td>
<td>2.1</td>
<td>-</td>
<td></td>
<td>Explosive Limit and Limited Quantity Index 0.12 ERAP Index 3000 Passenger Carrying Ship Index Forbidden Passenger Carrying Road or Rail Index Forbidden</td>
</tr>
<tr>
<td>IATA-DGR Class</td>
<td>UN1049</td>
<td>Hydrogen, compressed</td>
<td>2.1</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PG*: Packing group
15. **Regulatory information**

**United States inventory (TSCA 8b)**  
This material is listed or exempted.

**WHMIS (Canada)**  
Class A: Compressed gas.  
Class B-1: Flammable gas.

**Canadian lists**

- **Canadian NPRI**: This material is not listed.
- **CEPA Toxic substances**: This material is not listed.
- **Canada inventory**: This material is listed or exempted.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

**International regulations**

**International lists**  
- **Australia inventory (AICS)**: This material is listed or exempted.
- **China inventory (IECSC)**: This material is listed or exempted.
- **Japan inventory**: Not determined.
- **Korea inventory**: This material is listed or exempted.
- **Malaysia Inventory (EHS Register)**: This material is listed or exempted.
- **New Zealand Inventory of Chemicals (NZIoC)**: This material is listed or exempted.
- **Philippines inventory (PICCS)**: This material is listed or exempted.
- **Taiwan inventory (CSNN)**: This material is listed or exempted.

**Chemical Weapons Convention List Schedule I Chemicals**: Not listed

**Chemical Weapons Convention List Schedule II Chemicals**: Not listed

**Chemical Weapons Convention List Schedule III Chemicals**: Not listed

16. **Other information**

**Label requirements**  
FLAMMABLE GAS. MAY CAUSE FLASH FIRE. HIGH PRESSURE GAS. GAS REDUCES OXYGEN AVAILABLE FOR BREATHING. AT VERY HIGH CONCENTRATIONS, CAN DISPLACE THE NORMAL AIR AND CAUSE SUFFOCATION FROM LACK OF OXYGEN. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on MSDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

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16. Other information

The customer is responsible for determining the PPE code for this material.

Date of issue: 5/1/2014.
Date of previous issue: 5/15/2011.
Version: 6

Indicates information that has changed from previously issued version.

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