

SAFETY DATA SHEET

Classified in accordance with Health Canada Hazardous Products Regulations (SOR/2015-17)

1. Identification

Product identifier: Hydrogen Gas - Joffre**Other means of identification****Common name(s),** H₂, Hydrogen Gas**synonym(s):****SDS number:** NOVA-0019**Recommended use and restriction on use****Recommended use:** Fuel gas, petrochemical feedstock and purified hydrogen applications.**Restrictions on use:** All uses other than the identified.**Manufacturer/Importer/Supplier/Distributor Information****Manufacturer**

Company Name:

NOVA Chemicals

Address:

P.O. Box 2518, Station M

Calgary, Alberta, Canada T2P 5C6

Telephone:

Product Information: 1-412-490-4063

SDS Information Email:

msdsemail@novachem.com**Emergency telephone number:**

1-800-561-6682, 1-403-314-8767 (NOVA Chemicals) (24 hours)

Canada: 1-800-579-7421 (NCEC) (24 hours)

2. Hazard(s) identification

Hazard Classification According to Hazardous Products Regulations**Physical Hazards**

Flammable gas

Category 1

Gases under pressure

Compressed gas

Simple asphyxiant

Category 1

Label Elements**Hazard Symbol:****Signal Word:**

Danger

Hazard Statement:

Extremely flammable gas.

Contains gas under pressure; may explode if heated.

May displace oxygen and cause rapid suffocation.

Precautionary Statements:**Prevention:**

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response:	Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leakage, eliminate all ignition sources.
Storage:	Protect from sunlight. Store in a well-ventilated place.
Disposal:	Dispose of contents/ container to an approved facility in accordance with local, regional, national and international regulations.

Other hazards which do not result in GHS classification: Contact with pressurized gas may cause irritation and/or frostbite.

3. Composition/information on ingredients

Mixtures

Chemical Identity	Common name and synonyms	CAS number	Content in percent (%)*
Hydrogen	Hydrogen gas	1333-74-0	>=99.99%

* All concentrations are percent by weight.

Additional Information: This product is considered hazardous by the Hazardous Products Regulations, 2015.

4. First-aid measures

Inhalation:	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Seek medical attention.
Ingestion:	Ingestion of this product is not a likely route of exposure. Do NOT induce vomiting. Seek medical attention.
Skin Contact:	Contact with pressurized gas may cause irritation and/or frostbite. Seek medical attention immediately in the event of frostbite. IF ON SKIN: Gently wash with plenty of soap and water. Seek medical attention.
Eye contact:	Contact with pressurized gas may cause irritation and/or frostbite. Seek medical attention immediately in the event of frostbite. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

Most important symptoms/effects, acute and delayed

Symptoms: Frostbite can occur with exposure to compressed gases. High concentrations reduce available oxygen levels and may cause headache, dizziness, nausea, loss of coordination, difficulty breathing, suffocation, or cardiac rhythm disturbance.

Indication of immediate medical attention and special treatment needed

Treatment: Administer oxygen by mask if there is respiratory distress, any change in level of consciousness, or cardiac rhythm disturbance. Treat unconsciousness, frostbite, nausea, hypotension, seizures and cardiac dysrhythmias in the conventional manner.

5. Fire-fighting measures

General Fire Hazards: Extremely flammable gas. Contains gas under pressure; may explode if heated. Hydrogen gas has an extremely wide flammability range. Will be easily ignited by heat, sparks or flames. Hydrogen burns with an invisible to pale blue flame that is often very difficult to see. Vapours may travel considerable distance to a source of ignition and flash back. DO NOT

ATTEMPT TO EXTINGUISH A GAS FIRE UNLESS LEAK SOURCE CAN BE ISOLATED AND SHUT OFF. Be aware of possibility of reignition. Gas may form explosive mixture with air. Consider need for immediate emergency isolation and evacuation. If a pipeline or a storage vessel is involved in a fire, ISOLATE for 1600 metres (1 mile) in all directions.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Use dry chemical, carbon dioxide (CO₂), water spray or fog to extinguish. Use water to cool fire-exposed containers and to protect personnel.

Unsuitable extinguishing media: Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical: None known.

Special protective equipment and precautions for fire-fighters

Special fire-fighting procedures: DO NOT ATTEMPT TO EXTINGUISH A GAS FIRE UNLESS LEAK SOURCE CAN BE ISOLATED AND SHUT OFF. Hydrogen burns with an invisible to pale blue flame that is often very difficult to see. Use an alternate method of detection (thermal camera, broom handle, etc.). Keep upwind. Keep unauthorized personnel away. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned holders or monitor nozzles. Immediately withdraw in case of fire and container venting or heat discolouration of a container. Let uncontrolled fires burn off. Avoid inhaling any smoke and combustion materials. Remove and isolate contaminated clothing and shoes. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices as icing may occur. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Reference Emergency Response Guidebook No. 115 for additional details and instructions.

Special protective equipment for fire-fighters: Wear positive pressure self-contained breathing apparatus (SCBA). Structural fire-fighters' protective clothing provides thermal protection **but only limited chemical protection**.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Wear appropriate personal protective equipment. Check oxygen and flammable gas levels prior to entering confined spaces or buildings. Keep area isolated until any detectable flammable gas has been fully dispersed. Keep unauthorized personnel away. Alert stand-by emergency and fire-fighting personnel. Monitor surrounding area for buildup of flammable concentrations in air. Consider need for immediate emergency isolation and evacuation.

Methods and material for containment and cleaning up: Do not touch or walk through spilled material. In case of leakage, eliminate all ignition sources. Keep upwind. Keep out of low areas. Stop leak if safe to do so. All equipment used when handling the product must be grounded. Any release to water, air or land will immediately disperse into a highly flammable gas cloud that is easily ignited by heat, sparks, static charge or flames. Use water spray to reduce vapours or divert vapour cloud drift. Check for gas pockets under roofs or at high ends of equipment. Keep area isolated until any detectable flammable gas has been fully dispersed.

Small Spills: Isolate spill or leak area for at least 100 metres (330 feet) in all directions.

Large Spills: Consider initial downwind evacuation for at least 800 metres

(1/2 mile).

Environmental Precautions: Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply.

7. Handling and storage

Precautions for safe handling: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep container tightly closed. Ground and bond container and receiving equipment. Use explosion-proof [electrical/ventilating/lighting] equipment. Use non-sparking tools. Take action to prevent static discharges. These alone may be insufficient to remove static electricity. For additional information on equipment bonding and grounding, refer to the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity". Take special precautions when cold cutting or breaking into lines, or when cleaning and disposing of empty containers. Do not breathe dust/fume/gas/mist/vapours/spray. Wash face, hands and any exposed skin thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves/ protective clothing/ eye protection/ face protection. In case of inadequate ventilation, use respiratory protection.

Conditions for safe storage, including any incompatibilities: Protect from sunlight. Store in a well-ventilated place. Keep container tightly closed. Store locked up. Only allow access to authorized persons. Store and handle in properly designed pressure vessels and equipment. Store and use away from heat, sparks, open flame, or any other ignition source. Storage pressure vessels should be above ground and diked. Store away from incompatible materials. Store according to applicable regulations and standards for compressed materials. Keep cylinders secure while in storage or in transportation. Have appropriate extinguishing capability in storage area (e.g. sprinkler system, portable fire extinguishers) and flammable gas detectors.

8. Exposure controls/personal protection

Control Parameters

Occupational Exposure Limits

In the ACGIH TLVs® and BEIs® book, hydrogen (CAS# 1333-74-0) has been identified as "Simple asphyxiant" and "Explosion hazard". Please refer to the ACGIH TLVs® and BEIs® book, latest edition, for additional information.

Appropriate Engineering Controls

Engineering methods to reduce hazardous exposure are preferred controls. Methods include mechanical ventilation (dilution and local exhaust) process or personal enclosure, remote and automated operation, control of process conditions, leak detection and repair systems, and other process modifications. Ensure all exhaust ventilation systems are discharged to outdoors, away from air intakes and ignition sources. Supply sufficient replacement air to make up for air removed by exhaust systems. Administrative (procedure) controls and use of personal protective equipment may also be required.

Individual protection measures, such as personal protective equipment

General information:

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation, and/or applicable regulations to determine hazard

potential and ensure adequate protection.

Eye/face protection: Safety glasses. Chemical goggles under a full-face shield are recommended when handling hydrogen under pressure.

Skin Protection

Hand Protection: Wear protective gloves. Wear cold insulating gloves.

Skin and Body Protection: Wear appropriate clothing to prevent any possibility of skin contact. Wear work clothes with long sleeves and pants. Fire resistant (i.e., Nomex) or natural fibre clothing (i.e., cotton or wool) is recommended. Synthetic clothing can generate static electricity and is not recommended where a flammable vapour release may occur. Wear chemical-resistant safety footwear with good traction to prevent slipping. Static Dissipative (SD) rated footwear is also recommended.

Respiratory Protection: Supplied air breathing apparatus must be used when oxygen concentrations are low.

Hygiene measures: Use effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are in close proximity to work locations.

9. Physical and chemical properties

Appearance

Physical state:	Gas
Form:	Compressed gas
Colour:	Colourless
Odour:	Odourless
Odour Threshold:	No data available.
pH:	not applicable
Melting point/freezing point:	-259 °C (-434 °F)
Initial boiling point and boiling range:	-252.8 °C (-423.0 °F)
Flash Point:	< -50 °C (< -58 °F)
Evaporation rate:	not applicable
Flammability (solid, gas):	Extremely flammable.

Upper/lower limit on flammability or explosive limits

Flammability limit - upper (%): 74.5 %(V)

Flammability limit - lower(%): 4 %(V)

Vapour pressure:	not applicable
Vapour density:	0.07 (15 °C (59 °F)) 101.3 kPa
Density:	not applicable
Relative density:	not applicable

Solubility(ies)

Solubility in water: Slightly soluble

Solubility (other): Slightly soluble in ethanol and diethyl ether

Partition coefficient (n-octanol/water): 0.45 (estimated) Log P(oct)

Auto-ignition temperature: 570 °C (1058 °F)

Decomposition temperature: not applicable

Viscosity: not applicable

10. Stability and reactivity

Reactivity: Fire and explosion hazard in contact with incompatible materials and under

conditions to avoid.

Chemical Stability:	Stable under normal storage conditions.
Possibility of Hazardous Reactions:	High risk of fire and explosion if in contact with incompatible materials and under conditions to avoid.
Conditions to Avoid:	Keep away from heat, sparks and open flame.
Incompatible Materials:	Oxidizing agents. Halogens. Grease. Metal catalysts, such as platinum and nickel.
Hazardous Decomposition Products:	None known.

11. Toxicological information

Information on likely routes of exposure

Inhalation:	May displace oxygen and cause rapid suffocation.
Ingestion:	Ingestion of this product is not a likely route of exposure.
Skin Contact:	Hydrogen gas is not irritating to the skin. The compressed form will cause freezing burns (frostbite).
Eye contact:	Hydrogen gas is not irritating to the eyes. The compressed form will cause freezing burns (frostbite).

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation:	High concentrations reduce available oxygen levels and may cause headache, dizziness, nausea, loss of coordination, difficulty breathing, suffocation, or cardiac rhythm disturbance.
Ingestion:	No adverse effects due to ingestion are expected.
Skin Contact:	Frostbite or burns.
Eye contact:	Frostbite or burns.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral Product:	Not classified for acute toxicity based on available data.
Dermal Product:	Not classified for acute toxicity based on available data.
Inhalation Product:	Not classified for acute toxicity based on available data.

Repeated dose toxicity Product:	No data available.
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Skin Corrosion/Irritation Product:	Hydrogen gas is not irritating to the skin. The compressed form will cause freezing burns (frostbite).
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Serious Eye Damage/Eye Irritation

Product: Hydrogen gas is not irritating to the eyes. The compressed form will cause freezing burns (frostbite).

Respiratory or Skin Sensitization

Product: No data available.

Carcinogenicity

Product: No data available.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:

No carcinogenic components identified

ACGIH Carcinogen List:

No carcinogenic components identified

Germ Cell Mutagenicity
In vitro

Product: There are no known or reported genetic effects.

In vivo

Product: There are no known or reported genetic effects.

Reproductive toxicity

Product: There are no known or reported reproductive effects.

Specific Target Organ Toxicity - Single Exposure

Product: No data available.

Specific Target Organ Toxicity - Repeated Exposure

Product: No data available.

Aspiration Hazard

Product: Not classified.

Other effects:

Simple asphyxiant. A very high concentration of hydrogen may displace oxygen and cause rapid suffocation.

12. Ecological information

Ecotoxicity:
Acute hazards to the aquatic environment:
Fish

Product: No data available.

Aquatic Invertebrates

Product: No data available.

Toxicity to aquatic plants

Product: No data available.

Chronic hazards to the aquatic environment:
Fish

Product: No data available.

Aquatic Invertebrates
Product: No data available.

Toxicity to aquatic plants
Product: No data available.

Persistence and Degradability
Biodegradation
Product: No data available.

BOD/COD Ratio
Product: No data available.

Bioaccumulative Potential
Bioconcentration Factor (BCF)
Product: No data available.

Partition Coefficient n-octanol / water (log Kow)
Product: 0.45 (estimated) Log P(oct)

Mobility in Soil: not applicable

Other Adverse Effects: No data available.

13. Disposal considerations

Disposal instructions: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

Contaminated Packaging: Check local, federal and provincial environmental regulations prior to disposal.

14. Transport information
TDG

UN number or ID number:	UN 1049
UN Proper Shipping Name:	HYDROGEN, COMPRESSED
Class	2.1
Packing Group	—
Label(s)	2.1
Subsidiary risk label	—
Special precautions for user:	Reference Emergency Response Guidebook No. 115, latest revision.

15. Regulatory information
Canada Federal Regulations
List of Toxic Substances (CEPA, Schedule 1)
Chemical Identity

Methane

Export Control List (CEPA 1999, Schedule 3)

Not regulated

National Pollutant Release Inventory (NPRI)

Canada. Canadian Environmental Protection Act (CEPA). National Pollutant Release Inventory (NPRI) (Parts 1-4)

NPRI Carbon monoxide

Canada. National Pollutant Release Inventory (NPRI) Substances, Part 5, VOCs with Additional Reporting Requirements

NPRI PT5 Not regulated

Greenhouse Gases
Chemical Identity

Methane

Precursor Control Regulations

Not regulated

Canada. Substances Subject to Significant New Activity (SNAC) Reporting Requirements

Not regulated

Inventory status

Canada DSL Inventory List: On or in compliance with the inventory

US TSCA Inventory: On or in compliance with the inventory

16. Other information, including date of preparation or last revision
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Issue Date: 11/07/2023

Revision Information: 11/07/2023: SDS Update – composition edits, phrasing updates
01/16/2020: SDS Update

Version #: 7.1

Abbreviations and acronyms: ACGIH = American Conference of Governmental Industrial Hygienists; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CEPA = Canadian Environmental Protection Act; COD = Chemical Oxygen Demand; DSL = Domestic Substances List; EC50 = Effective Concentration 50%; EPA = Environmental Protection Agency; GHS = Globally Harmonized System for the Classification and Labelling of Chemicals; IARC = International Agency for Research on Cancer; IDLH = Immediately Dangerous to Life or Health; Kow = Octanol/water partition coefficient; LC50 = Lethal Concentration 50%; LD50 = Lethal Dose 50%; LEL = Lower Explosive Limit; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OEL = Occupational Exposure Limit; OSHA = Occupational Safety and Health Administration; PNOC = Particulates Not Otherwise Classified; PPE = Personal Protective Equipment; REL = Recommended Exposure Limit; SCBA = Self Contained Breathing Apparatus; SDS = Safety Data Sheet; STEL = Short Term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Further Information: For additional information on equipment bonding and grounding, refer to the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity".

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