MATERIAL SAFETY DATA SHEET
Hydrogen Gas

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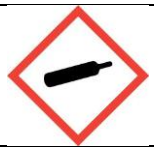
Section I. Product and Company Identification	
Material Name:	Hydrogen
Synonyms:	Hydrogen Gas, Make-up Hydrogen.
Material Use:	Make-up Gas for hydrotreater unit.
Manufacturer:	
MSDS Version:	1.0
MSDS Date:	17 May 2013

Section II. Hazards Identification		
Classification according to Regulation (EC) No. 1272/2008 [CLP]		
Flammable Gases Category 1	H220	Danger – Flammable gas
Gases Under Pressure	H280	Warning – Compressed gas
CLP Precautionary statements		
P210: Keep away from heat, sparks, open flames or hot surfaces. – No smoking		
P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely.		
P381: Eliminate all ignition sources if safe to do so.		
P403: Store in a well-ventilated place.		

GHS02



GHS04

Classification according to Directive 67/548/EEC or 1999/45/EC
F+: Extremely flammable
R12: Extremely flammable
S9 : Keep container in a well-ventilated place
S16 : Keep away from sources of ignition - No smoking
S33 : Take precautionary measures against static discharges

NFPA 704 HAZARD IDENTIFICATION

Summary of Hazards

Health	**Fire Hazard**	**Reactivity**	4	Extreme
			3	High
			2	Slight
			1	Least
	Specific Hazard			

Summary of Hazards

Health Hazards

Can cause suffocation. Can cause frostbite.
Physical Hazards
Extremely flammable gas.
Gas under pressure.
Health Effects: Eye Contact
Contact with rapidly expanding gas may cause frostbite or burns.
Health Effects: Skin Contact
Contact with rapidly expanding gas may cause frostbite or burns.
Health Effects: Ingestion
Not applicable to gas.
Health Effects: Inhalation
Can cause asphyxiation.

Section III. Composition/Information on Ingredients		
Material Description:	Incondensible gas. Lighter than air. Colorless. Odorless.	
Reportable Quantity:	See Section XV, Regulatory Information.	
Marine Pollutant:	No	
Hazardous Ingredients		
Ingredient Name	CAS #	Concentration Range
Hydrogen	1333-74-0	100%

Section IV. First Aid Measures
First Aid: Eye Contact
If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.
First aid: Skin Contact
If frostbite is suspected, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physican should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.
First Aid: Ingestion
Not Applicable for gas.
First Aid: Inhalation
Remove to fresh air. If breathing is difficult, ensure clear airway and administer oxygen. If not breathing, apply artificial respiration or cardiopulmonary resuscitation. Get medical attention.
First Aid: Notes to Physician
Treatment should be symptomatic and supportive.

Section V. Fire Fighting Measures
Fire & Explosion Hazards
Hydrogen is lighter than air and tends to collect in the upper portions of enclosed spaces. Burns with an almost invisible flame. Releases from high pressure may ignite via static discharge or without apparent ignition source. Containers may rupture under extreme heat. Forms explosive mixtures with air at almost any concentration.
Extinguishing Media
Dry chemical, carbon dioxide, water spray or fog. Do not extinguish the fire until gas supply is shut off as otherwise explosion may occur.
Advice for firefighters
If possible, stop the flow of gas. Do not extinguish the fire until supply is shut off as otherwise explosion may occur. If the fire is extinguished and the flow of gas continues, use increased ventilation to prevent build-up of explosive atmosphere. Ventilation fans must be explosion proof. Use non-sparking tools to close container valves. Isolate leak area for at least 330 feet in all directions. Vapors may accumulate in the upper parts of confined areas. Vapors may travel

to source of ignition and flash back. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible withdraw from area and let fire burn. Use water spray to cool surrounding containers and equipment. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

Section VI. Accidental Release Measures

Personnel precautions & protective equipment

Eliminate all ignition sources. No smoking, flares, sparks or flames. Evacuate personnel to safe areas. Keep people away from and upwind of leak. All equipment used when handling the product must be grounded. Use non sparking tools. Use only explosion proof equipment. Wear self-contained breathing apparatus when entering confined area unless atmosphere is proved to be safe. Monitor oxygen level.

Environmental precautions

None.

Spills

Try to stop release if possible. Beware of explosive mixtures buildup. Prevent spreading of gas through sewers, ventilation systems and confined areas. Ventilate area if possible. Ventilation equipment must be explosion proof. Use non-sparking tools.

Section VII. Handling and storage

Handling

Provide adequate ventilation to minimize gas concentrations. Ground and bond all lines and equipment associated with the hydrogen system. All equipment should be non-sparking and explosion proof. Separate hydrogen from oxidizers by a minimum distance of 20 ft. or by a 5 ft. high barrier with a minimum fire resistance rating of a half an hour. Post "NO SMOKING" signs in use and storage areas. Remove all sources of ignition. Use only in ventilated areas. Hydrogen is non-corrosive. However hydrogen can interact with metals (hardened steels) to cause embrittlement. Use equipment rated for design pressure. Use backflow preventive device in piping.

Storage

Store in grounded, proper vessels away from heat, sparks, open flame and other ignition sources. Provide storage area with adequate extinguishing measures. Outside storage is preferred. Keep at temperatures below 125°F.

Incompatible materials

Oxygen. Oxidizing agents.

Section VIII. Exposure Controls & Personal Protection

Exposure Limits Hydrogen (1333-74-0)

No exposure limit known

Exposure Controls

Equipment and piping under pressure should be regularly checked for leakages. Explosive gas detectors should be used. Provide adequate ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%. Use explosion proof ventilation systems. Use adequate hot work permit system. Wear leather safety gloves and safety shoes. Wear safety glasses with side shields. Consider the use of flame resistant anti-static safety clothing (NOMEX or equivalent). In case of oxygen depletion due to large leak, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent).

Section IX. Physical & Chemical Properties

Physical State	Gas
Appearance	-
Color	Colorless
Odour	Odorless
Odour threshold	No data available
pH	Not applicable
Boiling point ~~range~~	-423.2 °F
Freezing point	-434.8 °F

Vapor Pressure	Supercritical gas @ ambient conditions
Evaporation Rate (n-Butyl Acetate=1)	No data available
Gas Density	0.00521 lb/ft^3 at 70^{o}F
Viscosity	-
Flash Point	-
Auto Ignition Temperature	1058^{o}F
Upper Flammable Limit (UFL)	75% vol
Lower Flammable Limit (LFL)	4% vol
Relative Vapor Density (air=1)	0.069
Water Solubility	0.019 vol/vol @ 60^{o}F

Section X. Stability & Reactivity Information

Chemical Stability

Material stable under normal conditions.

Conditions to Avoid

Avoid ignition sources.

Incompatible materials

Oxidizing Agents. Gas may form explosive mixtures with air. Fluorine and hydrogen react at -418^{o}F. Chlorine / hydrogen mixtures explode if exposed to sunlight. Lithium metal will react violently in a hydrogen atmosphere.

Hazardous Decomposition Products

None.

Section XI. Toxicological Information

Hydrogen (1333-74-0)

LD50 oral: No Data available.

LD50 dermal: No Data available.

LC50 inhalation: No Data available.

Inhalation: Simple asphyxiant.

Acute toxicity : None.

Skin corrosion/irritation : None.

Serious eye damage/irritation : None

Respiratory or skin sensitisation : None.

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified. (IARC 3)

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure): None.

Potential Adverse human health effects and symptoms: Simple asphyxiant.

Section XII. Ecological Information

Ecotoxicity

General

None.

Biodegradability - Bioaccumulation

Not biodegradable.

Section XIII. Disposal Considerations

Depressurize equipment to plant's flare.

Section XIV. Transportation Information

UN

UN Number: 1049

Proper Shipping Name: Hydrogen Compressed

Class: 2.1

Packing group: Not Applicable (gas)

IATA / ICAO Information

UN Number: 1049

Proper Shipping Name: Hydrogen Compressed

Hazard Class: 2.1

ERG Code: 10L

Description: UN1049, Hydrogen, compressed, 2.1

Maximum Quantity for Passenger Plane: Forbidden

Maximum Quantity for Cargo Plane: 150 kg

Limited Quantity: No information available

IMDG Information

UN Number: 1049

Proper Shipping Name: Hydrogen Compressed

Hazard Class: 2.1

EmS Number: F-D, S-U

Description: UN1049, Hydrogen, compressed, 2.1

ADR Information

UN Number: 1049

Proper Shipping Name: Hydrogen Compressed

Hazard Class: 2.1

Classification Code: 1F

Description: UN1049, Hydrogen, compressed, 2.1

US DOT Information

UN Number: 1049

Proper Shipping Name: Hydrogen Compressed

Hazard Class: 2.1

Subsidiary Class: None

Description: UN1049, Hydrogen, compressed, 2.1

Emergency Response Guide Number: 115

TDG Information
UN Number: 1049
Proper Shipping Name: Hydrogen Compressed
Hazard Class: 2.1
Description: UN1049, Hydrogen, compressed, 2.1


Section XV. Regulatory Information
EU
EINECS: This material is listed.
US
TSCA: This material is listed or exempted.
CERCLA: No components of this product are subject to reporting requirements
SARA 302/304/311/312 extremely hazardous substances: Not listed.
SARA 302/304 emergency planning and notification: Not listed.
SARA 302/304/311/312 hazardous chemicals: hydrogen
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Hydrogen: Fire hazard, Sudden release of pressure
Clean Air Act (CAA) 112 accidental release prevention - Flammable Substances: Hydrogen
Clean Air Act (CAA) 112 regulated flammable substances: hydrogen

Section XVI. Other Information
The information presented in this Material Safety Data Sheet is based on current knowledge and is believed to be complete and accurate at the time of preparation of this document. It describes the material for the purposes of health, safety and environment requirements only and shall, therefore, be used only as a guide. The data refers to a specific product and may not be valid for combined uses with other products. It is the user´s obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. GIT shall not be responsible for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. Unless specifically agred otherwise GIT does not take responsibility for use, transportation, storage, handling or disposal of the material described herein.