SECTION 1: Product and Company Identification

1.1 Product identifier

Product name	:	Hydrogen
Trade name	:	No applicable.

1.2 Other means of identification

Chemical Name	:	Hydrogen
Chemical Formula	:	H2

1.3 Recommended use and restrictions on use

Product use	:	Semiconductor Processes Industrial & Professional use Synthetic/Analytical chemistry Photovoltaic Processes

1.4 Details of supplier of the safety data sheet

Company identification	:	Iwatani Corporation (Singapore) Pte. Ltd.
Address	:	6 Shenton Way, OUE Downtown 2 #13-11, Singapore 068809
Phone	:	+65 6862 2111

1.5 Emergency contact

Emergency phone number	:	+65 6220 8347

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Physical hazards	:	Gases under pressure- compressed gas
Characteristic	:	Flammable, Category 1
Acute toxicity (inhalation)	:	Not classified
Skin corrosion/irritation	:	Not classified
Target organ systemic toxicity-single exposure	:	Not classified
Serious eye damage/eye irritation	:	Not classified
Acute aquatic toxicity	:	Not classified

2.2 GHS label elements, including precautionary statements

Pictogram(s) :

Signal word(s)	:	Danger
Hazard statement(s)	:	H220 - Extremely flammable gas.

H280 – Contains gas under pressure; may explode if heated.
H380 - May displace oxygen and cause rapid suffocation.
Burns with invisible flame.

Precautionary statements

Prevention	:	P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. - No smoking.
Response	:	P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely. P381 - In case of leakage, eliminate all ignition sources.
Storage	:	P403 – Store in a well-ventilated place. P403+P410 - Store in a well-ventilated place. Protect from sunlight.
Disposal	:	None.

2.3 Other hazards which do not result in classification

Inhalation Hazard	:	Nausea, vomiting, difficulty breathing, irregular heartbeat, headache, fatigue, dizziness, disorientation, mood swings, tingling sensation, loss of coordination, convulsions, unconsciousness, coma.

SECTION 3. Composition/Information on ingredients

3.1 Substances / 3.2. Mixture

Substance name	Contents	CAS No.
Hydrogen	100 %	1333-74-0

SECTION 4. First-aid measures

4.1 Description of first aid measures

Inhalation	:	Immediately remove victim to fresh air. If breathing stopped, give artificial respiration. Get immediate medical attention
Skin contact	:	Wash exposed skin with soap and water.
Eye contact	:	Check for and remove any contact lenses. Continue to rinse for at least 15 minutes. Seek immediate medical attention.
Ingestion	:	If a large amount is swallowed, seek immediate medical attention.

4.2 Most important symptoms/effect, acute and delayed

None.

4.3 Indication of immediate medical attention and special treatment needed, if necessary

None.

SECTION 5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media	:	Dry chemical or Carbon dioxide.

Unsuitable extinguishing media	:	Do not use water jet to extinguish.

5.2 Special hazards arising from the substance or mixture

Flammable gas. Pressurized container may rupture or explode if exposed to sufficient heat.

5.3 Advice for fire-fighters

Move container from fire area if it can be done without risk.
Cool containers with water spray until well after fire is out. Stay away from ends of tanks.
Stay away from ends of tanks. Stop flow of gas.

SECTION 6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal precautions	:	Wear proper personal protective clothing and equipment in the event of a significant release from cylinder.

6.2 Environmental precautions

Avoid release to the environment (water, soil).

6.3 Methods and materials for containment and cleaning up

For containment	:	Do not extinguish, unless leak can be stopped safely. Reduce vapours with water spray. Stop leak, if possible, without personal risk. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.
Methods for cleaning up	:	Avoid heat, flames, sparks and other sources of ignition. Ventilate closed spaces before entering. Damaged cylinder(s) should be handled by trained personnel using pre-planned procedures. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Iwatani for proper disposal.

SECTION 7. Handling and storage

7.1 Precautions for safe handling

Operators should wear protective clothing while handling this gas. Avoid breath in gas. Proper respiratory protection equipment should be provided.

7.2 Conditions for safe storage, including any incompatibilities

Store and handle in accordance with all current regulations and standards.
Cylinders should be stored upright and be secured firmly to prevent falling.
Protect cylinders against extreme weather and from dampness from ground to prevent resting.

Stored cylinders in well-ventilated area, away from direct heat and ignition source.
Do not allow area where cylinders are stored to exceed 52°C.

SECTION 8. Exposure controls/personal protection

8.1 Control parameters/Occupational exposure limits

None of the components have assigned exposure limits.

8.2 Appropriate engineering control measures

Explosion proof ventilation systems.
Provide local exhaust ventilation system.
Gas detector should be used when flammable gases/vapours may be released.
Systems under pressure should be regularly checked for leakages. Consider installation of leak detection systems in areas of use and storage.

8.3 Personal protection

Individual protection measures, such as personal protective equipment (PPE)		A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered: Protect eyes, face and skin from liquid splashes. PPE compliant to the recommended EN/ISO standards should be selected.
Hand protection	:	Wear appropriate protective chemical-resistant gloves that protect chemicals directly. Standard EN 388 – Protective gloves against mechanical risk.
Eye/face protection	:	Wear facepiece with goggles to protect from scattering dust or toxic liquid. Further eye protection such as chemical goggles and/or protecting glasses must be worn when the possibility exists for eye contact due to splashing or spraying liquid or airborne particle. EN 166 - Personal Eye Protection
Skin and Body protection	:	As needed, wear hand, and body protection, which help to prevent injury from radiation and sparks (see ANSI Z49.1. at a minimum), this includes welder's glove and may include arm protectors, aprons, hats, and shoulder protection, as well as substantial clothing. Wear fire/flame resistant/retardant clothing. Take precautionary measures against static discharge. Wear safety shoes while handling containers. ISO 20345 - Personal protective equipment - Safety footwear.
Respiratory protection	:	Under conditions of frequent use or exposure, respiratory protection may be needed. Use positive pressure airline respirator with escape cylinder or self-contained breathing apparatus for oxygen-deficient atmospheres (<19.5%).
Hygiene Considerations	:	Handle in accordance with good industrial hygiene and safety practice.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	:	Gas
Colour	:	Colourless.
Odour	:	Odourless.
Odour threshold	:	No applicable.
pH	:	No applicable.
Melting point	:	-259 °C (-434.2 °F)
Boiling point	:	-253 °C (-423.4 °F)
Flash point	:	No data available.
Critical Temperature	:	-240 °C (-400 °F)
Flammability (solid, gas)	:	Extremely flammable gas.
Lower explosive limit	:	4%
Upper explosive limit	:	75%
Vapour pressure	:	760 mmHg @ -253 °C
Vapour density (air=1)	:	0.07
Molecular mass	:	2 g/mol
Gas density @ 0°C	:	0.08987 g/L
Solubility	:	Water 0.019 vol/vol @ 15.6°C
Viscosity	:	No data available.
Partition coefficient: n-octanol/water	:	No data available.
Evaporation rate	:	No data available.
Decomposition temperature	:	No data available.

Section 10. Stability and reactivity

10.1 Reactivity

No reactivity hazard other than the effects described in sub-section below.

10.2 Chemical stability

Stable under normal conditions. Extremely flammable gas. Contains gas under pressure; may explode if heated.

10.3 Possibility of hazardous reactions

Consider as non-reactive. Avoid incompatible materials (metals, oxidizing materials).

10.4 Conditions to avoid

Avoid incompatible materials (metals, oxidizing materials).

Protect from physical damage and heat. Containers may rupture, burst or explode when exposed to high temperatures or direct flame.

10.5 Incompatible materials

Metals, oxidizing materials.

10.6 Hazardous decomposition products

None known.

SECTION 11. Toxicology information

11.1 Information on toxicological effects

Acute toxicity (Oral)	:	Not classified.
Acute toxicity (Inhalation)	:	Product is a simple asphyxiant.
Skin corrosion or irritation	:	Not classified.
Serious eye damage or irritation	:	Not classified.
Respiratory or skin sensitization	:	Not classified.
Germ cell mutagenicity	:	Not classified.
Carcinogenicity	:	None of this product's components are listed by WSHA, ACGIH or OSHA.
Reproductive toxicity	:	Not classified.
Specific Target Organ Toxicity (STOT)-single exposure	:	Simple asphyxiant.
STOT-repeated exposure	:	Not classified.
Aspiration hazard	:	Not applicable.

SECTION 12. Ecological information

12.1 Ecotoxicity

No ecological damage caused by this product.

12.2 Persistence and degradability

Not established.

12.3 Bioaccumulative potential

Not established.

12.4 Mobility in soil

No additional information available.

SECTION 13. Disposal information

13.1 Disposal methods

Waste from residues	:	Waste must be disposed of in accordance with federal, state and local

		environmental control regulations. Refer to the EIGA code of practice (Doc.30 "Disposal of Gases", downloadable at http://www.eiga.org) for more guidance on suitable disposal methods.
Contaminated packaging	:	Container may remain hazardous when empty. Continue to observe all precaution. Handle empty container with care because residual vapours are flammable. Do not puncture or incinerate container. Never attempt to dispose off residual locally, rreturn in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Iwatani for proper disposal.

SECTION 14. Transport information

14.1 UN number

: UN1049

14.2 UN proper shipping name

: HYDROGEN, COMPRESSED

14.3 Transport Hazard Class(es)

UNRTDG (United Nations Recommendations Transport Dangerous Goods)

Class : 2.1
Subsidiary risk : Not classified.

IATA-DGR (International Air Transport Association – Dangerous Goods)

Class : 2.1
Subsidiary risk : Not classified.

IMDG (International Maritime Dangerous Goods) – Code

Class : 2.1
Subsidiary risk : Not classified.

14.4 Packing group

Not assigned by regulation.

14.5 Environmental hazards

None.

14.6 Special precaution for user

Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Before transporting product containers:

- Ensure there is adequate ventilation.
- Ensure that containers are firmly secured.

- Ensure valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.

SECTION 15. Regulatory information

End users are required to have to purchase, store and use according to local NEA regulations.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

Restrictions on use	:	None
Other information, restriction and prohibition regulations	:	Ensure all national/local regulations are observed.
Applicable national regulations	:	Safety, health and environmental regulations/legislation specific for the substance or mixture are observed.

SECTION 16. Other information

16.1 Other information

Indication of changes	:	Ensure all national/local regulations are observed.
Disclaimer of liability	:	Before using this product in any new process or experiment, a thorough material combability and safety study should be carried out. Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use ca be accepted.

End of Safety Data Sheet