SECTION 1: Product and Company Identification

1.1 Product identifier

Product name	:	Propylene
Trade name	:	No applicable.

1.2 Other means of identification

Chemical Name	:	Propylene
Chemical Formula	:	C3H6

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- liquefied gas. (Simple asphyxiants)
Characteristic	:	Flammable, Category 1.
Acute toxicity (inhalation)	:	Not classified.
Skin corrosion/irritation	:	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.
May form explosive mixtures with air

May cause frostbite

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.

Disposal : None.

2.3 Other hazards which do not result in classification

Potential Health Effects:

Inhalation : Asphyxiant, effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, nausea, vomiting, and unconsciousness. The vapor from a liquid release may also cause incoordination, abdominal pain. Effects may be delayed. Lack of oxygen can kill.

SECTION 3. Composition/Information on ingredients

3.1 Substances / 3.2. Mixture

Substance name	Contents	CAS No.
Propylene, C3H6	100 %	115-07-1

SECTION 4. First-aid measures

4.1 Description of first aid measures

General advice : Show this safety data sheet to the doctor in attendance.

Inhalation : Victim may not be aware of asphyxiation. Move victims immediately to place with fresh air and not contaminated area.
If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately if inhaled.

Skin contact : For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.
Contact with evaporating liquid may cause frostbite or freezing of skin. In case of frostbite spray with water for at least 15 minutes.
Take off and remove contaminated clothing and shoes.
In case of contact with chemicals, get immediate medical advice/attention.

Eye contact : If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.
Remove contact lenses if present and easy to do.
Get immediate medical advice/attention if irritating, pain, swelling, tear, dazzling eyes occur.

Ingestion	:	Ingestion is not considered a potential route of exposure.

4.2 Most important symptoms/effect, acute and delayed

Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death. May cause central nervous system depression with nausea, headache, dizziness, vomiting, and incoordination. Contact with evaporating liquid may cause cold burns/frostbite.

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

Hazards	:	Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.
Treatment	:	Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention. Treat symptomatically.

SECTION 5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media	:	Dry chemical or CO2. Water spray (fog). DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Unsuitable extinguishing media	:	Do not use a solid water stream as it may scatter and spread fire.

5.2 Special hazards arising from the substance or mixture

Specific hazards	:	Extremely flammable gas. May form explosive mixtures with air. May burn with an almost invisible flame in bright light. This product will ignite at ambient temperatures and can be expected to form a flammable mixture upon release to the atmosphere. Will be easily ignited by heat, sparks or flames. Vapours may travel to source of ignition and flash back. Vapours from liquefied gas are initially heavier than air and spread along ground. Vapours may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.). Cylinders may rupture under extreme heat.
Hazardous combustion products	:	Carbon monoxide. Carbon dioxide (CO2).

5.3 Advice for fire-fighters

Special fire fighting procedures	:	In case of fire: Stop leak if safe to do so. Do not extinguish flames at leak because possibility of uncontrolled explosive reignition exists. Ventilation fans must be explosion proof. Use non-sparking tools to close container valves. Use water spray to cool surrounding containers. Be cautious of a Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers. For massive fire, use unmanned hose holders or monitor nozzles; if

this is impossible withdraw from area and let fire burn. Damaged cylinders should be handled only by specialists.

Special protective equipment for fire-fighters : As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.
Guideline:
EN 469 - Protective clothing for firefighters. Performance requirements for protective clothing for firefighting.
EN 15090 - Footwear for firefighters.
EN 659 - Protective gloves for firefighters.
EN 443 - Helmets for fire fighting in buildings and other structures.
EN 137 - Respiratory protective devices - Self-contained open circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

SECTION 6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas. Consider the risk of potentially explosive atmospheres. Monitor oxygen level. All equipment used when handling the product must be grounded. Use non-sparking tools and equipment. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Gas/vapor is heavier than air. Prevent from entering sewers, basements and workpits, or any place where accumulation may be dangerous.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so.

6.3 Methods and materials for containment and cleaning up

Methods for containment : Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1.

Methods for cleaning up : Stop the source of the release, if safe to dos so. 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

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Ground and bond all lines and equipment associated with product system. All equipment should be non-sparking and explosion proof. Separate flammable gas cylinders from oxygen and other 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. "NO SMOKING" signs should be posted in storage and

use areas.
Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.
Only experienced and properly instructed persons should handle gases under pressure. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

7.2 Conditions for safe storage, including any incompatibilities

Storage Conditions	:	Store in accordance with local regulations. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Stored containers should be periodically checked for general condition and leakage. Outside or detached storage is preferred.
Incompatible materials	:	Reacts with oxides of nitrogen to form an explosive product. Acids. Oxidizing agents. Halogenated compounds. Molten sulfur.

SECTION 8. Exposure controls/personal protection

8.1 Control parameters/Occupational exposure limits

Components	CAS-No.	Value type (form of exposure)	Control parameters/permissible concentration	Basis
Propylene, C3H6	115-07-1	TLV	500 ppm	ACGIH

STEL = Short term exposure limit; TWA=Time weighted average; REL=Recommended Exposure Limit; OEL= Occupational exposure limits; PEL= Permissible Exposure Limit; TLV= threshold limit value

8.2 Appropriate engineering control measures

Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%. Explosion proof ventilation systems. Oxygen detectors should be used when asphyxiating gases may be released. Consider installation of leak detection systems in areas of use and storage. Systems under pressure should be regularly checked for leakages. Showers. Eyewash stations.

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	:	Work gloves and safety shoes are recommended when handling cylinders. 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.
Respiratory protection	:	Use positive pressure airline respirator with escape cylinder or self-contained breathing apparatus for oxygen-deficient atmospheres (<19.5%). Wear NIOSH/MESA approved full or half face piece (with goggles) respiratory protective equipment. EN 137 - Respiratory protective devices - Self-contained open-circuit. compressed air breathing apparatus with full face mask - Requirements, testing, marking.
Skin and Body protection	:	Take precautionary measures against static discharge. Wear fire resistant or flame-retardant clothing. ISO/TR 2801:2007 Clothing for protection against heat and flame -- General recommendations for selection, care and use of protective clothing. Wear safety shoes while handling containers. ISO 20345 - Personal protective equipment - Safety footwear.
Hygiene measures	:	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	:	Mild olefinic.
Odour threshold	:	23 ppm (detection); 68-80 ppm (recognition).
pH	:	Not applicable.
Melting point	:	-185.25 °C (-301.5 °F)
Boiling point	:	-47.72 °C (-54 °F)
Flash point	:	-108 °C (-162 °F)
Critical Temperature	:	91.78 °C (197.2 °F)
Flammability (solid, gas)	:	Flammable gas.
Lower explosive limit	:	2.0 % (V).
Upper explosive limit	:	11 % (V).
Vapour pressure @ 25°C	:	915.7 kPa @ 21.1°C
Vapour density (air=1)	:	1.45
Gas density	:	1.7692 kg/m^3 @20°C
Molecular mass	:	42.07 g/mol
Solubility	:	Water -Slightly soluble.
Viscosity	:	Not applicable.
Partition coefficient: n-	:	No data available.

octanol/water		
Evaporation rate	:	No data available.
Decomposition temperature	:	No data available.
Autoignition temperature	:	460 °C (860 °F).

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.

10.3 Possibility of hazardous reactions

May form explosive mixtures with air. Explosive polymerization is initiated by lithium nitrate and sulfur dioxide.

10.4 Conditions to avoid

Heat, flames and sparks. May explode at high temperatures and pressure (955 atm; 327°C).

10.5 Incompatible materials

Reacts with oxides of nitrogen to form an explosive product. Acids. Oxidizing agents. Halogenated compounds. Molten sulfur.

10.6 Hazardous decomposition products

Carbon monoxide. Carbon dioxide (CO_2).

SECTION 11. Toxicology information

11.1 Information on toxicological effects

Inhalation	:	Product is a simple asphyxiant.
Skin contact	:	Contact with evaporating liquid may cause cold burns/frostbite.
Eye contact	:	Contact with evaporating liquid may cause cold burns/frostbite.
Ingestion	:	Not an expected route of exposure.
Symptoms	:	Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<=19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death. May cause central nervous system depression with nausea, headache, dizziness, vomiting, and incoordination.

11.2 Delayed and immediate effects as well as chronic effects from short and long-term exposure

Acute toxicity (Oral)	:	Not data available.

Acute toxicity (Inhalation)	:	Rat, LC_{50} > 65000 ppm.4hr.
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	:	IARC Group 3.
Reproductive toxicity	:	Not classified.
Specific Target Organ Toxicity (STOT)		
Toxicity (STOT)-single exposure	:	Not classified.
STOT-repeated exposure	:	
Chronic toxicity	:	None known.
Target Organ Effects	:	No information available.
Aspiration hazard	:	Not applicable.

SECTION 12. Ecological information

12.1 Ecotoxicity

No known acute aquatic toxicity.

12.2 Persistence and degradability

Not data available.

12.3 Bioaccumulative potential

Will not bioconcentrate.

12.4 Mobility in soil

Not data 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
Disposal methods		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 14. Transport information

14.1 UN number

: UN1077

14.2 UN proper shipping name

: PROPYLENE

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

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

Restrictions on use : None.
Other information, restriction : Ensure all national/local regulations are observed.

and prohibition regulations

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