SECTION 1: Product and Company Identification

1.1 Product identifier

Product name	:	Dimethyl Ether
Trade name	:	Dimethyl Ether

1.2 Other means of identification

Chemical Name	:	Dimethyl Ether, DME
Chemical Formula	:	C2H6O

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
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
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.

Emergency overview	:	DANGER! FLAMMABLE GAS. HIGH PRESSURE GAS. GAS MAY CAUSE FLASH FIRE. GAS REDUCES OXYGEN AVAILABLE FOR BREATHING. Keep away from sources of ignition. Keep away from heat (<52°C/125°F). Use only with adequate ventilation. Extremely hazardous gas under pressure. Keep cylinder valve closed when the product is not used.

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.
Dimethyl Ether	100%	115-10-6

SECTION 4. First-aid measures

4.1 Description of first aid measures

Inhalation	:	Move victims immediately to place with fresh air and not contaminated area. Get medical attention immediately if inhaled.
Skin contact	:	Take off and remove contaminated clothing and shoes. In case of contact with chemicals, get immediate medical advice/attention.
Eye contact	:	Remove contact lenses if present and easy to do. Get immediate medical advice/attention if irritating, pain, swelling, tear, dazzling eyes occur. Wash eyes immediately with large amounts of water.
Ingestion	:	Do NOT induce vomiting. If swallowed, immediately call a POISON CENTER or doctor/physician.

4.2 Most important symptoms/effect, acute and delayed

Respiratory arrest. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling.

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

Move victim to fresh air.
Call emergency medical service. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult.
Remove and isolate contaminated clothing and shoes.
Clothing frozen to the skin should be thawed before being removed.
In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
In case of burns, immediately cool affected skin for as long as possible with cold water.
Do not remove clothing if adhering to skin.
Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

SECTION 5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media	:	Dry chemical, Water spray, fog (Large fire).
Unsuitable extinguishing media	:	Do not use straight streams. Carbon dioxide (CO_2)- small fire.

5.2 Special hazards arising from the substance or mixture

Specific hazards	:	Thermal decomposition products: irritating and/or toxic gases, fires and an explosion. EXTREMELY FLAMMABLE Will be easily ignited by heat, sparks or flames. Will form explosive mixtures with air. Vapours from liquefied gas are initially heavier than air and spread along ground. Vapours may travel to source of ignition and flash back. Containers may explode when heated. Rupture cylinders may rocket. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED. If tank, rail car or tank truck is involved in a fire. ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
Hazardous combustion products.	:	Incomplete combustion may form carbon monoxide.

5.3 Advice for fire-fighters

Specific methods	:	Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

SECTION 6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.

As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions. Keep unauthorized personnel away and stay upwind. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).

6.2 Environmental precautions

Atmosphere: Provide local exhaust ventilation system.
Land: Make an embankment for further processing.
Underwater: Prevent entry into waterways, sewers, basements or confined areas.

6.3 Methods and materials for containment and cleaning up

Small spills: ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch or walk through spilled material. All equipment used when handling the product must be grounded**.** Stop leak if you can do it without risk. If possible, turn leaking containers so that gas escapes rather than liquid. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
Large spills: Do not direct water at spill or source of leak. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Isolate area until gas has dispersed. Keep out of low areas. Stay upwind.

SECTION 7. Handling and storage

7.1 Precautions for safe handling

Ventilate entire areas or by local ventilation system.
Wash thoroughly after handling.
When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.
Avoid contact with heat, sparks or flames.

7.2 Conditions for safe storage, including any incompatibilities

Store locked up. Keep in well-ventilated place.

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
Dimethyl Ether	115-10-6	TWA	1000 ppm (1900 mg/m^3)	US (NIOSH/OSHA and AGGIH)
		MAK	1000 ppm (1900 mg/m^3)	US (NIOSH/OSHA and AGGIH)

TWA=Time weighted average; MAK - Maximum Concentration Value in the Workplace

8.2 Appropriate engineering control measures

Provide local exhaust ventilation system or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.

Check legal suitability of exposure level.

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 appropriate protective chemical-resistant clothing. Wear safety shoes while handling containers. ISO 20345 - Personal protective equipment - Safety footwear.
Respiratory protection	:	Wear NIOSH/MESA approved full or half face piece (with goggles) respiratory protective equipment.
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	:	Slight ethereal odour.
Odour threshold	:	No data available.
pH	:	Not applicable.
Melting point	:	141.5 °C (286.7 °F)
Boiling point	:	-24.9 °C (-12.82 °F)
Flash point	:	-80 °C (-112 °F)
Critical Temperature	:	127.0 °C (260.6 °F)
Flammability (solid, gas)	:	Flammable gas.
Lower explosive limit	:	3.4 %
Upper explosive limit	:	27 %
Vapour pressure @ 20°C	:	5.12 hPa 4450 mmHg

Vapour density (air=1)	:	1.6
Specific gravity	:	1.91855g/L 1 atm at 25°C
Molecular mass	:	46.07 g/mol
Solubility	:	328 g/L @ 20°C
Viscosity	:	825 (20°C)
Partition coefficient: n-octanol/water	:	Log Kow = 0.10, Log Kow = -0.18
Evaporation rate	:	No data available.
Decomposition temperature	:	No data available.
Auto-ignition temperature	:	240 °C (464 °F).

Section 10. Stability and reactivity

10.1 Reactivity
No decomposition if stored and applied as directed.

10.2 Chemical stability
Avoid long-term storage or air, with light contact or on the storage and use above room temperature.

10.3 Possibility of hazardous reactions
Under light and air can be explosive in the formation of peroxides.

10.4 Conditions to avoid
Minimize contact with this substance. Avoid heat, sparks, open flames, or other sources of ignition. Containers may explode when heated.

10.5 Incompatible materials
Oxidants, combustible materials.

10.6 Hazardous decomposition products
Thermal decomposition product, irritating and/or toxic gases.

SECTION 11. Toxicology information

11.1 Information on toxicological effects

Acute toxicity (Oral)	:	Not available.
Acute toxicity (Inhalation)	:	Rat, LC_{50} = 164,000 ppm. 4 hrs
Skin corrosion or irritation	:	Category 2 **Human**: Dimethyl ether (Liquid material) will cause severe frostbite, irritation if spilled on skin.
Serious eye damage or irritation	:	Category 2A **Human:** Dimethyl ether (vpor) is irritating to eyes, nose, throat. Respiratory sensitizer: Category 1.

		Dimethyl ether was a cardiac sensitizer in dogs. Marked responses were observed in O/6 (0%) 202 (16.7%) and 216 (33.3%) dogs administered 100,000, 200,000, or 300,000 ppm DME, respectively.
Respiratory or skin sensitization	:	Not available.
Germ cell mutagenicity	:	Not classified.
Carcinogenicity	:	Not classified. IARC, ACGIH, NTP, OSHA, Regulation 1272/2008, US EPA: not listed. Dimethyl ether was not carcinogenic in a 2 years inhalation study with rats.
Reproductive toxicity	:	Not classified. 2-year combined inhalation developmental toxicity in rats. No compound-related effects on the reproductive organs of either male or female rats were observed.
Specific Target Organ Toxicity (STOT)-single exposure	:	Category 3 (drowsiness or dizziness). Observations that the gas is most unpleasant to inhale, being distinctly suffocating, even when taken with a high percentage of oxygen. Its principal physiological effect is that of anaesthesia. Inhalation may cause confusion, dizziness, lack of coordination, and unconsciousness.
STOT-repeated exposure	:	Not classified. Rats were exposed by inhalation to 0, 100, 5000, 10000 and 20000 ppm for 6 hours/day,5 days/week for 13 weeks. Health condition, behaviour and body weights did not change due to Dimethyl ether exposure. No toxicologically relevant significance is ascribed to a temporary difference in white blood cell counts in males. Neutrophil counts were higher in male rats at all test levels. A dose-effect relation could not be found.
Aspiration hazard	:	Not classified.

SECTION 12. Ecological information

12.1 Ecotoxicity

Toxicity to fish	:	LC_{50} = 1783 mg/l(estimated). 96 hrs
Toxicity to daphnia and other aquatic invertebrates		LC_{50} (Daphnia magna) = 755mg/l (estimated). 48 hrs
Toxicity to algae	:	EC_{50} = 154 mg/l (estimated) – 96 hrs
Toxicity to bacteria	:	Not data available.

12.2 Persistence and degradability

Persistence: Low persistency (log Kow = 3.162).
Photolysis: Degradation 63% after 7.7 days.
Biodegradation: Not rapidly degradable, 5% biodegradation after 28 days [OECD 301C, Modified MITI Test(I)].

12.3 Bioaccumulative potential

Bioaccumulation	:	Low Bioaccumulation (BCF=3.162 (estimated).
Partition coefficient; n-octanol /water	:	log Kow = 0.1

12.4 Mobility in soil

Mobility : Low potency of mobility to soil (Koc = 27L/kg).

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.
Consider the require attentions in accordance with waste treatment management regulation.
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 : 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

: UN1033

14.2 UN proper shipping name

: DIMETHYL ETHER

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 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