1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/UNDERTAKING

Identification of the substance/preparation	:	Trifluoromethane, (R23)
Chemical formula	:	CHF3
Other means of identification	:	Trifluoromethane (R23), Halocarbon-23, Fluoroform
Use of the Substance/Mixture	:	General Industrial
Restrictions on Use	:	No data available.
Manufacturer/Importer/Distributor	:	Versum Materials Singapore Pte. Ltd. 2 International Business Park #03-24, The Strategy Singapore 609930 Toll Free No: 800 448 1755
Email Address – Technical Information	:	techinfo@versummaterials.com
Telephone	:	800 448 1755
Emergency telephone number (24h)	:	800-101-2201 / +(65)-31581349

2. HAZARDS IDENTIFICATION

GHS classification

Gases under pressure - Liquefied gas.

GHS label elements

Hazard pictograms/symbols

Signal Word: Warning

Hazard Statements:

H280:Contains gas under pressure; may explode if heated.

Precautionary Statements:

Storage : P403:Store in a well-ventilated place.

Other hazards which do not result in classification

Can cause rapid suffocation.
Compressed liquefied gas.
Avoid breathing gas.
Direct contact with liquid can cause frostbite.
Self contained breathing apparatus (SCBA) may be required.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture : Substance

Components	Chemical formula	CAS Number	Concentration (Volume)
Trifluoromethane	CHF3	75-46-7	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

4. FIRST AID MEASURES

General advice : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Keep eye wide open while rinsing. Seek medical advice.

Skin contact : Wash frost-bitten areas with plenty of water. Do not remove clothing. Cover wound with sterile dressing.

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

Inhalation : Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. In case of shortness of breath, give oxygen.

Symptoms : Exposure to oxygen deficient atmosphere may cause the following symptoms: Dizziness. Salivation. Nausea. Vomiting. Loss of mobility/consciousness.

Notes to physician

Treatment : If exposed or concerned: Get medical attention/advice.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : All known extinguishing media can be used.

Specific hazards : Exposure to high temperatures may yield toxic by- products which may be corrosive in the presence of moisture. Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Move away from container and cool with water

from a protected position. If possible, stop flow of product. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out.

Special protective equipment for fire-fighters : Wear self contained breathing apparatus for fire fighting if necessary. Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask. Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions : Evacuate personnel to safe areas. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area. Monitor oxygen level.

Environmental precautions : Should not be released into the environment. Do not discharge into any place where its accumulation could be dangerous. Prevent further leakage or spillage. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

Methods for cleaning up : Ventilate the area.

Additional advice : If possible, stop flow of product. Increase ventilation to the release area and monitor oxygen level. If leak is from cylinder or cylinder valve, call the emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Always use backflow protective device in piping. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a

container. Containers should not be subjected to temperatures above 50°C (122°F). Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

Storage

Full containers should be stored so that oldest stock is used first. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Keep containers tightly closed in a cool, well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Return empty containers in a timely manner.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance whit local regulations. Keep away from combustible material.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide natural or mechanical ventilation to prevent oxygen deficient atmospheres below 19.5% oxygen.

Personal protective equipment

Respiratory protection	:	Self contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmosphere. Air purifying respirators will not provide protection. Users of breathing apparatus must be trained.
Hand protection	:	Wear working gloves when handling gas containers. Standard EN 388 - Protective gloves against mechanical risk.
Eye protection	:	Safety glasses recommended when handling cylinders. Standard EN 166 - Personal eye-protection.
Skin and body protection	:	Safety shoes are recommended when handling cylinders. Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
Special instructions for protection and hygiene	:	Ensure adequate ventilation, especially in confined areas.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Liquefied gas. Colorless gas
Odor	:	Ether-like. Poor warning properties at low concentrations.
Odor	:	Mixture contains one or more component(s) which have the following odor:

		Ether-like.
Odor threshold	:	No data available.
pH	:	Not applicable.
Melting point/range	:	-247 °F (-155.2 °C)
Boiling point/range	:	-116 °F (-82.2 °C)
Flash point	:	Not applicable.
Evaporation rate	:	Not applicable.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Upper/lower explosion/flammability limit	:	No data available.
Vapor pressure	:	603.34 psia (41.60 bara) at 68 °F (20 °C)
Water solubility	:	1.08 g/l
Relative vapor density	:	2.417 (air = 1) Heavier than air.
Relative density	:	1.4 (water = 1)
Partition coefficient (n-octanol/water)	:	Not applicable.
Auto-ignition temperature	:	No data available.
Decomposition temperature	:	No data available.
Viscosity	:	Not applicable.
Molecular Weight	:	70.01 g/mol
Density	:	0.181 lb/ft3 (0.0029 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	:	5.48 ft3/lb (0.3421 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	:	Stable under normal conditions.
Conditions to avoid	:	Alkali and alkaline earth metals - powdered aluminum, zinc, etc.
Possibility of hazardous reactions	:	Thermal decomposition yields toxic products that can be corrosive in the presence of moisture.

11. TOXICOLOGICAL INFORMATION

Likely routes of exposure

Effects on Eye	:	Contact with liquid may cause cold burns/frostbite.
Effects on Skin	:	Contact with liquid may cause cold burns/frostbite.
Inhalation Effects	:	Inhalation of high concentrations may also cause mild central nervous system depression and heartbeat irregularities. In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Asphyxiation may bring about unconsciousness without warning and so rapidly that victim may be unable to protect themselves.
Ingestion Effects	:	Ingestion is not considered a potential route of exposure.
Symptoms	:	Exposure to oxygen deficient atmosphere may cause the following symptoms: Dizziness. Salivation. Nausea. Vomiting. Loss of mobility/consciousness.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Inhalation	:	No data is available on the product itself.
Inhalation - Components Trifluoromethane (R23)		LC50 (4 h) : > 663000 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.
Serious eye damage/eye irritation	:	No data available.
Sensitization.	:	No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity	:	No data available.
Reproductive toxicity	:	No data is available on the product itself.
Germ cell mutagenicity	:	This material has been evaluated in a battery of tests and has not caused mutations or chromosomal damage.
Specific target organ systemic toxicity (single exposure)	:	No data available.
Specific target organ systemic toxicity (repeated exposure)	:	Animals exhibited anesthetic effects and weight loss from acute high level exposure to Trifluoromethane. Dogs that were exposed to80% Trifluoromethane for five to ten minutes and then challenged with epinephrine did not exhibit cardiac sensitization. Baboons that were exposed to 70% Trifluoromethane before or after epinephrine challenge did not exhibit cardiac sensitization; they

did exhibit a dose-related decrease in heart and respiratory rates during exposure. Cats exposed to 70% Trifluoromethane exhibited cardiac sensitization and moderate changes in cerebral electrical activity. Rats that were exposed six hours per day, for ninety days to 1% Trifluoromethane exhibited no toxic effects. The maternal and developmental "No Observed Adverse Effect Level" (NOAEL) is 50% Trifluoromethane. No developmental or reproductive effects were observed.

Aspiration hazard : No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity : No data is available on the product itself.

Toxicity to fish - Components		
Trifluoromethane	LC50 (96 h) : 633.26 mg/l	Species : Fathead minnow (Pimephales promelas).
Toxicity to daphnia - Components		
Trifluoromethane	EC50 (48 h) : 323.05 mg/l	Species : Daphnia magna.
Toxicity to algae - Components		
Trifluoromethane	EC50 (96 h) : 154.54 mg/l	Species : Algae.

Toxicity to other organisms : No data available.

Persistence and degradability

Biodegradability : No data is available on the product itself.

Mobility : No data available.
Bioaccumulation : Refer to Section 9 "Partition Coefficient (n-octanol/water)".

Further information

Contains fluorinated greenhouse gases covered by Kyoto Protocol. For quantities see concentrations or cylinder contents. Not covered by the 'Montreal Protocol'.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : Contact supplier if guidance is required. 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. List of hazardous waste codes: 14 06 01: Chlorofluorocarbons, HCFC, HFC.

Contaminated packaging : Return cylinder to supplier.

14. TRANSPORT INFORMATION

ADR

UN/ID No.	:	UN1984
Proper shipping name	:	TRIFLUOROMETHANE
Class or Division	:	2
Tunnel Code	:	(C/E)
Label(s)	:	2.2
ADR/RID Hazard ID no.	:	20
Marine Pollutant	:	No

IATA

UN/ID No.	:	UN1984
Proper shipping name	:	Trifluoromethane
Class or Division	:	2.2
Label(s)	:	2.2
Marine Pollutant	:	No

IMDG

UN/ID No.	:	UN1984
Proper shipping name	:	TRIFLUOROMETHANE
Class or Division	:	2.2
Label(s)	:	2.2
Marine Pollutant	:	No
Segregation Group:	:	None

RID

UN/ID No.	:	UN1984
Proper shipping name	:	TRIFLUOROMETHANE
Class or Division	:	2
Label(s)	:	2.2
Marine Pollutant	:	No

Further Information

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. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact customer service.

15. REGULATORY INFORMATION

Workplace Safety and Health Act & Workplace Safety and Health (General Provisions) Regulations

Workplace Health and Safety Act , SS586 Labeling.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.

Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

16. OTHER INFORMATION

Ensure all national/local regulations are observed.

Prepared by : Versum Materials, Product Regulatory Department

For additional information, please visit Versum Materials' Product Stewardship web site.
http://www.versummaterials.com/productstewardship/