Safety Data Sheet

Section 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product identifier

Product Name | **Tetrafluoroethane**

Synonyms | 1,1,1,2-Tetrafluoroethane; Arcton 134a; F 134a; FC 134a; Freon 134a; Fron 134a; Genetron 134a; HCFC 134a; HFA 134a; HFA-134a; HFC 134a; HFC-134a; Khladon 134a; Norflurane; R 134a; R-134a; Refrigerant R134a; TG 134a

CAS Number | 811-97-2

Product Code | 60042

EC Number | 212-377-0

Molecular Formula | :C 2:H 2:F 4:

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified use(s) | Semiconductor Uses

1.3 Details of the supplier of the safety data sheet

Manufacturer | Air Liquide

2700 Post Oak Blvd.
Houston, TX 77056
United States
www.us.airliquide.com
sds@airliquide.com

Telephone (Technical) | 713-896-2896

Telephone (Technical) | 800-819-1704

1.4 Emergency telephone number

Manufacturer | 800-424-9300 - CHEMTREC

Manufacturer | +1 703-527-3887 - Outside United States

Section 2: Hazards Identification

EU/EEC

According to Regulation (EC) No 1272/2008 (CLP)/REACH 1907/2006 [amended by 453/2010]
According to EU Directive 67/548/EEC (DSD) or 1999/45/EC (DPD)

2.1 Classification of the substance or mixture

CLP | Liquefied Gas - H280
Specific Target Organ Toxicity Single Exposure 3: Narcotic Effects - H336

DSD/DPD | R67

2.2 Label Elements

CLP

WARNING

Hazard statements | H280 - Contains gas under pressure; may explode if heated
H336 - May cause drowsiness or dizziness

Precautionary statements

Prevention | P261 - Avoid breathing gas.
P271 - Use only outdoors or in a well-ventilated area.

Response | P304+P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312 - Call a POISON CENTER or doctor/physician if you feel unwell.

Storage/Disposal | P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
P405 - Store locked up.
P501 - Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

DSD/DPD

Risk phrases | R67 - Vapours may cause drowsiness and dizziness.

2.3 Other Hazards

CLP | Contact with gas or liquefied gas will cause burns, severe injury and/or frostbite.
According to Regulation (EC) No. 1272/2008 (CLP) this material is considered hazardous.

DSD/DPD | Contact with gas or liquefied gas will cause burns, severe injury and/or frostbite.
This product is considered dangerous according to the European Directive 67/548/EEC.

United States (US)

According to OSHA 29 CFR 1910.1200 HCS

2.1 Classification of the substance or mixture

OSHA HCS 2012 | Liquefied Gas - H280
Specific Target Organ Toxicity Single Exposure 3: Narcotic Effects - H336
Hazards Not Otherwise Classified - Health Hazard - Frostbite

2.2 Label elements

OSHA HCS 2012

WARNING

Hazard statements | Contains gas under pressure; may explode if heated - H280
May cause drowsiness or dizziness - H336

Precautionary statements

Prevention | Avoid breathing gas. - P261
Use only outdoors or in a well-ventilated area. - P271

Response | IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. - P304+P340
Call a POISON CENTER or doctor/physician if you feel unwell. - P312

Storage/Disposal | Store in a well-ventilated place. Keep container tightly closed. - P403+P233
Store locked up. - P405
Dispose of content and/or container in accordance with local, regional, national, and/or

international regulations. - P501

2.3 Other hazards

OSHA HCS 2012

Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to WHMIS

2.1 Classification of the substance or mixture

WHMIS

Compressed Gas - A

2.2 Label elements

WHMIS

Compressed Gas - A

2.3 Other hazards

WHMIS

Contact with gas or liquefied gas will cause burns, severe injury and/or frostbite. In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

2.4 Other information

NFPA

Section 3 - Composition/Information on Ingredients

3.1 Substances

Composition				
Chemical Name	**Identifiers**	**%**	**LD50/LC50**	**Classifications According to Regulation/Directive**
1,1,1,2-Tetrafluoroethane	**CAS:**811-97-2 **EINECS:**212-377-0	100%	Inhalation-Rat LC50 • 1500 g/m³ 4 Hour(s)	**EU DSD/DPD:** Self Classified - R67 **EU CLP:** Self Classified - Press Gas - Llq., H280; STOT SE 3 Narc., H336 **OSHA HCS 2012:** Press Gas - Llq.; HNOC - Frostbite; STOT SE 3 Narc.

3.2 Mixtures

Material does not meet the criteria of a mixture in accordance with Regulation (EC) No 1272/2008.

Section 4 - First Aid Measures

4.1 Description of first aid measures

Inhalation | IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Administer oxygen if breathing is difficult. Give artificial respiration if victim is not breathing. If signs/symptoms continue, get medical attention.

Skin | If frostbite has occurred, seek medical attention immediately; do NOT rub the affected area(s) or flush them with water. In order to prevent further tissue damage, do NOT attempt to remove frozen clothing from frostbitten areas. If frostbite has not occurred, immediately and thoroughly wash contaminated skin with soap and water.

Eye | If eye tissue is frozen, seek medical attention immediately; if tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation, pain, swelling, lacrimation or photophobia persist, get medical attention as soon as possible.

Ingestion | If frostbite has occurred, seek medical attention immediately; do NOT rub the affected area(s) or flush them with water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting.

4.2 Most important symptoms and effects, both acute and delayed

| Refer to Section 11 - Toxicological Information.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to Physician | All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

4.4 Other information

| Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO GASES WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

Section 5 - Firefighting Measures

5.1 Extinguishing media

Suitable Extinguishing Media | Use extinguishing agent suitable for type of surrounding fire.
SMALL FIRES: Dry chemical or CO2.
LARGE FIRES: Water spray or fog.

Unsuitable Extinguishing Media | No data available

5.2 Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards | Containers may explode when heated.
Ruptured cylinders may rocket.

Hazardous Combustion Products | No data available

5.3 Advice for firefighters

| Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.
Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.
Wear positive pressure self-contained breathing apparatus (SCBA).
Move containers from fire area if you can do it without risk.
FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2

mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.
FIRE INVOLVING TANKS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
FIRE INVOLVING TANKS: Cool containers with flooding quantities of water until well after fire is out.
FIRE INVOLVING TANKS: Do not direct water at source of leak or safety devices; icing may occur.
FIRE INVOLVING TANKS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
FIRE INVOLVING TANKS: ALWAYS stay away from tanks engulfed in fire.

Section 6 - Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal Precautions

Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Do not touch or walk through spilled material. Ventilate the area before entry.

Emergency Procedures

Stop leak if you can do it without risk. Keep unauthorized personnel away. Keep out of low areas. Stay upwind. Do not direct water at spill or source of leak. LARGE SPILL: Consider initial downwind evacuation for at least 500 meters (1/3 mile)

6.2 Environmental precautions

Prevent entry into waterways, sewers, basements or confined areas.

6.3 Methods and material for containment and cleaning up

Containment/Clean-up Measures

Stop leak if you can do it without risk.
Do not direct water at spill or source of leak.
Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.
If possible, turn leaking containers so that gas escapes rather than liquid.
Isolate area until gas has dispersed.
Ventilate the area.
Allow substance to evaporate.
CAUTION: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.

6.4 Reference to other sections

Refer to Section 8 - Exposure Controls/Personal Protection and Section 13 - Disposal Considerations.

Section 7 - Handling and Storage

7.1 Precautions for safe handling

Handling

Use only with adequate ventilation. Ventilate closed spaces before entering. Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Cylinders should be firmly secured to prevent falling or being knocked-over. Do not attempt to repair, adjust, or in any other way modify cylinders. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Empty containers retain product residue and can be hazardous. Do not cut, weld, puncture or incinerate container.

7.2 Conditions for safe storage, including any incompatibilities

Storage

Store in a cool, dry, well-ventilated place. Protect cylinders against physical damage. Cylinders should be firmly secured to prevent falling or being knocked-over.

7.3 Specific end use(s)

Refer to Section 1.2 - Relevant identified uses.

Section 8 - Exposure Controls/Personal Protection

8.1 Control parameters

Exposure Limits/Guidelines				
	Result	**Germany DFG**	**Germany TRGS**	**Sweden**
1,1,1,2-Tetrafluoroethane (811-97-2)	STELs	Not established	Not established	750 ppm STV; 3000 mg/m3 STV
	TWAs	Not established	1000 ppm TWA AGW (The risk of damage to the embryo or fetus can be excluded when AGW and BGW values are observed, exposure factor 8); 4200 mg/m3 TWA AGW (The risk of damage to the embryo or fetus can be excluded when AGW and BGW values are observed, exposure factor 8)	500 ppm LLV; 2000 mg/m3 LLV
	Ceilings	8000 ppm Peak; 33600 mg/m3 Peak	Not established	Not established
	MAKs	1000 ppm TWA MAK; 4200 mg/m3 TWA MAK	Not established	Not established

Exposure Control Notations

Germany DFG

- 1,1,1,2-Tetrafluoroethane (811-97-2): **Pregnancy:** (no risk to embryo/fetus if exposure limits adhered to)

8.2 Exposure controls

Engineering Measures/Controls | Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Use explosion-proof - electrical, ventilating and/or lighting equipment.

Personal Protective Equipment

Respiratory | In case of insufficient ventilation, wear suitable respiratory equipment.

Eye/Face | Wear safety glasses.

Skin/Body | Wear leather gloves when handling cylinders.

Environmental Exposure Controls | Follow best practice for site management and disposal of waste. Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

Key to abbreviations

LLV = Limit Level Value is the exposure limit for 8-hour work day

MAK = Maximale Arbeitsplatz Konzentration is the maximum permissible concentration

STEL = Short Term Exposure Limits are based on 15-minute exposures

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

9.1 Information on Physical and Chemical Properties

Material Description			
Physical Form	Gas	Appearance/Description	Colorless gas with a slight ethereal odor.
Color	Colorless	Odor	Slight ethereal odor.
Odor Threshold	Data lacking		

General Properties			
Boiling Point	-26.3 C(-15.34 F)	Melting Point	-103.3 C(-153.94 F)
Decomposition Temperature	368 C(694.4 F)	pH	Data lacking
Specific Gravity/Relative Density	1.208 Water=1 @ 25 C(77 F)	Water Solubility	0.2 g/mL
Viscosity	Data lacking	Explosive Properties	Data lacking
Oxidizing Properties:	Data lacking		
Volatility			
Vapor Pressure	96.61 psia @ 25 C(77 F)	Vapor Density	3.5 Air=1
Evaporation Rate	< 1 n-Butyl Acetate = 1		
Flammability			
Flash Point	Data lacking	UEL	Data lacking
LEL	Data lacking	Autoignition	770 C(1418 F)
Flammability (solid, gas)	Data lacking		
Environmental			
Octanol/Water Partition coefficient	Data lacking		

9.2 Other Information

- No additional physical and chemical parameters noted.

Section 10: Stability and Reactivity

10.1 Reactivity

- No dangerous reaction known under conditions of normal use.

10.2 Chemical stability

- Stable under normal temperatures and pressures.

10.3 Possibility of hazardous reactions

- Hazardous polymerization will not occur.

10.4 Conditions to avoid

- Excess heat.

10.5 Incompatible materials

- This gas in compatible with oxidizers, alkali metals and finely powdered metals such as aluminum, magnesium and zinc.

10.6 Hazardous decomposition products

- Upon ignition, thermal decomposition products can include hydrogen fluoride, vinylidene fluoride and carbonyl halides.

Section 11 - Toxicological Information

11.1 Information on toxicological effects

Components		
1,1,1,2-Tetrafluoroethane (100%)	811-97-2	**Acute Toxicity:** Inhalation-Rat LC50 • 1500 g/m³ 4 Hour(s); **Reproductive:** Inhalation-Rat TCLo • 30 pph 6 Hour(s)(6-15D preg); *Reproductive Effects:Maternal Effects*:**Other effects**; *Reproductive Effects:Effects on Embryo or Fetus*:**Fetotoxicity (except death, e.g., stunted fetus)**

GHS Properties	Classification

Acute toxicity	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Aspiration Hazard	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Carcinogenicity	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Germ Cell Mutagenicity	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Skin corrosion/Irritation	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Skin sensitization	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
STOT-RE	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
STOT-SE	**EU/CLP** • Specific Target Organ Toxicity Single Exposure 3: Narcotic Effects **OSHA HCS 2012** • Specific Target Organ Toxicity Single Exposure 3: Narcotic Effects
Toxicity for Reproduction	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Respiratory sensitization	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met
Serious eye damage/Irritation	**EU/CLP** • Classification criteria not met **OSHA HCS 2012** • Classification criteria not met

Potential Health Effects

Inhalation

Acute (Immediate) | May affect the central nervous system. Symptoms may include dizziness, drowsiness, lethargy, coma and death.

Chronic (Delayed) | No data available

Skin

Acute (Immediate) | Contact with gas or liquefied gas will cause burns, severe injury and/or frostbite.

Chronic (Delayed) | No data available

Eye

Acute (Immediate) | Contact with gas or liquefied gas will cause burns, severe injury and/or frostbite.

Chronic (Delayed) | No data available

Ingestion

Acute (Immediate) | Ingestion can cause burns similar to frostbite.

Chronic (Delayed) | No data available

Key to abbreviations

LC = Lethal Concentration

TC = Toxic Concentration

Section 12 - Ecological Information

12.1 Toxicity

| Material data lacking.

12.2 Persistence and degradability

Material data lacking.

12.3 Bioaccumulative potential

Material data lacking.

12.4 Mobility in Soil

Material data lacking.

12.5 Results of PBT and vPvB assessment

PBT and vPvB assessment has not been conducted for this material.

12.6 Other adverse effects

No studies have been found.

Section 13 - Disposal Considerations

13.1 Waste treatment methods

Product waste

Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste

Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	14.1 UN number	14.2 UN proper shipping name	14.3 Transport hazard class(es)	14.4 Packing group	14.5 Environmental hazards
DOT	UN3159	1,1,1,2-Tetrafluoroethane or Refrigerant gas R 134a	2.2	NDA	NDA
TDG	UN3159	REFRIGERANT GAS R 134a; or 1,1,1,2-TETRAFLUOROETHANE	2.2	NDA	NDA
IMO/IMDG	UN3159	REFRIGERANT GAS R-134A OR 1,1,2,2-TETRAFLUOROETHANE	2.2	NDA	NDA
IATA/ICAO	UN3159	Refrigerant gas R-134a or 1,1,2,2-Tetrafluoroethane	2.2	NDA	NDA

14.6 Special precautions for user

Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not relevant.

Section 15 - Regulatory Information

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

SARA Hazard Classifications

Acute, Pressure(Sudden Release of)

Canada

Labor

Canada - WHMIS - Classifications of Substances
Not Listed

Canada - WHMIS - Ingredient Disclosure List
Not Listed

Environment

Canada - 2004 NPRI (National Pollutant Release Inventory)
Not Listed

Canada - 2005 NPRI (National Pollutant Release Inventory)
Not Listed

Canada - CEPA - Greenhouse Gases Subject to Mandatory Reporting
Not Listed

Canada - CEPA - Priority Substances List
Not Listed

Canada - DWQ (Drinking Water Quality) - IMACs
Not Listed

Other

Canada - Accelerated Reduction/Elimination of Toxics (ARET)
Not Listed

Canada New Brunswick

Environment

Canada - New Brunswick - Ozone Depleting Substances - Schedule A
Not Listed

Canada - New Brunswick - Ozone Depleting Substances - Schedule B
Not Listed

China

Environment

China - Ozone Depleting Substances - First Schedule
Not Listed

China - Ozone Depleting Substances - Second Schedule
Not Listed

China - Ozone Depleting Substances - Third Schedule
Not Listed

Other

China - Annex I & II - Controlled Chemicals Lists
Not Listed

China - Dangerous Goods List
Not Listed

China - Export Control List - Part I Chemicals
Not Listed

Europe

Other

EU - CLP (1272/2008) - Annex VI - Table 3.2 - Classification
Not Listed

EU - CLP (1272/2008) - Annex VI - Table 3.2 - Concentration Limits
Not Listed

EU - CLP (1272/2008) - Annex VI - Table 3.2 - Labelling
Not Listed

EU - CLP (1272/2008) - Annex VI - Table 3.2 - Notes - Substances and Preparations
Not Listed

EU - CLP (1272/2008) - Annex VI - Table 3.2 - Safety Phrases
Not Listed

Germany

Environment

Germany - TA Luft - Types and Classes
Not Listed

Germany - Water Classification (VwVwS) - Annex 1
Not Listed

Germany - Water Classification (VwVwS) - Annex 2 - Water Hazard Classes
Not Listed

Germany - Water Classification (VwVwS) - Annex 3
Not Listed

Other

Germany - Specifically Regulated Chemicals in TRGS
Not Listed

Portugal

Other

Portugal - Prohibited Substances
Not Listed

United Kingdom

Environment

United Kingdom - Pollution Inventory - Schedule 1 - Thresholds for Releases to Air
Not Listed

United Kingdom - Substances Contained in Dangerous Substances or Preparations
Not Listed

Other

United Kingdom - Workplace Exposure Limits (WELs) - Substances in Review
Not Listed

United Kingdom - List of Dangerous Substances in Water
Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals
Not Listed

U.S. - OSHA - Specifically Regulated Chemicals
Not Listed

Environment

U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants
Not Listed

U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities
Not Listed

U.S. - CERCLA/SARA - Radionuclides and Their Reportable Quantities
Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs
Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs
Not Listed

U.S. - CERCLA/SARA - Section 313 - Emission Reporting
Not Listed

U.S. - CERCLA/SARA - Section 313 - PBT Chemical Listing
Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

Not Listed

U.S. - California - Proposition 65 - Developmental Toxicity

Not Listed

U.S. - California - Proposition 65 - Maximum Allowable Dose Levels (MADL)

Not Listed

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

Not Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Female

Not Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Male

Not Listed

United States - Pennsylvania

Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

Not Listed

U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances

Not Listed

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out.

Section 16 - Other Information

Last Revision Date	23/December/2014
Preparation Date	23/December/2014
Disclaimer/Statement of Liability	To the best of Air Liquide's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

Key to abbreviations

NDA = No Data Available