

A-GAS R134AHazard Alert Code:
MODERATE

Chemwatch Material Safety Data Sheet

Revision No: 8

Chemwatch 7568-17

Issue Date: 11-Jun-2008

CD 2008/3

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**PRODUCT NAME**

A-GAS R134A

SYNONYMS

"HFA-134a, ", "HFC-134a, SUVA R134a, ", "Genetron 134a, ", "Klea 134a", "Forane 134a, ", "Asahiklin AK-134a"

PROPER SHIPPING NAME

1, 1, 1, 2-TETRAFLUOROETHANE (REFRIGERANT GAS R 134a)

PRODUCT USE

Wide use in household and commercial refrigeration and automotive air-conditioning.

SUPPLIER

Company: A-Gas (Singapore) PTE LTD

Address:

360 Orchard Road, #10-05

International Building 238869

Telephone: 65 6836 0065

Emergency Tel: 65 6836 0065

Fax: 65 6836 6521

HAZARD RATINGS

	Min	Max	
Flammability:	0		
Toxicity:	2		
Body Contact:	2		
Reactivity:	1		Min/Nil=0 Low=1 Moderate=2
Chronic:	2		High=3 Extreme=4

Section 2 - HAZARDS IDENTIFICATION**STATEMENT OF HAZARDOUS NATURE** **DANGEROUS GOODS. NON-HAZARDOUS SUBSTANCE. According to the Criteria of NOHSC, and the ADG Code.****POISONS SCHEDULE**

None

RISK

Risk Codes	Risk Phrases
R04	» Forms very sensitive explosive metallic compounds.
R44	» Risk of explosion if heated under confinement.

SAFETY

Safety Codes	Safety Phrases
S23	» Do not breathe gas/ fumes/ vapour/ spray.
S24	» Avoid contact with skin.
S51	» Use only in well ventilated areas.
S09	» Keep container in a well ventilated place.
S03	» Keep in a cool place.
S07	» Keep container tightly closed.
S60	» This material and its container must be disposed of as hazardous waste.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
tetrafluoroethane	811-97-2	>99.5

Section 4 - FIRST AID MEASURES

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SWALLOWED

» Not considered a normal route of entry.

- Avoid giving milk or oils.
- Avoid giving alcohol.

EYE

»

- If product comes in contact with eyes remove the patient from gas source or contaminated area.
- Take the patient to the nearest eye wash, shower or other source of clean water.
- Open the eyelid(s) wide to allow the material to evaporate.
- Gently rinse the affected eye(s) with clean, cool water for at least 15 minutes. Have the patient lie or sit down and tilt the head back. Hold the eyelid(s) open and pour water slowly over the eyeball(s) at the inner corners, letting the water run out of the outer corners.
- The patient may be in great pain and wish to keep the eyes closed. It is important that the material is rinsed from the eyes to prevent further damage.
- Ensure that the patient looks up, and side to side as the eye is rinsed in order to better reach all parts of the eye(s)
- Transport to hospital or doctor.
- Even when no pain persists and vision is good, a doctor should examine the eye as delayed damage may occur.
- If the patient cannot tolerate light, protect the eyes with a clean, loosely tied bandage.
- Ensure verbal communication and physical contact with the patient.

DO NOT allow the patient to rub the eyes DO NOT allow the patient to tightly shut the eyes DO NOT introduce oil or ointment into the eye(s) without medical advice
DO NOT use hot or tepid water.

SKIN

» If skin contact occurs:

- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

»

- Following exposure to gas, remove the patient from the gas source or contaminated area.
- NOTE: Personal Protective Equipment (PPE), including positive pressure self-contained breathing apparatus may be required to assure the safety of the rescuer.
- Prostheses such as false teeth, which may block the airway, should be removed, where possible, prior to initiating first aid procedures.
- If the patient is not breathing spontaneously, administer rescue breathing.
- If the patient does not have a pulse, administer CPR.
- If medical oxygen and appropriately trained personnel are available, administer 100% oxygen.
- Summon an emergency ambulance. If an ambulance is not available, contact a physician, hospital, or Poison Control Centre for further instruction.
- Keep the patient warm, comfortable and at rest while awaiting medical care.
- **MONITOR THE BREATHING AND PULSE, CONTINUOUSLY.**
- Administer rescue breathing (preferably with a demand-valve resuscitator, bag-valve mask-device, or pocket mask as trained) or CPR if necessary.

NOTES TO PHYSICIAN

» for intoxication due to Freons/ Halons;

A: Emergency and Supportive Measures

- Maintain an open airway and assist ventilation if necessary
- Treat coma and arrhythmias if they occur. Avoid (adrenaline) epinephrine or other sympathomimetic amines that may precipitate ventricular arrhythmias. Tachyarrhythmias caused by increased myocardial sensitisation may be treated with propranolol, 1-2 mg IV or esmolol 25-100 microgm/kg/min IV.

- Monitor the ECG for 4-6 hours

B: Specific drugs and antidotes:

- There is no specific antidote

C: Decontamination

- Inhalation; remove victim from exposure, and give supplemental oxygen if available.
- Ingestion; (a) Prehospital: Administer activated charcoal, if available. DO NOT induce vomiting because of rapid absorption and the risk of abrupt onset CNS depression. (b) Hospital: Administer activated charcoal, although the efficacy of charcoal is unknown. Perform gastric lavage only if the ingestion was very large and recent (less than 30 minutes)

D: Enhanced elimination:

- There is no documented efficacy for diuresis, haemodialysis, haemoperfusion, or repeat-dose charcoal.

POISONING and DRUG OVERDOSE, Californian Poison Control System Ed. Kent R Olson; 3rd Edition

- Do not administer sympathomimetic drugs unless absolutely necessary as material may increase myocardial irritability.
- No specific antidote.

- Because rapid absorption may occur through lungs if aspirated and cause systematic effects, the decision of whether to induce vomiting or not should be made by an attending physician.

- If lavage is performed, suggest endotracheal and/or esophageal control.

- Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach.

- Treatment based on judgment of the physician in response to reactions of the patient

for gas exposures:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary oedema .
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

BRONSTEIN, A.C. and CURRANCE, P.L.

EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.

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Section 5 - FIRE FIGHTING MEASURES**EXTINGUISHING MEDIA**

» SMALL FIRE: Use extinguishing agent suitable for type of surrounding fire.

LARGE FIRE: Cool cylinder.

DO NOT direct water at source of leak or venting safety devices as icing may occur.

FIRE FIGHTING

»

GENERAL

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus and protective gloves.
- Fight fire from a safe distance, with adequate cover.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- DO NOT approach cylinders suspected to be hot.
- Cool fire exposed cylinders with water spray from a protected location.
- If safe to do so, remove cylinders from path of fire.

SPECIAL REQUIREMENTS:

- Excessive pressures may develop in a gas cylinder exposed in a fire; this may result in explosion.
- Cylinders with pressure relief devices may release their contents as a result of fire and the released gas may constitute a further source of hazard for the fire-fighter.
- Cylinders without pressure-relief valves have no provision for controlled release and are therefore more likely to explode if exposed to fire.

FIRE FIGHTING REQUIREMENTS:

The need for proximity, entry and special protective clothing should be determined for each incident, by a competent fire-fighting safety professional.

FIRE/EXPLOSION HAZARD

»

- Containers may explode when heated - Ruptured cylinders may rocket
- Fire exposed containers may vent contents through pressure relief devices.
- High concentrations of gas may cause asphyxiation without warning.
- May decompose explosively when heated or involved in fire.
- Contact with gas may cause burns, severe injury and/ or frostbite.

Decomposition may produce toxic fumes of: carbon monoxide (CO), carbon dioxide (CO₂), hydrogen fluoride.
Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.

FIRE INCOMPATIBILITY

- Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

HAZCHEM

None

Personal Protective Equipment

Gas tight chemical resistant suit.

Section 6 - ACCIDENTAL RELEASE MEASURES**EMERGENCY PROCEDURES****MINOR SPILLS**

»

- Avoid breathing vapour and any contact with liquid or gas. Protective equipment including respirator should be used.
- DO NOT enter confined spaces were gas may have accumulated.
- Increase ventilation.
- Clear area of personnel.
- Stop leak only if safe to do so.
- Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.
- Orientate cylinder so that the leak is gas, not liquid, to minimise rate of leakage
- Keep area clear of personnel until gas has dispersed.

MAJOR SPILLS

»

- Clear area of all unprotected personnel and move upwind.
- Alert Emergency Authority and advise them of the location and nature of hazard.
- Wear breathing apparatus and protective gloves.
- Prevent by any means available, spillage from entering drains and water-courses.
- Consider evacuation.
- Increase ventilation.
- No smoking or naked lights within area.
- Stop leak only if safe to do so.
- Water spray or fog may be used to disperse vapour.
- DO NOT enter confined space where gas may have collected.
- Keep area clear until gas has dispersed.

PROTECTIVE ACTIONS FOR SPILL

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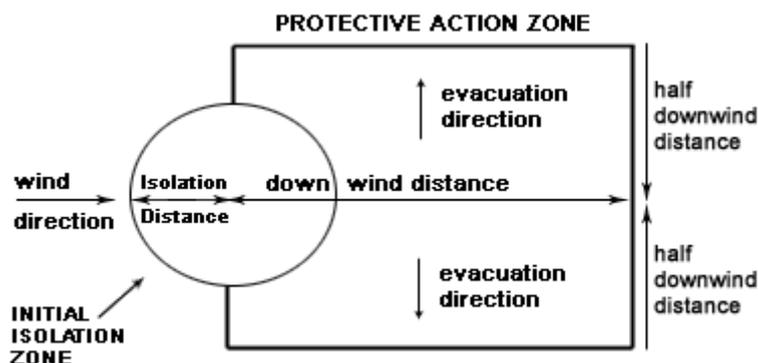
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From IERG (Canada/Australia)
 Isolation Distance 50 metres
 Downwind Protection Distance 500 metres
 IERG Number 6

FOOTNOTES

- 1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
- 2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
- 3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
- 4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
- 5 Guide 126 is taken from the US DOT emergency response guide book.
- 6 IERG information is derived from CANUTEC - Transport Canada.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE**PROCEDURE FOR HANDLING**

- Vented gas is more dense than air and may collect in pits, basements.
- Consider use in closed pressurised systems, fitted with temperature, pressure and safety relief valves which are vented for safe dispersal.
- Use a pressure reducing regulator when connecting cylinder to lower pressure (<100 psig) piping or systems
- Use a check valve or trap in the discharge line to prevent hazardous back-flow into the cylinder
- Check regularly for spills or leaks. Keep valves tightly closed but do not apply extra leverage to hand wheels or cylinder keys.
- Valve protection caps must remain in place unless container is secured with valve outlet piped to use point.
- Do NOT drag, slide or roll cylinders - use a suitable hand truck for cylinder movement
- Test for leakage with brush and detergent - NEVER use a naked flame.
- Do NOT heat cylinder by any means to increase the discharge rate of product from cylinder.
- Leaking gland nuts may be tightened if necessary.
- If a cylinder valve will not close completely, remove the cylinder to a well ventilated location (e.g. outside) and, when empty, tag as FAULTY and return to supplier.
- Obtain a work permit before attempting any repairs. DO NOT attempt repair work on lines, vessels under pressure.
- Atmospheres must be tested and O.K. before work resumes after leakage.
- DO NOT transfer gas from one cylinder to another.

SUITABLE CONTAINER

Cylinder: Steel packaging

Ensure the use of equipment rated for cylinder pressure.

Ensure the use of compatible materials of construction.

Valve protection cap to be in place until cylinder is secured, connected.

Cylinder must be properly secured either in use or in storage.

Cylinder valve must be closed when not in use or when empty.

Segregate full from empty cylinders.

WARNING: Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.

STORAGE INCOMPATIBILITY

» Haloalkanes:

- are highly reactive: some of the more lightly substituted lower members are highly flammable.
- may react with the lighter divalent metals to produce more reactive compounds analogous to Grignard reagents.

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- may produce explosive compounds following prolonged contact with metallic or other azides
- may react on contact with potassium or its alloys - although apparently stable on contact with a wide range of halocarbons, reaction products may be shock-sensitive and may explode with great violence on light impact; severity generally increases with the degree of halocarbon substitution and potassium-sodium alloys give extremely sensitive mixtures.

BREITHERICK L.: Handbook of Reactive Chemical Hazards

- react with metal halides and active metals, eg. sodium (Na), potassium (K), lithium (Li), calcium (Ca), zinc (Zn), powdered aluminium (Al) and aluminium alloys, magnesium (Mg) and magnesium alloys.
- may react with brass and steel.
- may react explosively with strong oxidisers
- may degrade rubber, and plastics such as methacrylate polymers, polyethylene and polystyrene, paint and coatings
- Avoid reaction with oxidising agents

STORAGE REQUIREMENTS

- »
- Cylinders should be stored in a purpose-built compound with good ventilation, preferably in the open.
- Such compounds should be sited and built in accordance with statutory requirements.
- The storage compound should be kept clear and access restricted to authorised personnel only.
- Cylinders stored in the open should be protected against rust and extremes of weather.
- Cylinders in storage should be properly secured to prevent toppling or rolling.
- Cylinder valves should be closed when not in use.
- Where cylinders are fitted with valve protection this should be in place and properly secured.
- Gas cylinders should be segregated according to the requirements of the Dangerous Goods Act.
- Preferably store full and empty cylinders separately.
- Check storage areas for hazardous concentrations of gases prior to entry.
- Full cylinders should be arranged so that the oldest stock is used first.
- Cylinders in storage should be checked periodically for general condition and leakage.
- Protect cylinders against physical damage. Move and store cylinders correctly as instructed for their manual handling.

NOTE: A 'G' size cylinder is usually too heavy for an inexperienced operator to raise or lower.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**EXPOSURE CONTROLS**

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC
Australia Exposure Standards	tetrafluoroethane (1,1,1,2-Tetrafluoroethane)	1000	4240					

MATERIAL DATA

» Not available. Refer to individual constituents.

INGREDIENT DATA**TETRAFLUOROETHANE:**

» Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.

OSHA (USA) concluded that exposure to sensory irritants can:

- cause inflammation
- cause increased susceptibility to other irritants and infectious agents
- lead to permanent injury or dysfunction
- permit greater absorption of hazardous substances and
- acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.

Studies show that HFC 134a is practically nontoxic by inhalation. The acute lethal effects occur at levels exceeding 500000 ppm whilst the threshold for cardiac sensitisation occurs at about 75000 ppm. Repeated exposures at 50000 ppm for 13 weeks did not produce significant toxicity in animals. Limited studies have shown the substance not to be a carcinogen, or to exhibit mutagenic effects. Exposures up to 300000 ppm and 40000 ppm did not produce teratogenic effects in rats and rabbits respectively. The workplace environmental exposure level (WEEL), recommended by the AIHA, is thought to be protective against cardiac sensitisation and systemic injury.

PERSONAL PROTECTION**EYE**

- »
- Chemical goggles.
- Full face shield may be required for supplementary but never for primary protection of eyes
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens

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or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59]

HANDS/FEET

- »
- When handling sealed cylinders wear cloth or leather gloves.
- Insulated gloves

OTHER

- »
- Positive pressure, full face, air-supplied breathing apparatus should be used for work in enclosed spaces if a leak is suspected or the primary containment is to be opened (e.g. for a cylinder change)
- Air-supplied breathing apparatus is required where release of gas from primary containment is either suspected or demonstrated.
- Protective overalls, closely fitted at neck and wrist.
- Eye-wash unit.
- Ensure availability of lifeline in confined spaces.
- Staff should be trained in all aspects of rescue work.
- Rescue gear: Two sets of SCUBA breathing apparatus Rescue Harness, lines etc.

RESPIRATOR

» Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	AX-AUS	-
1000	50	-	AX-AUS
5000	50	Airline *	-
5000	100	-	AX-2
10000	100	-	AX-3
	100+		Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

- »
- Areas where cylinders are stored require good ventilation and, if enclosed, need discrete/controlled exhaust ventilation.
- Secondary containment and exhaust gas treatment may be required by certain jurisdictions.
- Local exhaust ventilation may be required in work areas.
- Consideration should be given to the use of diaphragm or bellows-sealed, soft-seat valves; backflow prevention devices and flow-monitoring or limiting devices.
- Automated alerting systems with automatic shutdown of gas-flow may be appropriate and may in fact be mandatory in certain jurisdictions.
- Respiratory protection in the form of air-supplied or self-contained breathing equipment must be worn if the oxygen concentration in the workplace air is less than 19%.
- Cartridge respirators do NOT give protection and may result in rapid suffocation.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

- 1: Room air currents minimal or favourable to capture
- 2: Contaminants of low toxicity or of nuisance value only.
- 3: Intermittent, low production.
- 4: Large hood or large air mass in motion

Upper end of the range

- 1: Disturbing room air currents
- 2: Contaminants of high toxicity
- 3: High production, heavy use
- 4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2.5 m/s (200-500 f/min.) for extraction of gases discharged 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES**APPEARANCE**

Colourless pressurised liquefied gas with a mild ethereal odour; does not mix with water.

PHYSICAL PROPERTIES

Gas.

Does not mix with water.

Sinks in water.

Molecular Weight: 102.03

Melting Range (°C): -101 (freezing)

Solubility in water (g/L): Immiscible

pH (1% solution): Not Available

Volatile Component (%vol): 100

Relative Vapour Density (air=1): 4.32 @ 20 deg.C

Lower Explosive Limit (%): Not Applicable

Autoignition Temp (°C): Not Applicable

State: Liquefied Gas

Boiling Range (°C): -26.3

Specific Gravity (water=1): 1.21 @ 25 deg.C

pH (as supplied): 7

Vapour Pressure (kPa): 572 @ 20 deg.C

Evaporation Rate: Not Available

Flash Point (°C): Not Applicable

Upper Explosive Limit (%): Not Applicable

Decomposition Temp (°C): Not Available

Viscosity: 0.21 cSt@ 25 deg. °C

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Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION**CONDITIONS CONTRIBUTING TO INSTABILITY**

»

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

Section 11 - TOXICOLOGICAL INFORMATION**POTENTIAL HEALTH EFFECTS****ACUTE HEALTH EFFECTS****SWALLOWED**

» Not normally a hazard due to physical form of product.

EYE

» Vapourising liquid causes rapid cooling and contact may cause cold burns, frostbite, even through normal gloves. Frozen skin tissues are painless and appear waxy and yellow. Signs and symptoms of frost-bite may include "pins and needles", paleness followed by numbness, a hardening and stiffening of the skin, a progression of colour changes in the affected area, (first white, then mottled and blue and eventually black; on recovery, red, hot, painful and blistered).

SKIN

» Fluorocarbons remove natural oils from the skin, causing irritation, dryness and sensitivity.

Vapourising liquid causes rapid cooling and contact may cause cold burns, frostbite, even through normal gloves. Frozen skin tissues are painless and appear waxy and yellow. Signs and symptoms of frost-bite may include "pins and needles", paleness followed by numbness, a hardening and stiffening of the skin, a progression of colour changes in the affected area, (first white, then mottled and blue and eventually black; on recovery, red, hot, painful and blistered).

Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

» Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual. Inhalation of non-toxic gases may cause:

- CNS effects: headache, confusion, dizziness, stupor, seizures and coma;
- respiratory: shortness of breath and rapid breathing;
- cardiovascular: collapse and irregular heart beats;
- gastrointestinal: mucous membrane irritation, nausea and vomiting.

The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of the material, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.

Material is highly volatile and may quickly form a concentrated atmosphere in confined or unventilated areas. Vapour is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.

Exposure to fluorocarbons can produce non-specific flu-like symptoms such as chills, fever, weakness, muscle pain, headache, chest discomfort, sore throat and dry cough with rapid recovery. High concentrations can cause irregular heartbeats and a stepwise reduction in lung capacity. Heart rate may be reduced.

Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved.

CHRONIC HEALTH EFFECTS

» Principal route of occupational exposure to the gas is by inhalation.

Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

Fluorocarbons can cause an increased risk of cancer, spontaneous abortion and birth defects.

TOXICITY AND IRRITATION

» unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

Acute toxicity

- Oral route, LD 50, not applicable
- Dermal route, LD 50, not applicable
- Inhalation, LC 50, 4 h, rat, > 2.086 g/l

Irritation

- Rabbit, slightly irritant (skin)
- Rabbit, mild eye irritation (eyes)

Sensitization

- Guinea Pig, Did not cause sensitization on laboratory animals.

Chronic toxicity

- Inhalation, after a single exposure, dog, NOEL: >= 7.5%, cardiac sensitization following adrenergic stimulation

- Inhalation, Prolonged exposure, rat, Target organ: testes, NOEL: >= 0.209 g/l Remark: Leydig cells/benign tumours

TETRAFLUOROETHANE:

» unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY**IRRITATION**

Inhalation (Rat) LC50: 1500000 mg/m³/4h

Inhalation (Mouse) LC50: 1700000 mg/m³/2h

Inhalation (Rat) LC50: 80% vol 15 mins *

Inhalation (Rat) LC50: 60% vol 4 h *

* with added oxygen - ZhongHao New Chemical Materials MSDS

Excessive concentration can have a narcotic effect; inhalation of high concentrations of decomposition products can cause lung oedema.

Section 12 - ECOLOGICAL INFORMATION

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» DO NOT discharge into sewer or waterways.

Refer to data for ingredients, which follows:

TETRAFLUOROETHANE:

» In addition to carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), the greenhouse gases mentioned in the Kyoto Protocol include synthetic substances that share the common feature of being highly persistent in the atmosphere and exhibiting very high specific radiative forcing (radiative forcing is the change in the balance between radiation coming into the atmosphere and radiation out; a positive radiative forcing tends on average to warm the surface of the earth). These synthetic substances include hydrocarbons that are partially fluorinated (HCFs) or totally fluorinated (PFCs) as well as sulfur hexafluoride (SF₆).

The greenhouse potential of these substances, expressed as multiples of that of CO₂, are within the range of 140 to 11,700 for HFCs, from 6500 to 9,200 for PFCs and 23,900 for SF₆. Once emitted into the atmosphere, these substances have an impact on the environment for decades, centuries, or in certain instances, for thousands of years.

Many of these substances have only been commercialised for a few years, and still only contribute only a small percentage of those gases released to the atmosphere by humans (anthropogenic) which increase the greenhouse effect. However, a rapid increase can be seen in their consumption and emission, and therefore in their contribution to the anthropogenic increase in the greenhouse effect.

Since the adoption of the Kyoto Protocol, new fluorinated substances have appeared on the market, which are stable in air and have a high greenhouse potential; these include nitrogen trifluoride (NF₃) and fluoroethers.

Persistence and Degradation:

Ozone Destruction Potential (PDO) = 0 (R11=1)

Greenhouse Effect Potential (ESP) = 0.27 (R11=1)

Decomposed comparatively rapidly in the lower atmosphere (troposphere).

Atmospheric lifetime is 15.6 years. Products of decomposition will be highly dispersed and hence will have a very low concentration. Does not influence photochemical smog (i.e. is not a VOC under the terms of the UNECE agreement). Does not deplete ozone.

Effect on Effluent Treatment:

Discharges of the product will enter the atmosphere and will not result in long term aqueous contamination. [ICI]

Ecotoxicity:

Fish LC50 (96 h): *Salmo gairdneri* 450 mg/l ; NOEC 300 mg/l (mortality) (semi-static tests)

Daphnia EC50 (48 h): 980 mg/l

Bacteria EC10 (6 h): *Pseudomonas putida* >730 mg/l (growth)**Mobility**

Air: Henry's Law constant (H): 65 kPa.m³/ml (20 C/ calculated) - considerable volatility

Soil/ sediment log Koc 1.5 approx (adsorption - calculated)

Persistence and biodegradability**Abiotic degradation**

Air, indirect photo-oxidation t1/2=10.9 years

Conditions: sensitiser: OH radicals

Degradation products: carbon dioxide/ fluorhydric acid/ trichloroacetic acid

Air, photolysis, ODP=0

No effect on stratospheric ozone

Reference value for CFC 11: ODP=1

Air, greenhouse effect, GWP=0.25

Reference value for CFC 11: GWP=1

Biotic degradation

Aerobic, test ready biodegradability/ closed bottle, degradation from 2-3% 28 days

Result: not readily biodegradable

Aerobic, test biodegradation by methane oxidation

Result: non-biodegradable

Conditions: inoculum: *Methylosinus trichosporium* OB3b

Bioaccumulative potential; bioconcentration log PoW=1.06

Product is persistent in air (atmospheric lifetime: 15.7 years)

Product is not significantly hazardous for the aquatic environment as:

very low toxicity for aquatic organisms

considerable volatility

no bioaccumulation

Section 13 - DISPOSAL CONSIDERATIONS

»

- Evaporate residue at an approved site.
 - Return empty containers to supplier. If containers are marked non-returnable establish means of disposal with manufacturer prior to purchase.
 - Ensure damaged or non-returnable cylinders are gas-free before disposal.
- Dispose in compliance with local / federal and national regulations.

Section 14 - TRANSPORTATION INFORMATION

Labels Required: NON-FLAMMABLE COMPRESSED GAS
HAZCHEM: None (ADG6)

UNDG:

Dangerous Goods Class:	2.2	Subrisk:	None
UN Number:	3159	Packing Group:	None
Shipping Name: 1,1,1,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 134a)			

A-GAS R134A**Hazard Alert Code:
MODERATE**

Chemwatch Material Safety Data Sheet

Revision No: 8

Chemwatch 7568-17

Issue Date: 11-Jun-2008

CD 2008/3

Air Transport IATA:

ICAO/IATA Class:	2.2	ICAO/IATA Subrisk:	None
UN/ID Number:	3159	Packing Group:	None
Special provisions:	None		

Shipping Name: REFRIGERANT GAS R 134A

Maritime Transport IMDG:

IMDG Class:	2.2	IMDG Subrisk:	None
UN Number:	3159	Packing Group:	None
EMS Number:	F-C,S-V	Special provisions:	None

Limited Quantities: 120 ml

Shipping Name: 1,1,1,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 134a)

Section 15 - REGULATORY INFORMATION**POISONS SCHEDULE**

None

REGULATIONS

A- Gas R134a (CAS: None):

No regulations applicable

tetrafluoroethane (CAS: 811-97-2) is found on the following regulatory lists:

Australia Exposure Standards

Australia Hazardous Substances

Australia High Volume Industrial Chemical List (HVICL)

Australia Inventory of Chemical Substances (AICS)

OECD Representative List of High Production Volume (HPV) Chemicals

Section 16 - OTHER INFORMATION

» Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:

www.chemwatch.net/references.

» The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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