**SECTION 1 IDENTIFICATION**

**Product Identifier**

<table>
<thead>
<tr>
<th>Product name</th>
<th>R-134A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Name</td>
<td>1,1,1,2-tetrafluoroethane</td>
</tr>
<tr>
<td>Synonyms</td>
<td>C2H2F4; CF3CH2; 1,1,1,2-tetrafluoroethane; propellant R 134A Fluorocarbon HFC HFA 134a; Amerfrost A-134a; Blow Hard O.S. Extra; Dust-Pro Pressurized Duster; BOC R134A; DuPont SUVA 134a Refrigerant; Freon 134a; Koudemiddel R-134a; Forane R134a; Friogas 134a; Refrigerant Gas R134a; Klea 134a; HFC-134a; 08399 Reclin 134A; Actrol R134a</td>
</tr>
<tr>
<td>Proper shipping name</td>
<td>1,1,1,2-Tetrafluoroethane or Refrigerant gas R 134a</td>
</tr>
<tr>
<td>Chemical formula</td>
<td>C2H2F4</td>
</tr>
<tr>
<td>CAS number</td>
<td>811-97-2</td>
</tr>
</tbody>
</table>

**Recommended use of the chemical and restrictions on use**

Wide use in household and commercial refrigeration and automotive air conditioning. Suitable for use in medium temperature food cabinets, water chillers and fountains, heat pumps and dehumidifiers and as a blowing agent for various foams. Other uses include as a propellant for aerosol pharmaceuticals, lacquers, deodorants, perfumes, mousses, air fresheners, insecticides, cleaning products and other household products.

Hydrofluorocarbons (HFCs) are organic compounds that contain fluorine and hydrogen atoms, and are the most common type of organofluorine compounds. They are frequently used in air conditioning and as refrigerants in place of the older chlorofluorocarbons. Fluorocarbons with few C–F bonds behave similarly to the parent hydrocarbons, but their reactivity can be altered significantly. Packed as liquid under pressure and remains liquid only under pressure.

**Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party**

<table>
<thead>
<tr>
<th>Registered company name</th>
<th>A-Gas (U.S. Headquarters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>1100 Haskins Rd OH 43402 United States</td>
</tr>
<tr>
<td>Telephone</td>
<td>14198678990</td>
</tr>
<tr>
<td>Fax</td>
<td>1-419-867-3279</td>
</tr>
<tr>
<td>Website</td>
<td><a href="http://www.agasamericas.com">www.agasamericas.com</a></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:tammy.myers@agas.com">tammy.myers@agas.com</a></td>
</tr>
</tbody>
</table>

**Emergency phone number**

<table>
<thead>
<tr>
<th>Association / Organisation</th>
<th>PERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency telephone numbers</td>
<td>1-800-633-8253</td>
</tr>
<tr>
<td>Other emergency telephone numbers</td>
<td>International 1-801-629-0667</td>
</tr>
</tbody>
</table>

**SECTION 2 HAZARD(S) IDENTIFICATION**

**Classification of the substance or mixture**

**NFPA 704 diamond**

![NFPA 704 diamond]

- **0** Health
- **1** Reactivity
- **3** Flammability
- **1** Reactivity
- **3** Flammability

*Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)*

| Classification | Gas under Pressure (Liquefied gas), Simple Asphyxiant |

**Label elements**

- **Class 2 Gas under Pressure (Liquefied gas)**
- **Class 3 Simple Asphyxiant**
### SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

#### Substances

<table>
<thead>
<tr>
<th>CAS No</th>
<th>% [weight]</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>811-97-2</td>
<td>&gt;=99</td>
<td>R-134A</td>
</tr>
</tbody>
</table>

#### Mixtures

See section above for composition of Substances

### SECTION 4 FIRST-AID MEASURES

#### Description of first aid measures

**Eye Contact**
- 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
- Allow the patient to tightly shut the eyes
- Introduce oil or ointment into the eye(s) without medical advice
- Use hot or tepid water.

**Skin Contact**
- 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.
- In case of cold burns (frost-bite):
  - Move casualty into warmth before thawing the affected part; if feet are affected carry if possible
  - Bathe the affected area immediately in lukewarm water (not more than 35 deg C) for 10 to 15 minutes, immersing if possible and without rubbing
DO NOT apply hot water or radiant heat.

Apply a clean, dry, light dressing of "fluffed-up" dry gauze bandage

If a limb is involved, raise and support this to reduce swelling

If an adult is involved and where intense pain occurs provide painkillers such as paracetamol

Transport to hospital, or doctor

Subsequent blackening of the exposed tissue indicates potential of necrosis, which may require amputation.

Inhalation

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.

Ingestion

Not considered a normal route of entry.

Avoid giving milk or oils.

Avoid giving alcohol.

If spontaneous vomiting appears imminent or occurs, hold patient’s head down, lower than their hips to help avoid possible aspiration of vomitus.

Most important symptoms and effects, both acute and delayed

See Section 11

Indication of any immediate medical attention and special treatment needed

Cardiac sensitisation possible following exposure to the gas.

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 frost-bite caused by liquefied petroleum gas:

- If part has not thawed, place in warm water bath (41-46 C) for 15-20 minutes, until the skin turns pink or red.
- Analgesia may be necessary while thawing.
- If there has been a massive exposure, the general body temperature must be depressed, and the patient must be immediately rewarmed by whole-body immersion, in a bath at the above temperature.
- Shock may occur during rewarming.
- Administer tetanus toxoid booster after hospitalization.
- Prophylactic antibiotics may be useful.
- The patient may require anticoagulants and oxygen.

[Shell Australia 22/12/87]

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

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.

- Special hazards arising from the substrate or mixture
  - Fire Incompatibility
    - Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

- Special protective equipment and precautions for fire-fighters
  - 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.
  - Fire/Explosion Hazard
    - Although not flammable in air at temperatures up to 100 deg. C at atmospheric temperature, mixtures with high concentrations of air at elevated pressure and / or temperature can become combustible in the presence of an ignition source. The material can also become combustible in an oxygen enriched environment (oxygen concentrations greater than in air). Whether air-mixtures or oxygen-mixtures become combustible depends on temperature, pressure and oxygen concentration.
    - 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)
      - combustion products include:
        - carbon dioxide (CO2)
        - hydrogen fluoride
        - other pyrolysis products typical of burning organic material.
    - Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.
    - Vented gas is more dense than air and may collect in pits, basements.

SECTION 6 ACCIDENTAL RELEASE MEASURES

- Personal precautions, protective equipment and emergency procedures
  - See section 8

- Environmental precautions
  - See section 12

- Methods and material for containment and cleaning up
  - Minor Spills
    - Avoid breathing vapour and any contact with liquid or gas. Protective equipment including respirator should be used.
    - DO NOT enter confined spaces where gas may have accumulated.
    - Increase ventilation.
  - 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.
    - Remove leaking cylinders to a safe place.
    - Fit vent pipes. Release pressure under safe, controlled conditions
    - Burn issuing gas at vent pipes.
    - DO NOT exert excessive pressure on valve; DO NOT attempt to operate damaged valve.

Personal Protective Equipment advice is contained in Section 8 of the SDS.
### SECTION 7 HANDLING AND STORAGE

**Precautions for safe handling**

| Safe handling | Contact of welding or soldering torch flame with high concentration of refrigerant can result in visible changes in the size and colour of torch flames. This flame effect will only occur in concentrations of product well above the recommended exposure limit; therefore stop all work and ventilate to disperse refrigerant vapours from the work are before using any open flames.

- Consider use in closed pressurised systems, fitted with temperature, pressure and safety relief valves which are vented for safe dispersion. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature.
- The tubing network design connecting gas cylinders to the delivery system should include appropriate pressure indicators and vacuum or suction lines.
- Fully-welded types of pressure gauges, where the bourdon tube sensing element is welded to the gauge body, are recommended. Before connecting gas cylinders, ensure manifold is mechanically secure and does not containing another gas.

- **DO NOT transfer gas from one cylinder to another.**

| Other information | 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.

### Conditions for safe storage, including any incompatibilities

| Suitable container | **DO NOT use aluminium or galvanised containers**

- Cylinder:
  - 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.

| Storage incompatibility | Avoid reaction with alkali metals, zinc, aluminium alloys ( > 2% magnesium). Avoid contact with plastics such as methacrylate polymers, polyethylene and polystyrene.

Haloalkanes:

- are highly reactive: some of the more lightly substituted lower members are highly flammable; the more highly substituted may be used as fire suppressants, not always with the anticipated results.
- may react with the lighter divalent metals to produce more reactive compounds analogous to Grignard reagents.
- may produce explosive compounds following prolonged contact with metallic or other aizides.
- 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.

BREThERICK 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.

As a general rule, hydrofluorocarbons tend to be flammable unless they contain more fluorine atoms than hydrogen atoms.

- Compressed gases may contain a large amount of kinetic energy over and above that potentially available from the energy of reaction produced by the gas in chemical reaction with other substances.

### SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

#### Control parameters

<table>
<thead>
<tr>
<th>OCCUPATIONAL EXPOSURE LIMITS (OEL)</th>
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</table>

<table>
<thead>
<tr>
<th>INGREDIENT DATA</th>
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Not Available

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<th>EMERGENCY LIMITS</th>
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<th>Ingredient</th>
<th>Material name</th>
<th>TEEL-1</th>
<th>TEEL-2</th>
<th>TEEL-3</th>
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<tr>
<td>R-134A</td>
<td>HFC 134a (Tetrafluoroethane, 1,1,1,2-)</td>
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<th>Ingredient</th>
<th>Original IDLH</th>
<th>Revised IDLH</th>
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<tbody>
<tr>
<td>R-134A</td>
<td>Not Available</td>
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</table>

#### MATERIAL DATA

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.

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.

May act as a simple asphyxiants; these are gases which, when present in high concentrations, reduce the oxygen content in air below that required to support breathing, consciousness and life; loss of consciousness, with death by suffocation may rapidly occur in an oxygen deficient atmosphere.

**CARE:** Most simple asphyxiants are odourless or possess low odour and there is no warning on entry into an oxygen deficient atmosphere. If there is any doubt, oxygen content can be checked simply and quickly. It may not be appropriate to only recommend an exposure standard for simple asphyxiants rather it is essential that sufficient oxygen be maintained.

#### Exposure controls
Appropriate engineering controls
Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are:
Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.

Personal protection

Eye and face protection
- 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 lenses or restrictions on use, should be created for each workplace or task.

Skin protection
See Hand protection below

Hands/feet protection
- When handling sealed and suitably insulated cylinders wear cloth or leather gloves.
- Insulated gloves:
  NOTE: Insulated gloves should be loose fitting so that may be removed quickly if liquid is spilled upon them. Insulated gloves are not made to permit hands to be placed in the liquid; they provide only short-term protection from accidental contact with the liquid.

Body protection
See Other protection below

Other protection
- 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.

Respiratory protection
Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

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.

<table>
<thead>
<tr>
<th>Required minimum protection factor</th>
<th>Maximum gas/vapour concentration present in air p.p.m. (by volume)</th>
<th>Half-face Respirator</th>
<th>Full-Face Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 10</td>
<td>1000</td>
<td>AX-AUS / Class1</td>
<td>-</td>
</tr>
<tr>
<td>up to 50</td>
<td>1000</td>
<td>-</td>
<td>AX-AUS / Class 1</td>
</tr>
<tr>
<td>up to 50</td>
<td>5000</td>
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<tr>
<td>up to 100</td>
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<td>AX-2</td>
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<tr>
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<td>10000</td>
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<td>AX-3</td>
</tr>
<tr>
<td>100+</td>
<td></td>
<td>Airline**</td>
<td></td>
</tr>
</tbody>
</table>

* - Continuous Flow  ** - Continuous-flow or positive pressure demand
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used
- 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.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Colourless gas with slight ethereal odour; does not mix well with water (0.09 wt %, 25 C, 1 Bar).</th>
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<tbody>
<tr>
<td>Physical state</td>
<td>Liquified Gas</td>
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<td>Odour</td>
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<tr>
<td>Odour threshold</td>
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<td>pH (as supplied)</td>
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<tr>
<td>Melting point / freezing point (°C)</td>
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<td>Initial boiling point and boiling range (°C)</td>
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<td>Flash point (°C)</td>
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<tr>
<td>Relative density (Water = 1)</td>
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<tr>
<td>Partition coefficient n-octanol / water</td>
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<tr>
<td>Auto-ignition temperature (°C)</td>
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<tr>
<td>Decomposition temperature</td>
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<td>Viscosity (cSt)</td>
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<td>Molecular weight (g/mol)</td>
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### SECTION 10 STABILITY AND REACTIVITY

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<tr>
<th>Reactivity</th>
<th>See section 7</th>
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<tbody>
<tr>
<td>Chemical stability</td>
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<tr>
<td>‣ Unstable in the presence of incompatible materials.</td>
<td></td>
</tr>
<tr>
<td>‣ Product is considered stable.</td>
<td></td>
</tr>
<tr>
<td>‣ Hazardous polymerisation will not occur.</td>
<td></td>
</tr>
<tr>
<td>Possibility of hazardous reactions</td>
<td>See section 7</td>
</tr>
<tr>
<td>Conditions to avoid</td>
<td>See section 7</td>
</tr>
<tr>
<td>Incompatible materials</td>
<td>See section 7</td>
</tr>
<tr>
<td>Hazardous decomposition products</td>
<td>See section 5</td>
</tr>
</tbody>
</table>

### SECTION 11 TOXICOLOGICAL INFORMATION

#### Information on toxicological effects

**Inhaled**

Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.

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.

Limited evidence or practical experience suggests that the material may produce irritation of the respiratory system, in a significant number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.

Exposure to high concentrations of fluorocarbons may produce cardiac arrhythmias or cardiac arrest due sensitisation of the heart to adrenalin or noradrenalin. Deaths associated with exposures to fluorocarbons (specifically halogenated aliphatics) have occurred in occupational settings and in inhalation of bronchodilator drugs.

Bronchospasm consistently occurs in human subjects inhaling fluorocarbons. At a measured concentration of 1700 ppm of one of the commercially available aerosols there is a biphasic change in ventilatory capacity, the first reduction occurring within a few minutes and the second delayed up to 30 minutes.

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

Symptoms of asphyxia (suffocation) may include headache, dizziness, shortness of breath, muscular weakness, drowsiness and ringing in the ears. If the asphyxia is allowed to progress, there may be nausea and vomiting, further physical weakness and unconsciousness and, finally, convulsions, coma and death. Significant concentrations of the non-toxic gas reduce the oxygen level in the air. As the amount of oxygen is reduced from 21 to 14 volume %, the pulse rate accelerates and the rate and volume of breathing increase.

The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation. 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.

#### Overexposure

Overexposure is unlikely in this form.

Not normally a hazard due to physical form of product.

Considered an unlikely route of entry in commercial/industrial environments.

Swallowing of the liquid may cause aspiration of vomit into the lungs with the risk of haemorrhaging, pulmonary oedema, progressing to chemical pneumonitis; serious consequences may result.

Signs and symptoms of chemical (aspiration) pneumonitis may include coughing, gasping, choking, burning of the mouth, difficult breathing, and bluish coloured skin (cyanosis).

#### Skin Contact

Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.

Repeated exposure may cause skin cracks, flaking or drying following normal handling and use.

Limited evidence exists, or practical experience predicts, that the material either produces inflammation of the skin in a substantial number of individuals following direct contact, and/or produces significant inflammation when applied to the healthy intact skin of animals, for up to four hours, such inflammation being present twenty-four hours or more after the end of the exposure period. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesication), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.
In common with other halogenated aliphatics, fluorocarbons may cause dermal problems due to a tendency to remove natural oils from the skin causing irritation and the development of dry, sensitive skin. They do not appear to be appreciably absorbed. Open cuts, abraded or irritated skin should not be exposed to this material. Entry into the blood-stream through, for example, cuts, abrasions, puncture wounds 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. 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 of the 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].

Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn). Direct contact with the eye may not cause irritation because of the extreme volatility of the gas; however concentrated atmospheres may produce irritation after brief exposures...

No effects have been seen in rats exposed to up to 50,000 ppm for 90 days. It is not teratogenic in rats or rabbits. Short term screening tests for carcinogenicity have proved negative. No long term effects were noted when administered by gavage to rats at a dose of 300 mg/kg/day for one year and the rats held for the remainder of their life span. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

It is generally accepted that the fluorocarbons are less toxic than the corresponding halogenated aliphatic based on chlorine. Repeated inhalation exposure to the fluorocarbon FC-11 does not produce pathologic lesions of the liver and other viscera organs in experimental animals. There has been conjecture in non-scientific publications that fluorocarbons may cause leukemia, cancer, sterility and birth defects; these have not been verified by current research. The high incidence of cancer, spontaneous abortion and congenital anomalies amongst hospital personnel, repeatedly exposed to fluoride-containing general anaesthetics, has caused some scientists to call for a lowering of the fluorocarbon exposure standard to 5 ppm since some are mutagens. Principal route of occupational exposure to the gas is by inhalation.

### R-134A

<table>
<thead>
<tr>
<th>ENDPOINT</th>
<th>TEST DURATION (HR)</th>
<th>SPECIES</th>
<th>VALUE</th>
<th>SOURCE</th>
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<tbody>
<tr>
<td>Acute Toxicity</td>
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</tr>
<tr>
<td>Skin Irritation/Corrosion</td>
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<td></td>
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</tr>
<tr>
<td>Serious Eye Damage/Irritation</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Respiratory or Skin sensitisation</td>
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</tr>
<tr>
<td>Mutagenicity</td>
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<tr>
<td>LC50</td>
<td>96</td>
<td>Fish</td>
<td>29.671mg/L</td>
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<tr>
<td>EC50</td>
<td>48</td>
<td>Crustacea</td>
<td>980mg/L</td>
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<tr>
<td>EC50</td>
<td>96</td>
<td>Algae or other aquatic plants</td>
<td>97.260mg/L</td>
<td>3</td>
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<tr>
<td>NOEC</td>
<td>72</td>
<td>Algae or other aquatic plants</td>
<td>ca.13.2mg/L</td>
<td>2</td>
</tr>
</tbody>
</table>

Legend:  
- **X** = Data either not available or does not fill the criteria for classification  
- **+** = Data available to make classification

### SECTION 12 ECOLOGICAL INFORMATION

#### Toxicity

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) (semistatic tests) Daphnia EC50 (48 h): 980 mg/l; Bacteria EC10 (6 h): Pseudomonas putida >730 mg/l (growth) Mobility: 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 photolysis t1/2 = 10.9 years. Conditions: scavenger OH radicals. Degradation products: carbon dioxide, fluorhydric acid, trichloroactic acid, Air, photolysis, ODP=0. 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 biodegradability, closed bottle, degradation from 2.3 to 28 days: Result: not readily biodegradable. Aerobic, test biodegradability by methane: 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.

HFCs (hydrofluorocarbons) have been widely used as replacements for Ozone Depleting Substances (ODSs). Because they do not contain chlorine or bromine, they have an ozone Depletion Potential (ODP) of 0. However, certain HFCs have high Global warming Potential (GWPs). Perfluorinated fluorocarbons (PFCs) have extremely high GWPs and long atmospheric lifetimes. They do not deplete stratospheric ozone, but the U.S. Environmental Protection Agency (EPA) is concerned about their impact on global warming.

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.

DO NOT discharge into sewer or waterways.

### Persistence and degradability

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Persistence: Water/Soil</th>
<th>Persistence: Air</th>
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<tbody>
<tr>
<td>R-134A</td>
<td>HIGH</td>
<td>HIGH</td>
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### Bioaccumulative potential

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<tr>
<th>Ingredient</th>
<th>Bioaccumulation</th>
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<td>R-134A</td>
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### Mobility in soil

<table>
<thead>
<tr>
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<th>Mobility</th>
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<tbody>
<tr>
<td>R-134A</td>
<td>LOW (KOC = 96.63)</td>
</tr>
</tbody>
</table>

### SECTION 13 DISPOSAL CONSIDERATIONS

#### Waste treatment methods

- 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.

### SECTION 14 TRANSPORT INFORMATION

#### Labels Required

- Marine Pollutant: NO

#### Land transport (DOT)

<table>
<thead>
<tr>
<th>UN number</th>
<th>3159</th>
</tr>
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<tbody>
<tr>
<td>UN proper shipping name</td>
<td>1,1,1,2-Tetrafluoroethane or Refrigerant gas R 134a</td>
</tr>
<tr>
<td>Transport hazard class(es)</td>
<td>Class 2.2</td>
</tr>
<tr>
<td>Subrisk</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Packing group</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Environmental hazard</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Special precautions for user</td>
<td>Hazard Label 2.2</td>
</tr>
<tr>
<td>Special provisions</td>
<td>T50</td>
</tr>
</tbody>
</table>

#### Air transport (ICAO-IATA / DGR)
TRANSPORT HAZARD CLASS:

ICAO/IATA Class: 2.2
ICAO / IATA Subrisk: Not Applicable
ERG Code: 2L

PACKING GROUP:
Not Applicable

ENVIRONMENTAL HAZARD:
Not Applicable

SPECIAL PRECAUTIONS FOR USER:

<table>
<thead>
<tr>
<th>Special provisions</th>
<th>Cargo Only Packing Instructions</th>
<th>200</th>
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<tbody>
<tr>
<td></td>
<td>Cargo Only Maximum Qty / Pack</td>
<td>150 kg</td>
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<td></td>
<td>Passenger and Cargo Packing Instructions</td>
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<tr>
<td></td>
<td>Passenger and Cargo Maximum Qty / Pack</td>
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<tr>
<td></td>
<td>Passenger and Cargo Limited Quantity Packing Instructions</td>
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<td></td>
<td>Passenger and Cargo Limited Maximum Qty / Pack</td>
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</table>

SEA TRANSPORT (IMDG-Code / GGVSee):

UN number: 3159
UN proper shipping name: 1,1,1,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 134a)
Transport hazard class(es):
IMDG Class: 2.2
IMDG Subrisk: Not Applicable
Packing group: Not Applicable
Environmental hazard: Not Applicable
Special precautions for user:
EMS Number: F-C , S-V
Special provisions: Not Applicable
Limited Quantities: 120 mL

TRANSPORT IN BULK ACCORDING TO ANNEX II OF MARPOL AND THE IBC CODE

Not Applicable

SECTION 15 REGULATORY INFORMATION

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

R-134A IS FOUND ON THE FOLLOWING REGULATORY LISTS

- US DOE Temporary Emergency Exposure Limits (TEELs)
- US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
- US Toxicology Excellence for Risk Assessment (TERA) Workplace Environmental Exposure Levels (WEEL)
- US TSCA Chemical Substance Inventory - Interim List of Active Substances
- US TSCA Section 5(a)(2) - Significant New Use Rules (SNURs)
- Federal Regulations

FEDERAL REGULATIONS

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SECTION 311/312 HAZARD CATEGORIES

| Flammable (Gases, Aerosols, Liquids, or Solids) | No |
| Gas under pressure | Yes |
| Explosive | No |
| Self-heating | No |
| Pyrophoric (Liquid or Solid) | No |
| Pyrophoric Gas | No |
| Corrosive to metal | No |
| Oxidizer (Liquid, Solid or Gas) | No |
| Organic Peroxide | No |
| Self-reactive | No |
| In contact with water emits flammable gas | No |
| Combustible Dust | No |
Carcinogenicity
Acute toxicity (any route of exposure) No
Reproductive toxicity No
Skin Corrosion or Irritation No
Respiratory or Skin Sensitization No
Serious eye damage or eye irritation No
Specific target organ toxicity (single or repeated exposure) No
Aspiration Hazard No
Germ cell mutagenicity No
Simple Asphyxiant Yes
Hazards Not Otherwise Classified No

US. EPA CERCLA HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES (40 CFR 302.4)
None Reported

State Regulations
US. CALIFORNIA PROPOSITION 65
None Reported

National Inventory Status

<table>
<thead>
<tr>
<th>National Inventory</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Australia - AICS</td>
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</tr>
<tr>
<td>Canada - DSL</td>
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</tr>
<tr>
<td>Canada - NDSL</td>
<td>No (R-134A)</td>
</tr>
<tr>
<td>China - IECSC</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe - EINEC / ELINCS / NLP</td>
<td>Yes</td>
</tr>
<tr>
<td>Japan - ENCS</td>
<td>Yes</td>
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<tr>
<td>Korea - KECI</td>
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<tr>
<td>New Zealand - NZIoC</td>
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</tr>
<tr>
<td>Philippines - PICCS</td>
<td>Yes</td>
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<tr>
<td>USA - TSCA</td>
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<tr>
<td>Taiwan - TCSI</td>
<td>Yes</td>
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<tr>
<td>Mexico - INSQ</td>
<td>Yes</td>
</tr>
<tr>
<td>Vietnam - NCI</td>
<td>Yes</td>
</tr>
<tr>
<td>Russia - ARIIPS</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Legend:
Yes = All CAS declared ingredients are on the inventory
No = One or more of the CAS listed ingredients are not on the inventory and are not exempt from listing[see specific ingredients in brackets]

SECTION 16 OTHER INFORMATION

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>31/10/2018</th>
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<tr>
<td>Initial Date</td>
<td>16/08/2006</td>
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SDS Version Summary

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<th>Version</th>
<th>Issue Date</th>
<th>Sections Updated</th>
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<tr>
<td>9.1.1.1</td>
<td>31/10/2018</td>
<td>Acute Health (skin), Acute Health (swallowed), Advice to Doctor, Appearance, CAS Number, Chronic Health, Personal Protection (Respirator), Physical Properties, Storage (storage incompatibility), Storage (storage requirement), Toxicity and Irritation (Other)</td>
</tr>
</tbody>
</table>

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.

The 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.

Definitions and abbreviations
PC — TWA: Permissible Concentration-Time Weighted Average
PC — STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer