# R448A

## A-Gas (South Africa) (Pty) Ltd

Version No: **7.1**
Safety Data Sheet

Initial Date: **09/10/2015**
Revision Date: **07/05/2024**
Print Date: **06/11/2026**
L.GHS.ZAF.EN

## SECTION 1 Identification of the substance / mixture and of the company / undertaking

### Product Identifier

| | |
|---|---|
| **Product name** | R448A |
| **Synonyms** | R448A |
| **Proper shipping name** | LIQUEFIED GAS, N.O.S. (contains pentafluoroethane, difluoromethane and 1,1,1,2-tetrafluoroethane) |
| **Chemical formula** | Not Applicable |
| **Other means of identification** | Not Available |

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

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|---|---|
| **Relevant identified uses** | Refrigerant. |

### Details of the manufacturer or importer of the safety data sheet

| | |
|---|---|
| **Registered company name** | **A-Gas (South Africa) (Pty) Ltd** |
| **Address** | 8 Railway Road, Montague Gardens Cape Town 7441 South Africa |
| **Telephone** | +27 (0) 21 551 8790 |
| **Fax** | +27 (0) 21 551 8758 |
| **Website** | www.agas.com |
| **Email** | info.sa@agas.com |

### Emergency telephone number

| | | |
|---|---|---|
| **Association / Organisation** | **A-Gas (South Africa) (Pty) Ltd** | **CHEMWATCH EMERGENCY RESPONSE (24/7)** |
| **Emergency telephone number(s)** | **0800 00 5817** | **0800 296456 (ID#: 59-1014)** |
| **Other emergency telephone number(s)** | **Not Available** | **+61 3 9573 3188** |

## SECTION 2 Hazards identification

### Classification of the substance or mixture

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|---|---|
| **Classification** | Gases Under Pressure (Liquefied Gas) |

### Label elements

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| **Hazard pictogram(s)** |  |
| **Signal word** | Warning |

### Hazard statement(s)

Page 1 continued...

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| **H280** | Contains gas under pressure; may explode if heated. |

### Precautionary statement(s) General

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| **P101** | If medical advice is needed, have product container or label at hand. |
| **P102** | Keep out of reach of children. |
| **P103** | Read label before use. |

### Precautionary statement(s) Prevention

Not Applicable

### Precautionary statement(s) Response

Not Applicable

### Precautionary statement(s) Storage

| | |
|---|---|
| **P410+P403** | Protect from sunlight. Store in a well-ventilated place. |

### Precautionary statement(s) Disposal

Not Applicable

No further product hazard information.

## SECTION 3 Composition / information on ingredients

### Substances

See section below for composition of Mixtures

### Mixtures

| CAS No | %[weight] | Name |
|---|---|---|
| 75-10-5 | 24-28 | difluoromethane |
| 354-33-6 | 24-28 | pentafluoroethane |
| 811-97-2 | 19-23 | 1,1,1,2-tetrafluoroethane |
| 754-12-1 | 18-20 | 2,3,3,3-tetrafluoropropene |
| 29118-24-9 | 5-10 | 1,3,3,3-tetrafluoropropene |

## SECTION 4 First aid measures

### Description of first aid measures

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| **Eye Contact** | ‣ If product comes in contact with eyes remove the patient from gas source or contaminated area.<br>‣ Take the patient to the nearest eye wash, shower or other source of clean water.<br>‣ Open the eyelid(s) wide to allow the material to evaporate.<br>‣ 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.<br>‣ 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.<br>‣ 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)<br>‣ Transport to hospital or doctor.<br>‣ Even when no pain persists and vision is good, a doctor should examine the eye as delayed damage may occur.<br>‣ If the patient cannot tolerate light, protect the eyes with a clean, loosely tied bandage.<br>‣ Ensure verbal communication and physical contact with the patient.<br>**DO NOT** allow the patient to rub the eyes<br>**DO NOT** allow the patient to tightly shut the eyes<br>**DO NOT** introduce oil or ointment into the eye(s) without medical advice<br>**DO NOT** use hot or tepid water. |
| **Skin Contact** | If skin contact occurs:<br>‣ Immediately remove all contaminated clothing, including footwear.<br>‣ Flush skin and hair with running water (and soap if available).<br>‣ Seek medical attention in event of irritation. |
| **Inhalation** | ‣ Following exposure to gas, remove the patient from the gas source or contaminated area.<br>‣ NOTE: Personal Protective Equipment (PPE), including positive pressure self-contained breathing apparatus may be required to assure the safety of the rescuer.<br>‣ Prostheses such as false teeth, which may block the airway, should be removed, where possible, prior to initiating first aid procedures.<br>‣ If the patient is not breathing spontaneously, administer rescue breathing.<br>‣ If the patient does not have a pulse, administer CPR. |

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| | ‣ If medical oxygen and appropriately trained personnel are available, administer 100% oxygen.<br>‣ Summon an emergency ambulance. If an ambulance is not available, contact a physician, hospital, or Poison Control Centre for further instruction.<br>‣ Keep the patient warm, comfortable and at rest while awaiting medical care.<br>‣ **MONITOR THE BREATHING AND PULSE, CONTINUOUSLY.**<br>‣ 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. |

## Indication of any immediate medical attention and special treatment needed

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:
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BASIC TREATMENT
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- 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.

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ADVANCED TREATMENT
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- 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

**Continued...**

## SECTION 5 Firefighting 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 substance or mixture

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| **Fire Incompatibility** | ‣ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result |

### Advice for firefighters

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| **Fire Fighting** | ----------<br>GENERAL<br>----------<br>‣ Alert Fire Brigade and tell them location and nature of hazard.<br>‣ Wear breathing apparatus and protective gloves.<br>‣ Fight fire from a safe distance, with adequate cover.<br>‣ Use water delivered as a fine spray to control fire and cool adjacent area. |
| **Fire/Explosion Hazard** | ‣ Containers may explode when heated - Ruptured cylinders may rocket<br>‣ Fire exposed containers may vent contents through pressure relief devices.<br>‣ High concentrations of gas may cause asphyxiation without warning.<br>‣ May decompose explosively when heated or involved in fire.<br>‣ Contact with gas may cause burns, severe injury and/ or frostbite.<br>Decomposition may produce toxic fumes of:<br>‣ carbon monoxide (CO)<br>‣ carbon dioxide (CO2)<br>hydrogen fluoride<br>‣ other pyrolysis products typical of burning organic material.<br>**Contains low boiling substance:** Closed containers may rupture due to pressure buildup under fire conditions. |

## 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

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| **Minor Spills** | ‣ Avoid breathing vapour and any contact with liquid or gas. Protective equipment including respirator should be used.<br>‣ **DO NOT** enter confined spaces where gas may have accumulated.<br>‣ Increase ventilation. |
| **Major Spills** | ‣ Clear area of all unprotected personnel and move upwind.<br>‣ Alert Emergency Authority and advise them of the location and nature of hazard.<br>‣ Wear breathing apparatus and protective gloves.<br>‣ Prevent by any means available, spillage from entering drains and water-courses. |

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

## SECTION 7 Handling and storage

### Precautions for safe handling

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| **Safe handling** | · Consider use in closed pressurised systems, fitted with temperature, pressure and safety relief valves which are vented for safe dispersal.<br>Use only properly specified equipment which is suitable for this product, its supply pressure and temperature<br>· The tubing network design connecting gas cylinders to the delivery system should include appropriate pressure indicators and vacuum or suction lines.<br>· Fully-welded types of pressure gauges, where the bourdon tube sensing element is welded to the gauge body, are recommended.<br>· Before connecting gas cylinders, ensure manifold is mechanically secure and does not containing another gas.<br>‣ **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.<br>‣ Such compounds should be sited and built in accordance with statutory requirements.<br>‣ The storage compound should be kept clear and access restricted to authorised personnel only.<br>‣ Cylinders stored in the open should be protected against rust and extremes of weather. |

### Conditions for safe storage, including any incompatibilities

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| **Suitable container** | ‣ Cylinder:<br>‣ Ensure the use of equipment rated for cylinder pressure.<br>‣ Ensure the use of compatible materials of construction.<br>‣ Valve protection cap to be in place until cylinder is secured, connected.<br>‣ Cylinder must be properly secured either in use or in storage. |
| **Storage incompatibility** | ‣ Avoid reaction with oxidising agents<br>metals |



| | | | | | | |
|---|---|---|---|---|---|---|
| + | x | + | o | + | + | o |

**X** — *Must not be stored together*
**0** — *May be stored together with specific preventions*
**+** — *May be stored together*

*Note: Depending on other risk factors, compatibility assessment based on the table above may not be relevant to storage situations, particularly where large volumes of dangerous goods are stored and handled. Reference should be made to the Safety Data Sheets for each substance or article and risks assessed accordingly.*

## SECTION 8 Exposure controls / personal protection

### Control parameters

**Occupational Exposure Limits (OEL)**

**INGREDIENT DATA**

| Source | Ingredient | Material name | TWA | STEL | Peak | Notes |
|---|---|---|---|---|---|---|
| South Africa Occupational Exposure Limits for Airborne Pollutants | 1,1,1,2-tetrafluoroethane | 1,1,1,2-Tetrafluoroethane [HFC 134a] | 1000 ppm / 4200 mg/m3 | Not Available | Not Available | Not Available |

**MATERIAL DATA**

### Exposure controls

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| **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.<br>The basic types of engineering controls are:<br>Process controls which involve changing the way a job activity or process is done to reduce the risk.<br>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. |
| **Individual protection measures, such as personal protective equipment** |  |
| **Eye and face protection** | ‣ Safety glasses with side shields.<br>‣ Chemical goggles.[AS/NZS 1337.1, EN166 or national equivalent]<br>‣ 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. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. |
| **Skin protection** | See Hand protection below |
| **Hands/feet protection** | ‣ When handling sealed and suitably insulated cylinders wear cloth or leather gloves. |
| **Body protection** | See Other protection below |
| **Other protection** | ‣ Protective overalls, closely fitted at neck and wrist.<br>‣ Eye-wash unit.<br>‣ Ensure availability of lifeline in confined spaces.<br>‣ 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)

- 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.

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- 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

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| **Appearance** | Clear/colourless liquefied gas with a slight ether odour. |

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| **Physical state** | Liquified Gas | **Relative density (Water = 1)** | 1.11 |
| **Odour** | Not Available | **Partition coefficient n-octanol / water** | Not Available |
| **Odour threshold** | Not Available | **Auto-ignition temperature (°C)** | 628 |
| **pH (as supplied)** | Not Available | **Decomposition temperature (°C)** | Not Available |
| **Melting point / freezing point (°C)** | Not Available | **Viscosity (mm2/s)** | Not Available |
| **Initial boiling point and boiling range (°C)** | -45.9-(-39.8) | **Molecular weight (g/mol)** | Not Applicable |
| **Flash point (°C)** | Not Available | **Taste** | Not Available |
| **Evaporation rate** | Not Available | **Explosive properties** | Not Available |
| **Flammability** | Not Applicable | **Oxidising properties** | Not Available |
| **Upper Explosive Limit (%)** | Not Available | **Surface Tension (dyn/cm or mN/m)** | Not Available |
| **Lower Explosive Limit (%)** | Not Available | **Volatile Component (%vol)** | Not Available |
| **Vapour pressure (kPa)** | 1120 @21.1C | **Gas group** | Not Available |
| **Solubility in water** | Not Available | **pH as a solution (1%)** | Not Available |
| **Vapour density (Air = 1)** | 2.98 | **VOC g/L** | Not Available |
| **Heat of Combustion (kJ/g)** | Not Available | **Ignition Distance (cm)** | Not Available |
| **Flame Height (cm)** | Not Available | **Flame Duration (s)** | Not Available |
| **Enclosed Space Ignition Time Equivalent (s/m3)** | Not Available | **Enclosed Space Ignition Deflagration Density (g/m3)** | Not Available |

## SECTION 10 Stability and reactivity

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| **Reactivity** | See section 7 |
| **Chemical stability** | • Unstable in the presence of incompatible materials.<br>• Product is considered stable.<br>• Hazardous polymerisation will not occur. |
| **Possibility of hazardous reactions** | See section 7 |
| **Conditions to avoid** | See section 7 |
| **Incompatible materials** | See section 7 |
| **Hazardous decomposition products** | See section 5 |

## SECTION 11 Toxicological information

### Information on toxicological effects

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|---|---|
| **a) Acute Toxicity** | Based on available data, the classification criteria are not met. |
| **b) Skin Irritation/Corrosion** | Based on available data, the classification criteria are not met. |
| **c) Serious Eye Damage/Irritation** | Based on available data, the classification criteria are not met. |
| **d) Respiratory or Skin sensitisation** | Based on available data, the classification criteria are not met. |
| **e) Mutagenicity** | Based on available data, the classification criteria are not met. |
| **f) Carcinogenicity** | Based on available data, the classification criteria are not met. |

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| **g) Reproductivity** | Based on available data, the classification criteria are not met. |
| **h) STOT - Single Exposure** | Based on available data, the classification criteria are not met. |
| **i) STOT - Repeated Exposure** | Based on available data, the classification criteria are not met. |
| **j) Aspiration Hazard** | Based on available data, the classification criteria are not met. |

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| **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.<br>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.<br>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.<br>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.<br>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.<br>Common, generalised symptoms associated with non-toxic gas inhalation include :<br>‣ central nervous system effects such as headache, confusion, dizziness, progressive stupor, coma and seizures;<br>‣ respiratory system complications may include tachypnoea and dyspnoea;<br>‣ cardiovascular effects may include circulatory collapse and arrhythmias;<br>‣ gastrointestinal effects may also be present and may include mucous membrane irritation and nausea and vomiting.<br>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.<br>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.<br>Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin) |
| **Ingestion** | Not normally a hazard due to physical form of product.<br>Considered an unlikely route of entry in commercial/industrial environments |
| **Skin Contact** | Limited evidence suggests that repeated exposure may cause skin cracking, flaking or drying following normal handling and use.<br><br>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 (vesiculation), 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.<br><br>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.<br>Open cuts, abraded or irritated skin should not be exposed to this material<br>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.<br>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 an 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). |
| **Eye** | Although the material is not classified as an eye irritant under Regulation (EC) No 1272/2008 (CLP), as amended, direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn).<br>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.. |
| **Chronic** | On the basis, primarily, of animal experiments, concern has been expressed by at least one classification body that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.<br>Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.<br>Halogenated oxiranes may arise following epoxidation of haloalkenes.<br>The metabolism of haloethylenes by microsomal oxidation leading to epoxide formation across the double bond has been proposed. The resulting oxiranes are highly reactive and may covalently bind to nucleic acids leading to mutations and possible cancers A measure of such potential carcinogenicity is the development of significant preneoplastic foci in livers of treated rats.<br>The carcinogenicity of halogenated oxiranes may lie in the reactivity of an epoxide intermediate.<br>Principal route of occupational exposure to the gas is by inhalation. |

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| | 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 visceral 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 fluorine-containing general anaesthetics, has caused some scientists to call for a lowering of the fluorocarbon exposure standard to 5 ppm since some are mutagens. |

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|---|---|---|
| **R448A** | **TOXICITY** | **IRRITATION** |
| | Not Available | Not Available |
| **difluoromethane** | **TOXICITY** | **IRRITATION** |
| | Inhalation (Rat) LC50: >760000 ppm4h[2] | Not Available |
| | Oral (Mouse) LD50; 1810 mg/kg[2] | |
| **pentafluoroethane** | **TOXICITY** | **IRRITATION** |
| | Inhalation (Rat) LC50: >709000 ppm4h[2] | Eye: no adverse effect observed (not irritating)[1] |
| | | Skin: no adverse effect observed (not irritating)[1] |
| **1,1,1,2-tetrafluoroethane** | **TOXICITY** | **IRRITATION** |
| | Inhalation (Rat) LC50: 359453.102 ppm4h[2] | Eye: adverse effect observed (irritating)[1] |
| | | Skin: adverse effect observed (irritating)[1] |
| | | Skin: no adverse effect observed (not irritating)[1] |
| **2,3,3,3-tetrafluoropropene** | **TOXICITY** | **IRRITATION** |
| | Inhalation (Rat) LC50: >86.831 ppm4h[2] | Not Available |
| **1,3,3,3-tetrafluoropropene** | **TOXICITY** | **IRRITATION** |
| | Inhalation (Rat) LC50: >1157.752 ppm4h[2] | Skin: no adverse effect observed (not irritating)[1] |

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| ***Legend:*** | *1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances* |

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| **PENTAFLUOROETHANE** | Cardiac sensitisation threshold limit >245400 mg/m3 Anaesthetic effects threshold limit 490800 mg/m3 * DuPont SDS |
| **1,1,1,2-TETRAFLUOROETHANE** | * 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. |
| **2,3,3,3-TETRAFLUOROPROPENE** | Mutagenicity : Did not cause genetic damage in animals. Did not cause genetic damage in cultured mammalian cells. Experiments showed mutagenic effects in cultured bacterial cells. Reproductive toxicity : Animal testing showed no reproductive toxicity. Teratogenicity : Animal testing showed effects on embryo-fetal development at levels equal to or above those causing maternal toxicity. For similar product, 1,3,3,3-tetrafluoropropene HFO-1234ze is practically non-toxic. Short-term exposures at levels higher than 10% have not induced cardiac sensitization to adrenalin nor induced serious toxic effects. Rats and rabbits did not exhibit any serious toxic, developmental or reproductive effects even with exposures to high levels of HFO-1234ze. Based on a series of mutagenicity and genomics studies, the cancer risk for HFO-1234ze is LOW |
| **1,3,3,3-TETRAFLUOROPROPENE** | Inhalation (rat) NOEL (28 days): >1.5 mg/l * HFO-1234ze is practically non-toxic. Short-term exposures at levels higher than 10% have not induced cardiac sensitization to adrenalin nor induced serious toxic effects. Rats and rabbits did not exhibit any serious toxic, developmental or reproductive effects even with exposures to high levels of HFO-1234ze. Based on a series of mutagenicity and genomics studies, the cancer risk for HFO-1234ze is low, no cardiac sensitisation was observed in dogs with exposures up to 120,000 ppm; repeated dose toxicity in rats (13-wk) found mild effects on the heart (NOEL 5,000ppm); in vitro genotoxicity findings include negative Ames Test and negative human lymphocyte chromosome aberration test; in vivo genotoxicity findings in the mouse micronucleus test were negative (inhalation, mammalian bone-marrow cytogenic test with chromosomal analysis). |
| **1,1,1,2-TETRAFLUOROETHANE & 2,3,3,3-TETRAFLUOROPROPENE & 1,3,3,3-TETRAFLUOROPROPENE** | Disinfection by products (DBPs) re formed when disinfectants such as chlorine, chloramine, and ozone react with organic and inorganic matter in water. The observations that some DBPs such as trihalomethanes (THMs), di-/trichloroacetic acids, and 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone (MX) are carcinogenic in animal studies have raised public concern over the possible adverse health effects of DBPs. To date, several hundred DBPs have been identified.<br>Numerous haloalkanes and haloalkenes have been tested for carcinogenic and mutagenic activities. n general, the genotoxic potential is dependent on the nature, number, and position of halogen(s) and the molecular size of the compound. |
| **2,3,3,3-TETRAFLUOROPROPENE & 1,3,3,3-TETRAFLUOROPROPENE** | * Vendor HFO-1234ze is not likely to accumulate in the bodies of humans or animals<br>The fluoroalkenes vary widely in acute inhalation toxicity. Those, such as perfluoroisobutylene, PFIB, the most highly toxic member, attacks the pulmonary epithelium of rats eventuating in edema and death after a delay of about one day. Other fluoroalkenes, such as hexafluoropropylene (HFP) or chlorotrifluoroethylene (CTFE), also cause pulmonary injury but at lower concentrations produce concentration dependent changes in the renal concentrating mechanism of the rat. Changes in the CNS of rats and rabbits have also been reported for CTFE. |

**Continued...**

| | | | |
|---|---|---|---|
| **Acute Toxicity** | ✗ | **Carcinogenicity** | ✗ |
| **Skin Irritation/Corrosion** | ✗ | **Reproductivity** | ✗ |
| **Serious Eye Damage/Irritation** | ✗ | **STOT - Single Exposure** | ✗ |
| **Respiratory or Skin sensitisation** | ✗ | **STOT - Repeated Exposure** | ✗ |
| **Mutagenicity** | ✗ | **Aspiration Hazard** | ✗ |

***Legend:*** ✗ *– Data either not available or does not fill the criteria for classification*
✓ *– Data available to make classification*

## SECTION 12 Ecological information

### Toxicity

**R448A**

| Endpoint | Test Duration (hr) | Species | Value | Source |
|---|---|---|---|---|
| Not Available | Not Available | Not Available | Not Available | Not Available |

**difluoromethane**

| Endpoint | Test Duration (hr) | Species | Value | Source |
|---|---|---|---|---|
| EC50 | 72h | Algae or other aquatic plants | >114mg/l | 2 |
| EC50 | 48h | Crustacea | >97.9mg/l | 2 |
| NOEC(ECx) | 96h | Fish | 10mg/l | 2 |
| EC50 | 96h | Algae or other aquatic plants | 142mg/l | 2 |
| LC50 | 96h | Fish | >81.8mg/l | 2 |

**pentafluoroethane**

| Endpoint | Test Duration (hr) | Species | Value | Source |
|---|---|---|---|---|
| EC50 | 72h | Algae or other aquatic plants | >114mg/l | 2 |
| EC50 | 48h | Crustacea | >97.9mg/l | 2 |
| EC50 | 96h | Algae or other aquatic plants | 142mg/l | 2 |
| NOEC(ECx) | 96h | Fish | 10mg/l | 2 |
| LC50 | 96h | Fish | >81.8mg/l | 2 |

**1,1,1,2-tetrafluoroethane**

| Endpoint | Test Duration (hr) | Species | Value | Source |
|---|---|---|---|---|
| EC50 | 72h | Algae or other aquatic plants | >114mg/l | 2 |
| EC50 | 48h | Crustacea | 980mg/L | 5 |
| EC50 | 96h | Algae or other aquatic plants | 142mg/l | 2 |
| LC50 | 96h | Fish | 450mg/l | 2 |
| NOEC(ECx) | 72h | Algae or other aquatic plants | ~13.2mg/l | 2 |

**2,3,3,3-tetrafluoropropene**

| Endpoint | Test Duration (hr) | Species | Value | Source |
|---|---|---|---|---|
| EC50 | 72h | Algae or other aquatic plants | >2.5mg/l | 2 |
| EC50 | 48h | Crustacea | 65mg/l | 2 |
| NOEC(ECx) | 72h | Algae or other aquatic plants | >=2.5mg/l | 2 |
| LC50 | 96h | Fish | 33mg/l | 2 |
| ErC50 | 72h | Algae or other aquatic plants | >100mg/l | 2 |

**1,3,3,3-tetrafluoropropene**

| Endpoint | Test Duration (hr) | Species | Value | Source |
|---|---|---|---|---|
| EC50 | 72h | Algae or other aquatic plants | >170mg/l | 2 |
| EC50 | 48h | Crustacea | >160mg/l | 2 |
| EC50(ECx) | 48h | Crustacea | >160mg/l | 2 |
| ErC50 | 72h | Algae or other aquatic plants | >170mg/l | 2 |
| LC50 | 96h | Fish | >117mg/l | 2 |
| EC50 | 72h | Algae or other aquatic plants | >10mg/l | 2 |
| EC50(ECx) | 72h | Algae or other aquatic plants | >10mg/l | 2 |

***Legend:*** *Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. US EPA, Ecotox database - Aquatic Toxicity Data 4. ECETOC Aquatic Hazard Assessment Data 5. NITE (Japan) - Bioconcentration Data 6. METI (Japan) - Bioconcentration Data 7. Vendor Data 8. User defined data*

**Continued...**

**DO NOT** discharge into sewer or waterways.

### Persistence and degradability

| Ingredient | Persistence: Water/Soil | Persistence: Air |
|---|---|---|
| difluoromethane | LOW | LOW |
| pentafluoroethane | HIGH | HIGH |
| 1,1,1,2-tetrafluoroethane | HIGH | HIGH |
| 2,3,3,3-tetrafluoropropene | HIGH | HIGH |

### Bioaccumulative potential

| Ingredient | Bioaccumulation |
|---|---|
| difluoromethane | LOW (LogKOW = 0.2) |
| pentafluoroethane | LOW (LogKOW = 1.55) |
| 1,1,1,2-tetrafluoroethane | LOW (LogKOW = 1.68) |
| 2,3,3,3-tetrafluoropropene | LOW (LogKOW = 2.15) |

### Mobility in soil

| Ingredient | Mobility |
|---|---|
| difluoromethane | LOW (Log KOC = 23.74) |
| pentafluoroethane | LOW (Log KOC = 154.4) |
| 1,1,1,2-tetrafluoroethane | LOW (Log KOC = 96.63) |
| 2,3,3,3-tetrafluoropropene | LOW (Log KOC = 154.4) |

## SECTION 13 Disposal considerations

### Waste treatment methods

| | |
|---|---|
| **Product / Packaging disposal** | ▸ Evaporate residue at an approved site.<br>▸ Return empty containers to supplier. If containers are marked non-returnable establish means of disposal with manufacturer prior to purchase.<br>▸ Ensure damaged or non-returnable cylinders are gas-free before disposal. |

## SECTION 14 Transport information

### Labels Required

| | |
|---|---|
| |  |
| **Marine Pollutant** | NO |

### Land transport (UN)

| | |
|---|---|
| 14.1. **UN number or ID number** | 3163 |
| 14.2. **UN proper shipping name** | LIQUEFIED GAS, N.O.S. (contains pentafluoroethane, difluoromethane and 1,1,1,2-tetrafluoroethane) |
| 14.3. **Transport hazard class(es)** | Class: 2.2<br>Subsidiary Hazard: Not Applicable |
| 14.4. **Packing group** | Not Applicable |
| 14.5. **Environmental hazard** | Not Applicable |
| 14.6. **Special precautions for user** | Special provisions: 274; 392<br>Limited quantity: 120 ml |

### Air transport (ICAO-IATA / DGR)

**Continued...**

| | |
|---|---|
| 14.1. **UN number** | 3163 |
| 14.2. **UN proper shipping name** | Liquefied gas, n.o.s. * (contains pentafluoroethane, difluoromethane and 1,1,1,2-tetrafluoroethane) |
| 14.3. **Transport hazard class(es)** | ICAO/IATA Class: 2.2<br>ICAO / IATA Subsidiary Hazard: Not Applicable<br>ERG Code: 2L |
| 14.4. **Packing group** | Not Applicable |
| 14.5. **Environmental hazard** | Not Applicable |
| 14.6. **Special precautions for user** | Special provisions: Not Applicable<br>Cargo Only Packing Instructions: 200<br>Cargo Only Maximum Qty / Pack: 150 kg<br>Passenger and Cargo Packing Instructions: 200<br>Passenger and Cargo Maximum Qty / Pack: 75 kg<br>Passenger and Cargo Limited Quantity Packing Instructions: Forbidden<br>Passenger and Cargo Limited Maximum Qty / Pack: Forbidden |

**Sea transport (IMDG-Code / GGVSee)**

| | |
|---|---|
| 14.1. **UN number** | 3163 |
| 14.2. **UN proper shipping name** | LIQUEFIED GAS, N.O.S. (contains pentafluoroethane, difluoromethane and 1,1,1,2-tetrafluoroethane) |
| 14.3. **Transport hazard class(es)** | IMDG Class: 2.2<br>IMDG Subsidiary Hazard: Not Applicable |
| 14.4. **Packing group** | Not Applicable |
| 14.5 **Environmental hazard** | Not Applicable |
| 14.6. **Special precautions for user** | EMS Number: F-C, S-V<br>Special provisions: 274 392<br>Limited Quantities: 120 mL |

### 14.7. Maritime transport in bulk according to IMO instruments

#### 14.7.1. Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

#### 14.7.2. Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

| Product name | Group |
|---|---|
| difluoromethane | Not Applicable |
| pentafluoroethane | Not Applicable |
| 1,1,1,2-tetrafluoroethane | Not Applicable |
| 2,3,3,3-tetrafluoropropene | Not Applicable |
| 1,3,3,3-tetrafluoropropene | Not Applicable |

#### 14.7.3. Transport in bulk in accordance with the IGC Code

| Product name | Ship Type |
|---|---|
| difluoromethane | Not Applicable |
| pentafluoroethane | Not Applicable |
| 1,1,1,2-tetrafluoroethane | Not Applicable |
| 2,3,3,3-tetrafluoropropene | Not Applicable |
| 1,3,3,3-tetrafluoropropene | Not Applicable |

**Continued...**

## SECTION 15 Regulatory information

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

**difluoromethane is found on the following regulatory lists**

EAEU Ozone-Depleting Substances Subject to Permit/Licensing for Import/Export - List F (Russian)

**pentafluoroethane is found on the following regulatory lists**

EAEU Ozone-Depleting Substances Subject to Permit/Licensing for Import/Export - List F (Russian)

**1,1,1,2-tetrafluoroethane is found on the following regulatory lists**

EAEU Ozone-Depleting Substances Subject to Permit/Licensing for Import/Export - List F (Russian)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs - Not Classified as Carcinogenic
South Africa Occupational Exposure Limits for Airborne Pollutants

**2,3,3,3-tetrafluoropropene is found on the following regulatory lists**

Not Applicable

**1,3,3,3-tetrafluoropropene is found on the following regulatory lists**

Not Applicable

### Additional Regulatory Information

Not Applicable

### National Inventory Status

| National Inventory | Status |
|---|---|
| Australia - AIIC / Australia Non-Industrial Use | Yes |
| Canada - DSL | Yes |
| Canada - NDSL | No (difluoromethane; pentafluoroethane; 1,1,1,2-tetrafluoroethane; 2,3,3,3-tetrafluoropropene) |
| China - IECSC | No (difluoromethane; 2,3,3,3-tetrafluoropropene) |
| Colombia - Colombia National Industrial Chemicals Inventory | No (difluoromethane; pentafluoroethane; 1,1,1,2-tetrafluoroethane; 2,3,3,3-tetrafluoropropene; 1,3,3,3-tetrafluoropropene) |
| Europe - EINEC / ELINCS / NLP | Yes |
| Japan - ENCS | Yes |
| Korea - KECI | Yes |
| New Zealand - NZIoC | Yes |
| Philippines - PICCS | No (1,3,3,3-tetrafluoropropene) |
| USA - TSCA | All chemical substances in this product have been designated as TSCA Inventory 'Active' |
| Taiwan - TCSI | Yes |
| Mexico - INSQ | No (2,3,3,3-tetrafluoropropene; 1,3,3,3-tetrafluoropropene) |
| Vietnam - NCI | Yes |
| Russia - FBEPH | No (2,3,3,3-tetrafluoropropene; 1,3,3,3-tetrafluoropropene) |
| UAE - Control List (Banned/Restricted Substances) | No (difluoromethane; pentafluoroethane; 1,1,1,2-tetrafluoroethane; 2,3,3,3-tetrafluoropropene; 1,3,3,3-tetrafluoropropene) |
| ***Legend:*** | *Yes = All CAS declared ingredients are on the inventory*<br>*No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.* |

## SECTION 16 Other information

| | |
|---|---|
| **Revision Date** | 07/05/2024 |
| **Initial Date** | 09/10/2015 |

### SDS Version Summary

**Continued...**

| Version | Date of Update | Sections Updated |
|---|---|---|
| 6.1 | 26/07/2021 | Toxicological information - Acute Health (skin), Physical and chemical properties - Appearance, Hazards identification - Classification, Ecological Information - Environmental, Exposure controls / personal protection - Exposure Standard, First Aid measures - First Aid (swallowed), Composition / information on ingredients - Ingredients, Accidental release measures - Spills (major), Handling and storage - Storage (storage incompatibility), Toxicological information - Toxicity and Irritation (Other), Identification of the substance / mixture and of the company / undertaking - Use |

**Continued...**

| Version | Date of Update | Sections Updated |
|---|---|---|
| 7.1 | 07/05/2024 | Hazards identification - Classification, Handling and storage - Storage (suitable container) |

### Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources 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
- ACGIH: American Conference of Governmental Industrial Hygienists
- STEL: Short Term Exposure Limit
- TEEL: Temporary Emergency Exposure Limit。
- IDLH: Immediately Dangerous to Life or Health Concentrations
- ES: Exposure Standard
- OSF: Odour Safety Factor
- NOAEL: No Observed Adverse Effect Level
- LOAEL: Lowest Observed Adverse Effect Level
- TLV: Threshold Limit Value
- LOD: Limit Of Detection
- OTV: Odour Threshold Value
- BCF: BioConcentration Factors
- BEI: Biological Exposure Index
- DNEL: Derived No-Effect Level
- PNEC: Predicted no-effect concentration
- MARPOL: International Convention for the Prevention of Pollution from Ships
- IMSBC: International Maritime Solid Bulk Cargoes Code
- IGC: International Gas Carrier Code
- IBC: International Bulk Chemical Code

- AIIC: Australian Inventory of Industrial Chemicals
- DSL: Domestic Substances List
- NDSL: Non-Domestic Substances List
- IECSC: Inventory of Existing Chemical Substance in China
- EINECS: European INventory of Existing Commercial chemical Substances
- ELINCS: European List of Notified Chemical Substances
- NLP: No-Longer Polymers
- ENCS: Existing and New Chemical Substances Inventory
- KECI: Korea Existing Chemicals Inventory
- NZIoC: New Zealand Inventory of Chemicals
- PICCS: Philippine Inventory of Chemicals and Chemical Substances
- TSCA: Toxic Substances Control Act
- TCSI: Taiwan Chemical Substance Inventory
- INSQ: Inventario Nacional de Sustancias Químicas
- NCI: National Chemical Inventory
- FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

**Disclaimer:** This SDS was prepared by a third party for product identification purposes only and is not endorsed by or affiliated with the original brand owner.