

A-GAS R409AHazard Alert Code:
MODERATE

Chemwatch Material Safety Data Sheet

Revision No: 3

Chemwatch 7633-08

Issue Date: 10-Jul-2008

CD 2008/3

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

A-GAS R409A

PROPER SHIPPING NAME

LIQUEFIED GAS, N.O.S.

PRODUCT USE

Refrigerant. 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. Used according to manufacturer's directions.

SUPPLIER

Company: A-Gas (Singapore) PTE LTD

Address:

360 Orchard Road, #10-05

International Building 238869

Telephone: 65 6836 0065

Emergency Tel: 65 6836 0065

Fax: 65 6836 6521

HAZARD RATINGS

	Min	Max	
Flammability:	0		
Toxicity:	2		
Body Contact:	2		
Reactivity:	1		
Chronic:	2		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4

Section 2 - HAZARDS IDENTIFICATION**STATEMENT OF HAZARDOUS NATURE**

DANGEROUS GOODS. NON-HAZARDOUS SUBSTANCE. According to the Criteria of NOHSC, and the ADG Code.

POISONS SCHEDULE

None

RISK

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

SAFETY

Safety Codes	Safety Phrases
S23	» Do not breathe gas/ fumes/ vapour/ spray.
S24	» Avoid contact with skin.
S39	» Wear eye/ face protection.
S51	» Use only in well ventilated areas.
S09	» Keep container in a well ventilated place.
S07	» Keep container tightly closed.
S26	» In case of contact with eyes rinse with plenty of water and contact Doctor or Poisons Information Centre.
S60	» This material and its container must be disposed of as hazardous waste.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
chlorodifluoromethane	75-45-6	60
chlorotetrafluoroethane	2837-89-0	25
chlorodifluoroethane	75-68-3	15

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Section 4 - FIRST AID MEASURES**SWALLOWED**

» Not considered a normal route of entry. For advice, contact a Poisons Information Centre or a doctor.

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

EYE

»

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

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

SKIN

» If skin contact occurs:

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

INHALED

»

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

NOTES TO PHYSICIAN

» for intoxication due to Freons/ Halons;

A: Emergency and Supportive Measures

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

- Monitor the ECG for 4-6 hours

B: Specific drugs and antidotes:

- There is no specific antidote

C: Decontamination

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

D: Enhanced elimination:

- There is no documented efficacy for diuresis, haemodialysis, haemoperfusion, or repeat-dose charcoal.
- POISONING and DRUG OVERDOSE, Californian Poison Control System Ed. Kent R Olson; 3rd Edition
- Do not administer sympathomimetic drugs unless absolutely necessary as material may increase myocardial irritability.
 - No specific antidote.
 - Because rapid absorption may occur through lungs if aspirated and cause systematic effects, the decision of whether to induce vomiting or not should be made by an attending physician.
 - If lavage is performed, suggest endotracheal and/or esophageal control.
 - Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach.
 - Treatment based on judgment of the physician in response to reactions of the patient

DO NOT administer sympathomimetic drugs as they may cause ventricular arrhythmias.
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.

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- 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.

FIRE FIGHTING

»

GENERAL

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

SPECIAL REQUIREMENTS:

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

FIRE FIGHTING REQUIREMENTS:

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

FIRE/EXPLOSION HAZARD

- Containers may explode when heated - Ruptured cylinders may rocket
 - Fire exposed containers may vent contents through pressure relief devices.
 - High concentrations of gas may cause asphyxiation without warning.
 - May decompose explosively when heated or involved in fire.
 - Contact with gas may cause burns, severe injury and/ or frostbite.
- Decomposition may produce toxic fumes of: carbon monoxide (CO), carbon dioxide (CO₂), hydrogen chloride, phosgene, 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.

FIRE INCOMPATIBILITY

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

HAZCHEM

None

Personal Protective Equipment

Gas tight chemical resistant suit.

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

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

MAJOR SPILLS

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

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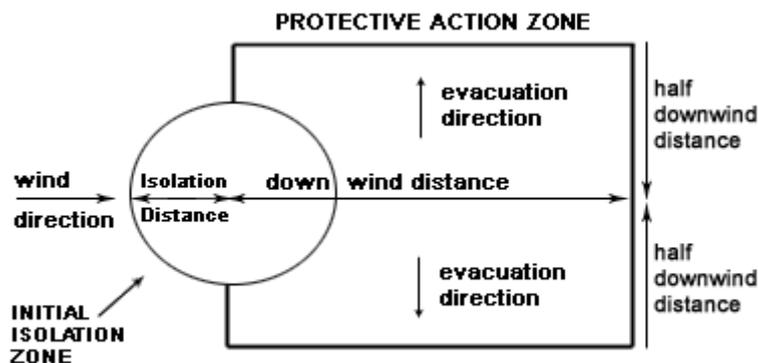
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- Remove leaking cylinders to a safe place.
- Fit vent pipes. Release pressure under safe, controlled conditions
- Burn issuing gas at vent pipes.
- DO NOT exert excessive pressure on valve; DO NOT attempt to operate damaged valve.

PROTECTIVE ACTIONS FOR SPILL

From IERG (Canada/Australia)

Isolation Distance 50 metres

Downwind Protection Distance 500 metres

IERG Number 6

FOOTNOTES

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

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:

chlorodifluoroethane 25000ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

chlorodifluoroethane 15000ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:

chlorodifluoroethane 10000ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according exceed the following cutoffs

Very Toxic (T+) >= 0.1% Toxic (T) >= 3.0%

R50 >= 0.25% Corrosive (C) >= 5.0%

R51 >= 2.5%

else >= 10%

where percentage is percentage of ingredient found in the mixture

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

X: Must not be stored together

O: May be stored together with specific preventions

+ : May be stored together

Personal Protective Equipment advice is contained in Section 8 of the MSDS.**Section 7 - HANDLING AND STORAGE****PROCEDURE FOR HANDLING**

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- »
- Vented gas is more dense than air and may collect in pits, basements.

SUITABLE CONTAINER

Cylinder: Steel packaging

Ensure the use of equipment rated for cylinder pressure.

Ensure the use of compatible materials of construction.

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

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

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

Segregate full from empty cylinders.

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

STORAGE INCOMPATIBILITY

» Avoid reaction with.

- Avoid magnesium, aluminium and their alloys, brass and steel.

Haloalkanes:

- are highly reactive: some of the more lightly substituted lower members are highly flammable.
- may react with the lighter divalent metals to produce more reactive compounds analogous to Grignard reagents.
- may produce explosive compounds following prolonged contact with metallic or other azides
- may react on contact with potassium or its alloys - although apparently stable on contact with a wide range of halocarbons, reaction products may be shock-sensitive and may explode with great violence on light impact; severity generally increases with the degree of halocarbon substitution and potassium-sodium alloys give extremely sensitive mixtures.

BRETHERRICK L.: Handbook of Reactive Chemical Hazards

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

STORAGE REQUIREMENTS

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

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

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC
Australia Exposure Standards	chlorodifluoromethane (Chlorodifluoromethane)	1000	3540					
Australia Exposure Standards	chlorodifluoromethane (Fluorides (as F))		2.5					
Australia Exposure Standards	chlorodifluoroethane (Fluorides (as F))		2.5					

The following materials had no OELs on our records

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- chlorotetrafluoroethane: CAS:2837-89-0 CAS:63938-10-3

MATERIAL DATA

» 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. Air normally has 21 percent oxygen by volume, with 18 percent regarded as minimum under normal atmospheric pressure to maintain consciousness / life. At pressures significantly higher or lower than normal atmospheric pressure, expert guidance should be sought.

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

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

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

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INGREDIENT DATA**CHLORODIFLUOROMETHANE:**

The recommended TLV-TWA should provide an ample margin of safety to prevent cardiac sensitisation and systemic injury.

CHLOROTETRAFLUOROETHANE:

CEL TWA: 1000 ppm (compare WEEL TWA (8hr))
 HCFC 124 is practically nontoxic by inhalation. Acute lethal levels exceed 230000 ppm for a 4 hour exposure in rats. The threshold for cardiac sensitisation in experimental screening studies is 25000 ppm. repeat exposures at levels up to 50000 ppm for 13 weeks did not appear to produce signs of toxicity although minimal effects were noted at 15000 ppm. There was no evidence for developmental or teratogenic effects in rabbits exposed at 50000 ppm. A workplace environmental exposure level (WEEL) recommended by the AIHA is thought to provide an ample margin of safety against cardiac sensitisation and systemic injury.

CHLORODIFLUOROETHANE:

» No exposure limits set by NOHSC or ACGIH.

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.

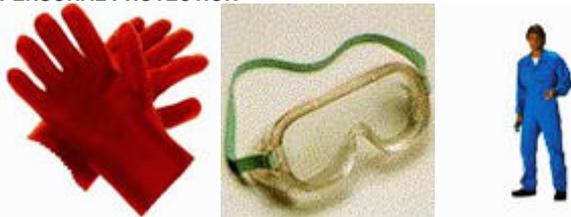
CARE: Most simple asphyxiants are odourless or possess low odour and there is no warning on entry into an oxygen deficient atmosphere. If there is any doubt, oxygen content can be checked simply and quickly. It may not be appropriate to only recommend an exposure standard for simple asphyxiants rather it is essential that sufficient oxygen be maintained. Air normally has 21 percent oxygen by volume, with 18 percent regarded as minimum under normal atmospheric pressure to maintain consciousness / life. At pressures significantly higher or lower than normal atmospheric pressure, expert guidance should be sought.

MAK value: 1000 ppm, 4200 mg/m³

» MAK Category IV Peak Limitation: For substances with very weak effects (ie.) those with MAK value >500 ml/m³ (ppm): Allows excursions of twice the MAK value for 60 minutes at a time, 3 times per shift.

MAK Group IIc: Substances with MAK Values but no pregnancy risk group classification. These are substances which have been investigated but for which no information regarding possible damage to the foetus/embryo was found. Mention calls attention to the absence of adequate data.

MAK values, and categories and groups are those recommended within the Federal Republic of Germany.

PERSONAL PROTECTION**EYE**

»

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59]

HANDS/FEET

»

- When handling sealed cylinders wear cloth or leather gloves.

OTHER

»

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

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

ENGINEERING CONTROLS

»

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

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

Type of Contaminant:

Air Speed:

gas discharge (active generation into zone of rapid air motion)

1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

Upper end of the range

1: Room air currents minimal or favourable to capture

1: Disturbing room air currents

2: Contaminants of low toxicity or of nuisance value only.

2: Contaminants of high toxicity

3: Intermittent, low production.

3: High production, heavy use

4: Large hood or large air mass in motion

4: Small hood-local control only

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

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

Colourless liquefied gas with a slightly ethereal odour; partly mixes with water.

PHYSICAL PROPERTIES

Gas.

Molecular Weight: Not Applicable	Boiling Range (°C): -34
Melting Range (°C): Not Available	Specific Gravity (water=1): 1.221 @ 25 deg.C
Solubility in water (g/L): Partly Miscible	pH (as supplied): 7
pH (1% solution): Not Available	Vapour Pressure (kPa): 820 @ deg.C
Volatile Component (%vol): 100	Evaporation Rate: Not Available
Relative Vapour Density (air=1): >3	Flash Point (°C): Not Applicable
Lower Explosive Limit (%): 9	Upper Explosive Limit (%): 14.8
Autoignition Temp (°C): Not Applicable	Decomposition Temp (°C): 96
State: COMPRESSED GAS	Viscosity: 0.198 mPa.s cSt@ 25 deg.°C

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

»

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

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

» Not normally a hazard due to physical form of product.
Considered an unlikely route of entry in commercial/industrial environments.

EYE

» There is some evidence to suggest that this material can cause eye irritation and damage in some persons.

SKIN

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

INHALED

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

CHRONIC HEALTH EFFECTS

» Principal route of occupational exposure to the gas is by inhalation.
Fluorocarbons can cause an increased risk of cancer, spontaneous abortion and birth defects.

TOXICITY AND IRRITATION

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

Acute toxicity

- . Oral route, LD 50, not applicable.
- . Dermal route, LD 50, not applicable.
- . Inhalation, LC 50, 6 hour(s), rat, > 40 % v/v air (R 142b).
- . Inhalation, LC 50, 4 hour(s), rat, 21.9 % v/v air (R 22).

Irritation

- . Rabbit, slightly irritant (skin) (R 22).
- . Rabbit, slightly irritant (eyes) (R 22).

Sensitisation

- . Guinea Pig, Non sensitising (skin) (R 22).

Chronic toxicity

- . Inhalation, after a single exposure, dog, 2.6 % v/v air, cardiac sensitization following adrenergic stimulation (R 22/R 142b/R 124).
- . Inhalation, after prolonged exposure, rat, 5 % v/v air, no observed effect (R 142b/R 124).
- . No carcinogenic, teratogenic effects (R 142b/R 124).
- . Inhalation, rat, Target organ: eyes, 5 % v/v air, teratogenic effect (R 22).
- . No mutagenic effect (R 22/R 124).
- . In vitro, Ambiguous mutagenic effect (R 142b).
- . In vivo, no mutagenic effect (R 142b).

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. Inhalation, after prolonged exposure, rat, Target organ: salivary glands, 5 % v/v air, carcinogenic effect (R 22).

. Inhalation, after prolonged exposure, mouse, no carcinogenic effect (R22).

CHLORODIFLUOROMETHANE:

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

TOXICITY

Inhalation (rat) LC50: 35 pph/15m

Oral (rat) TDLo: 2457 mg/kg/26W-I

IRRITATION

Nil Reported

» The substance is classified by IARC as Group 3:

NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

CHLOROTETRAFLUOROETHANE:

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

Inhalation (rat) LC50: 570000 ppm 15m

Nil Reported

CHLORODIFLUOROETHANE:

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

Inhalation (rat) LC50: 2,050,000 mg/m³/4h

Nil Reported

(This approx. 45% gas, 55% air)

CARCINOGEN

chlorodifluoromethane

International Agency for Research on Cancer (IARC) Carcinogens

Group 3

Section 12 - ECOLOGICAL INFORMATION

Marine Pollutant:

Not Determined

» DO NOT discharge into sewer or waterways.

Acute ecotoxicity

. Fishes, *Poecilia reticulata*, LC 50, 96 hour(s), 220 mg/l (R 142b).

. Crustaceans, *Daphnia magna*, EC 50, 48 hour(s), 160 mg/l (R 142b).

Chronic ecotoxicity

. Result: no data.

Mobility

. Air, Henry's law constant (H) from 15 to 36 kPa.m³/mol.

Result: considerable volatility.

Conditions: ambient temperature/calculated value (R 22/R 142b/R 124).

. Water, evaporation, t (100%) = 3 day(s).

Conditions: 20 °C/saturated solution (R 22).

. Water, evaporation, t 1/2 = 3 hour(s).

Conditions: calculated value from mathematical model/river (R 142b).

. Soil/sediments, adsorption, log KOC from 1.25 to 1.76.

Conditions: calculated value (R 22).

. Soil/sediments, adsorption, log KOC from 1.6 to 2.

Conditions: calculated value (R 142b/R 124).

Abiotic degradation

. Air, indirect photo-oxidation, t 1/2 from 5 to 17 year(s).

Conditions: sensitiser: OH radicals.

Degradation's products: carbon dioxide/hydrochloric acid/fluorhydric acid/trifluoroacetic acid (R 22/R 142b/R 124).

. Air, photolysis, ODP from 0.016 to 0.065.

Result: limited effect on stratospheric ozone.

Reference value for CFC 11: ODP = 1 (R 22/R 142b/R 124).

. Air, greenhouse effect, GWP from 0.1 to 0.42.

Reference value for CFC 11: GWP = 1 (R 22/R 142b/R 124).

. Water/soil, hydrolysis, t 1/2 from 25 to 40 year(s).

Result: non-significant hydrolysis.

Conditions: pH 8/25 °C (R 22).

. Water/soil, hydrolysis, t 1/2 > 10000 year(s).

Result: non-significant hydrolysis.

Conditions: calculated value (R 142b).

Biotic degradation

. Aerobic, test: ready biodegradability/closed bottle, degradation = 0%, 28 day(s).

Result: non-readily biodegradable (R 22).

. Aerobic, test: ready biodegradability/modified STURM, degradation = 5%, 28 day(s).

Result: non-readily biodegradable (R 142b).

. Aerobic, test: ready biodegradability/closed bottle, degradation from 1 to 2 %, 28 day(s).

Result: non-readily biodegradable (R 124).

Potential for bioaccumulation

. Bioconcentration: log Po/w = 1.08.

Result: non-bioaccumulable (R 22).

. Bioconcentration: Aquatic organisms, BCF = 42.

Result: non-bioaccumulable.

Conditions: calculated value (R 142b).

. Bioconcentration: log Po/w from 1.9 to 2.

Result: weak bioaccumulation potential (R 124).

Comments

. Product is persistent in air.

. Product is not significantly hazardous for the aquatic environment as:

. Considerable volatility.

A-GAS R409A**Hazard Alert Code:
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. Low bioaccumulation potential.
Refer to data for ingredients, which follows:
CHLORODIFLUOROMETHANE:
Koc: 57.5
Half-life (hr) air: 97236-151548
Half-life (hr) H2O surface water: 2.7
Henry's atm m³/mol: 0.0294
BCF: 3.9
controlled ozone depleting gases: phase out by 1996 (C)
Bioaccumulation: not sig
processes Abiotic: RxnOH*,hydrol
CHLOROTETRAFLUOROETHANE:
CHLORODIFLUOROETHANE:
log Kow: 1.6
Koc: 35
Half-life (hr) air: 43800-175200
Half-life (hr) H2O surface water: 2.93
Henry's atm m³/mol: 0.239
BCF: 42
controlled ozone depleting gases: phase out by 2030 (C)
Toxicity Fish: LC50 34-53mg/L
Anaerobic effects: sig degrad
Degradation Biological: sig
processes Abiotic: slw hydrl,photl&ox notsig,RxnOH*

Section 13 - DISPOSAL CONSIDERATIONS

- »
- Evaporate residue at an approved site.
 - Return empty containers to supplier. If containers are marked non-returnable establish means of disposal with manufacturer prior to purchase.
 - Ensure damaged or non-returnable cylinders are gas-free before disposal.

Section 14 - TRANSPORTATION INFORMATION

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

UNDG:

Dangerous Goods Class:	2.2	Subrisk:	None
UN Number:	3163	Packing Group:	None

Shipping Name: LIQUEFIED GAS, N.O.S.

Air Transport IATA:

ICAO/IATA Class:	2.2	ICAO/IATA Subrisk:	None
UN/ID Number:	3163	Packing Group:	None

Special provisions: None

Shipping Name: LIQUEFIED GAS, N.O.S. *

Maritime Transport IMDG:

IMDG Class:	2.2	IMDG Subrisk:	None
UN Number:	3163	Packing Group:	None
EMS Number:	F-C,S-V	Special provisions:	274
Limited Quantities:	120 ml	Marine Pollutant:	Not Determined

Shipping Name: LIQUEFIED GAS, N.O.S.

Section 15 - REGULATORY INFORMATION**POISONS SCHEDULE**

None

REGULATIONS

A- Gas R409A (CAS: None):

No regulations applicable

chlorodifluoromethane (CAS: 75-45-6) is found on the following regulatory lists;

Australia - Australian Capital Territory - Environment Protection Regulation: Ambient environmental standards (Domestic water supply - disinfection by-products)

Australia - Australian Capital Territory - Environment Protection Regulation: Pollutants entering waterways taken to cause environmental harm (Aquatic habitat)

Australia - Australian Capital Territory Environment Protection Regulation Ecosystem maintenance - Organic chemicals - Non-pesticide anthropogenic organics

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Australia - Australian Capital Territory Environment Protection Regulation Pollutants entering waterways - Domestic water quality
 Australia - New South Wales Ozone Protection Regulation - Schedule 1 Controlled substances [NLV]
 Australia Exposure Standards
 Australia Hazardous Substances
 Australia High Volume Industrial Chemical List (HVICL)
 Australia Inventory of Chemical Substances (AICS)
 Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 2
 Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 5
 International Agency for Research on Cancer (IARC) Carcinogens
 International Council of Chemical Associations (ICCA) - High Production Volume List
 OECD Representative List of High Production Volume (HPV) Chemicals
 UNEP Montreal Protocol Ozone Depletors - Annex C
 WHO Guidelines for Drinking- water Quality - Guideline values for chemicals that are of health significance in drinking-water
 chlorotetrafluoroethane (CAS: 2837- 89- 0) is found on the following regulatory lists;
 Australia - New South Wales Ozone Protection Regulation - Schedule 1 Controlled substances [NLV]
 Australia Inventory of Chemical Substances (AICS)
 International Council of Chemical Associations (ICCA) - High Production Volume List
 OECD Representative List of High Production Volume (HPV) Chemicals
 UNEP Montreal Protocol Ozone Depletors - Annex C
 chlorotetrafluoroethane (CAS: 63938- 10- 3) is found on the following regulatory lists;
 Australia - New South Wales Ozone Protection Regulation - Schedule 1 Controlled substances [NLV]
 UNEP Montreal Protocol Ozone Depletors - Annex C
 chlorodifluoroethane (CAS: 75- 68- 3) is found on the following regulatory lists;
 Australia - New South Wales Ozone Protection Regulation - Schedule 1 Controlled substances [NLV]
 Australia Exposure Standards
 Australia Inventory of Chemical Substances (AICS)
 Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 2
 Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 5
 International Air Transport Association (IATA) Dangerous Goods Regulations
 International Council of Chemical Associations (ICCA) - High Production Volume List
 OECD Representative List of High Production Volume (HPV) Chemicals
 UNEP Montreal Protocol Ozone Depletors - Annex C

Section 16 - OTHER INFORMATION**Ingredients with multiple CAS Nos**

Ingredient Name	CAS
chlorotetrafluoroethane	2837-89-0, 63938-10-3

EXPOSURE STANDARD FOR MIXTURES

chlorotetrafluoroethane 0.0000 25.0

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

A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

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

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