



## A-GAS R408A

Chemwatch Material Safety Data Sheet  
Issue Date: 11-Jun-2008  
NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09  
Version No:4  
CD 2010/3 Page 1 of 18

### Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

#### PRODUCT NAME

A-GAS R408A

#### PROPER SHIPPING NAME

REFRIGERANT GAS, N.O.S.(contains chlorodifluoromethane, 1,1,1-trifluoroethane)

#### PRODUCT USE

Refrigerant. Used according to manufacturer's directions.

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

#### SUPPLIER

Company: A- Gas (Australia) Pty Ltd

Address:

9- 11 Oxford Road

Laverton North

VIC 3026

Australia

Telephone: [+61] (0) 3 93689222

Emergency Tel:TOLL: [+61] 1800 024 973

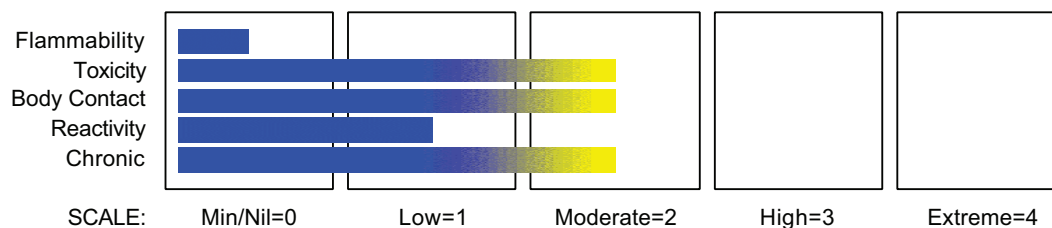
Fax: [+61] (0) 3 93689233

### Section 2 - HAZARDS IDENTIFICATION

#### STATEMENT OF HAZARDOUS NATURE

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

#### CHEMWATCH HAZARD RATINGS



continued...

# A-GAS R408A

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 2 of 18

Section 2 - HAZARDS IDENTIFICATION



## RISK

- Forms very sensitive explosive metallic compounds.
- Risk of explosion if heated under confinement.
- Dangerous for the ozone layer.
- Inhalation may produce health damage\*.
- Cumulative effects may result following exposure\*.
- May produce discomfort of the eyes, respiratory tract and skin\*.
- Limited evidence of a carcinogenic effect\*.
- Repeated exposure potentially causes skin dryness and cracking\*.
- Vapours potentially cause drowsiness and dizziness\*.

\* (limited evidence).

## SAFETY

- Do not breathe gas/ fumes/ vapour/ spray.
- Avoid contact with skin.
- Wear eye/ face protection.
- Use only in well ventilated areas.
- Keep container in a well ventilated place.
- To clean the floor and all objects contaminated by this material, use water and detergent.
- Keep container tightly closed.
- This material and its container must be disposed of in a safe way.
- In case of contact with eyes, rinse with plenty of water and contact Doctor or Poisons Information Centre.
- Use appropriate container to avoid environment contamination.
- Avoid release to the environment. Refer to special instructions/ safety data sheets.
- 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	47
1, 1, 1- trifluoroethane	420-46-2	46
pentafluoroethane	354-33-6	7

## Section 4 - FIRST AID MEASURES

### SWALLOWED

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

### EYE

- If product comes in contact with eyes remove the patient from gas source or contaminated area.

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

## Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 3 of 18

Section 4 - FIRST AID MEASURES

- 
- 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

#### ■ 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 luke-warm 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 pain killers such as paracetamol
  - Transport to hospital, or doctor
  - Subsequent blackening of the exposed tissue indicates potential of necrosis, which may require amputation.
- 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

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

## Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 4 of 18

Section 4 - FIRST AID MEASURES

• 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.

• 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...

# A-GAS R408A

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 5 of 18

## 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.

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#### SPECIAL REQUIREMENTS:

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- 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.

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#### FIRE FIGHTING REQUIREMENTS:

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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 (CO<sub>2</sub>), 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

2TE

### Personal Protective Equipment

Breathing apparatus.

Gas tight chemical resistant suit.

continued...

# A-GAS R408A

Chemwatch Material Safety Data Sheet  
Issue Date: 11-Jun-2008  
NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09  
Version No:4  
CD 2010/3 Page 6 of 18

Section 5 - FIRE FIGHTING MEASURES

Limit exposure duration to 1 BA set 30 mins.

## Section 6 - ACCIDENTAL RELEASE MEASURES

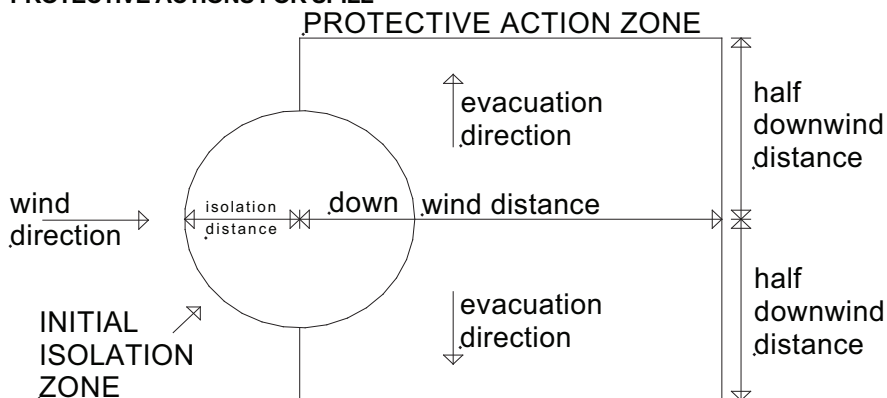
### MINOR SPILLS

- 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.
- Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.
- Do not exert excessive pressure on the valve; do not attempt to operate a damaged 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.
- 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.
- 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

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 7 of 18

Section 6 - ACCIDENTAL RELEASE MEASURES

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.

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

## Section 7 - HANDLING AND STORAGE

### PROCEDURE FOR HANDLING

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

### SUITABLE CONTAINER

- 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.
- 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; 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 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

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

## Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 8 of 18

Section 7 - HANDLING AND STORAGE

impact; severity generally increases with the degree of halocarbon substitution and potassium-sodium alloys give extremely sensitive mixtures .

BREITHERICK L.: Handbook of Reactive Chemical Hazards

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

### STORAGE REQUIREMENTS

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

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

Store below 49 deg.C.

### SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



+: May be stored together

O: May be stored together with specific preventions

X: Must not be stored together

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>
Australia Exposure Standards	chlorodifluoromethane (Chlorodifluoromethane)	1000	3540

The following materials had no OELs on our records

- 1, 1, 1- trifluoroethane: CAS:420- 46- 2 CAS:27987- 06- 0
- pentafluoroethane: CAS:354- 33- 6

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# A-GAS R408A

Hazard Alert Code: MODERATE

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 9 of 18

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

## EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m <sup>3</sup> )	Revised IDLH Value (ppm)
1,1,1-trifluoroethane		2,000

## MATERIAL DATA

1,1,1-TRIFLUOROETHANE:

A-GAS R408A:

CHLORODIFLUOROMETHANE:

■ 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.

1,1,1-TRIFLUOROETHANE:

A-GAS R408A:

■ 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.

CHLORODIFLUOROMETHANE:

■ for chlorodifluoromethane:

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

1,1,1-TRIFLUOROETHANE:

CEL-TWA: 200 mg/m<sup>3</sup>; STEL: 500 mg/m<sup>3</sup>

PENTAFLUOROETHANE:

CEL TWA: 1000 ppm, 4240 mg/m<sup>3</sup> [DuPont]

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 10 of 18

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

## PERSONAL PROTECTION



### EYE

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

### OTHER

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

### RESPIRATOR

■ Respiratory protection may be required when ANY "Worst Case" vapour-phase concentration is exceeded (see Computer Prediction in "Exposure Standards").

Protection Factor	Half- Face Respirator	Full- Face Respirator
5 x ES	Air- line*	AX- - 2
	-	AX- - PAPR- 2
10 x ES	-	AX- - 3
10+ x ES	-	Air- line**

\* - Continuous Flow;

\*\* - Continuous-flow or positive pressure demand

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

Chemwatch Material Safety Data Sheet  
Issue Date: 11-Jun-2008  
NC317TCP

CHEMWATCH 7633-09  
Version No:4  
CD 2010/3 Page 11 of 18

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

^ - Full-face.

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

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

Within each range the appropriate value depends on:

#### Lower end of the range

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

#### Upper end of the range

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

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

continued...

# A-GAS R408A

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 12 of 18

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

### APPEARANCE

Clear colourless liquefied gas with a faint ethereal odour; partly mixes with water.

### PHYSICAL PROPERTIES

Gas.

State	Liquefied Gas	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Available
Boiling Range (°C)	- 43.5	Solubility in water (g/L)	Partly Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	Not Applicable
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	1041.109 @ 21 deg.C
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	1.04 @ 25 deg.C
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	3.25
Volatile Component (%vol)	100	Evaporation Rate	Not Available

## Section 10 - CHEMICAL STABILITY

### CONDITIONS CONTRIBUTING TO INSTABILITY

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

*For incompatible materials - refer to Section 7 - Handling and Storage.*

## 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

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

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 13 of 18

Section 11 - TOXICOLOGICAL INFORMATION

## SKIN

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

## INHALED

■ Material is highly volatile and may quickly form a concentrated atmosphere in confined or unventilated areas. Vapour is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure. 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 ability to maintain attention and think clearly is diminished and muscular coordination is somewhat disturbed. As oxygen decreases from 14-10% judgement becomes faulty; severe injuries may cause no pain. Muscular exertion leads to rapid fatigue. Further reduction to 6% may produce nausea and vomiting and the ability to move may be lost. Permanent brain damage may result even after resuscitation at exposures to this lower oxygen level. Below 6% breathing is in gasps and convulsions may occur. Inhalation of a mixture containing no oxygen may result in unconsciousness from the first breath and death will follow in a few minutes. 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. 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

■ 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.

■ Not available. Refer to individual constituents.

### CHLORODIFLUOROMETHANE:

#### TOXICITY

Inhalation (rat) LC50: 35 pph/15m

■ 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.

#### IRRITATION

Nil Reported

### 1,1,1-TRIFLUOROETHANE:

#### TOXICITY

Inhalation (rat) LC50: >540000 ppm/4h \*

■ NOTE: Substance has been shown to be mutagenic in at least one assay, or belongs to a family of chemicals producing damage or change to cellular DNA.

#### IRRITATION

Nil Reported \*[DuPont]

### PENTAFLUOROETHANE:

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 14 of 18

Section 11 - TOXICOLOGICAL INFORMATION

## TOXICITY

Inhalation (rat) LC50: >709000 ppm/4h \*

## IRRITATION

Nil Reported \* [DuPont]

## CARCINOGEN

Chlorodifluoromethane	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
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## Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

### PENTAFLUOROETHANE:

#### 1,1,1-TRIFLUOROETHANE:

■ In addition to carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), the greenhouse gases mentioned in the Kyoto Protocol include synthetic substances that share the common feature of being highly persistent in the atmosphere and exhibiting very high specific radiative forcing (radiative forcing is the change in the balance between radiation coming into the atmosphere and radiation out; a positive radiative forcing tends on average to warm the surface of the earth). These synthetic substances include hydrocarbons that are partially fluorinated (HCFs) or totally fluorinated (PFCs) as well as sulfur hexafluoride (SF<sub>6</sub>).

The greenhouse potential of these substances, expressed as multiples of that of CO<sub>2</sub>, are within the range of 140 to 11,700 for HFCs, from 6500 to 9,200 for PFCs and 23,900 for SF<sub>6</sub>. Once emitted into the atmosphere, these substances have an impact on the environment for decades, centuries, or in certain instances, for thousands of years.

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

Since the adoption of the Kyoto Protocol, new fluorinated substances have appeared on the market, which are stable in air and have a high greenhouse potential; these include nitrogen trifluoride (NF<sub>3</sub>) and fluoroethers.

### CHLORODIFLUOROMETHANE:

#### 1,1,1-TRIFLUOROETHANE:

#### A-GAS R408A:

■ DO NOT discharge into sewer or waterways.

#### A-GAS R408A:

#### Aquatic Toxicity:

HFC-143A (1,1,1-trifluoroethane)

\*96hr. LC50, rainbow trout: >40 mg/L.

HFCF-22 (chlorodifluoromethane)

\* 48 hour EC50 - Daphnia magna: 433 mg/L

### CHLORODIFLUOROMETHANE:

■ On the basis of the available evidence concerning properties and predicted or observed environmental fate and behavior, the material may present a danger to the structure and/ or functioning of the stratospheric ozone layer.

■ For haloalkanes and haloalkenes:

continued...

# A-GAS R408A

Hazard Alert Code: MODERATE

## Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 15 of 18

## Section 12 - ECOLOGICAL INFORMATION

### Environmental fate:

Certain haloalkane gases in the atmosphere can also contribute to the greenhouse effect by restricting heat loss from the Earth's atmosphere through absorbing infrared emissions from the surface. Generally haloalkanes contributing to the greenhouse effect consist of a fully or partly fluorinated carbon backbone.

Gas-phase reactions with OH radicals are the major tropospheric loss process for the haloalkanes. In addition photooxidation reactions with O<sub>3</sub> and NO<sub>3</sub> radicals can result in transformation.

Organic substances containing chlorine, if primarily present in the atmospheric compartment and if their lifetime is long enough can reach the stratosphere and decompose through photolysis and other chemical reaction (e.g. with OH radical). Chlorine atoms can then participate in the catalytic ozone destruction cycles. The atmospheric lifetime is too short to enable a significant fraction of the compound emitted to reach the stratosphere

Haloalkanes do not hydrolyse easily. Acids do not catalyse the hydrolysis and base catalysis is only important at higher pHs than are observed in the environment.

The apparent hazard of halo- alkanes and alkenes to human health has prompted investigations concerning their fate in subsurface waters and in soil. Although abiotic transformations may be significant within the time scales commonly associated with groundwater movement, biotic process typically proceed much faster, provided that there are sufficient substrates, nutrients and microbial populations to mediate such transformations.

Several bacterial strains including methane-utilising bacteria capable of utilising haloalkanes have been isolated. Microbial dehalogenation by these strains is mediated by enzymes (oxygenase and hydrolase). The biodegradation of haloalkanes can proceed through different pathways. Haloparaffins (C<sub>12</sub> to C<sub>18</sub>) have been reported to be incorporated into fatty acids in bacteria, yeasts, and fungi, resulting in their accumulation in the food chain. Another pathway is the oxygenation at the nonhalogenated end of monohalogenated alkanes by an inherent oxygenase with a tight substrate selectivity. In this case fluoroalkanes were defluorinated, but no dehalogenation was observed with chloro-, bromo-, or iodoalkanes. Chain length was reported to have minor effects on this oxygenation reaction. In general, alpha- and alpha,omega-chlorinated haloalkanes with short carbon chains (C<sub>1</sub> to C<sub>6</sub>) are dehalogenated hydrolytically or by a glutathione-dependent mechanism. In contrast, alpha- and alpha,omega-haloalkanes with longer chains, e.g., 1,9-dichlorononane and 1,10-dichlorodecane (1,10-DCD), have been proposed to be dehalogenated by oxidative mechanisms. Studies on the biodegradation of this class of compounds are rare, because haloalkane-degrading microorganisms are not easily found

In water and terrestrial compartments haloalkanes may hydrolyse in the presence of naturally occurring sulfur-containing nucleophiles. Bisulfide ion (HS<sup>-</sup>) is generally the most important nucleophile because it is moderately reactive and is usually present at the highest concentration. When elemental sulfur is present, polysulfides (S<sub>4</sub><sup>2-</sup> and S<sub>5</sub><sup>2-</sup>) will be more important than HS<sup>-</sup> at pH 7 (approximately) because they are 60 times more reactive and their equilibrium concentrations increase with increasing pH. The end products of such reactions include a variety of mercaptans and dialkyl sulfides.

Koc: 57.5

Half-life (hr) air: 97236-151548

Half-life (hr) H<sub>2</sub>O surface water: 2.7

Henry's atm m<sup>3</sup> /mol: 0.0294

BCF: 3.9

controlled ozone depleting gases: phase out by 1996 (C)

Bioaccumulation: not sig

processes Abiotic: RxnOH\*,hydrol

### Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
chlorodifluoromethane	HIGH		LOW	HIGH
1, 1, 1- trifluoroethane	HIGH		LOW	HIGH
pentafluoroethane	HIGH		LOW	MED

continued...

# A-GAS R408A

Chemwatch Material Safety Data Sheet  
Issue Date: 11-Jun-2008  
NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09  
Version No:4  
CD 2010/3 Page 16 of 18

## 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:

2TE (ADG7)

### Land Transport UNDG:

Class or division:	2.2	Subsidiary risk:	None
UN No.:	1078	UN packing group:	None
Shipping Name: REFRIGERANT GAS, N.O.S. (contains chlorodifluoromethane, 1,1,1-trifluoroethane)			

### Air Transport IATA:

ICAO/IATA Class:	2.2	ICAO/IATA Subrisk:	None
UN/ID Number:	1078	Packing Group:	-
Special provisions:	None		
Cargo Only			
Packing Instructions:	200	Maximum Qty/Pack:	150 kg
Passenger and Cargo			
Packing Instructions:	200	Maximum Qty/Pack:	75 kg
Passenger and Cargo Limited Quantity			
Packing Instructions:	-	Maximum Qty/Pack:	-

Shipping Name: REFRIGERANT GAS, N.O.S. \*(CONTAINS CHLORODIFLUOROMETHANE, 1,1,1-TRIFLUOROETHANE)

### Maritime Transport IMDG:

IMDG Class:	2.2	IMDG Subrisk:	None
UN Number:	1078	Packing Group:	None
EMS Number:	F-C, S-V	Special provisions:	274
Limited Quantities:	120 ml		
Shipping Name: REFRIGERANT GAS, N.O.S. (contains chlorodifluoromethane, 1,1,1-trifluoroethane)			

continued...



# A-GAS R408A

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 17 of 18

## Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

### REGULATIONS

Regulations for ingredients

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

"Australia Exposure Standards", "Australia Hazardous Substances", "Australia High Volume Industrial Chemical List (HVICL)", "Australia Inventory of Chemical Substances (AICS)", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals"

**1,1,1-trifluoroethane (CAS: 420-46-2,27987-06-0) is found on the following regulatory lists;**

"Australia Inventory of Chemical Substances (AICS)", "OECD Representative List of High Production Volume (HPV) Chemicals"

**pentafluoroethane (CAS: 354-33-6) is found on the following regulatory lists;**

"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"

**No data for A-Gas R408A (CW: 7633-09)**

## Section 16 - OTHER INFORMATION

### INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
1,1,1-trifluoroethane	420-46-2, 27987-06-0

### EXPOSURE STANDARD FOR MIXTURES

- "Worst Case" computer-aided prediction of vapour components/concentrations:
- Composite Exposure Standard for Mixture (TWA) (mg/m<sup>3</sup>): 4240 mg/m<sup>3</sup>
- If the breathing zone concentration of ANY of the components listed below is exceeded, "Worst Case" considerations deem the individual to be overexposed.

Component	Breathing Zone ppm	Breathing Zone mg/m <sup>3</sup>	Mixture Conc: (%)
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Component	Breathing zone (ppm)	Breathing zone (mg/m <sup>3</sup> )	Mixture Conc (%)
pentafluoroethane	1000.00	4240.0000	7.0
pentafluoroethane	0.00	0.0000	0.0

- 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](http://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

continued...

# A-GAS R408A

Chemwatch Material Safety Data Sheet

Issue Date: 11-Jun-2008

NC317TCP

Hazard Alert Code: MODERATE

CHEMWATCH 7633-09

Version No:4

CD 2010/3 Page 18 of 18

Section 16 - OTHER INFORMATION

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controls must be considered.

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*This is the end of the MSDS.*