2,3,3,3-Tetrafluoroprop-1-ene, HFO-1234yf

Version 1 Revision Date 11/10/2008 Print Date 11/10/2008

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	2,3,3,3-Tetrafluoroprop-1-ene, HFO-1234yf
MSDS Number	:	000000011078
Product Use Description	:	For R&D use only. Not for pharmaceutical, household or other uses.
Company	:	Honeywell International, Inc. 101 Columbia Road Morristown, NJ 07962-1057
For more information call	:	800-522-8001 (Monday-Friday, 9:00am-5:00pm)
In case of emergency call	:	**Medical: 1-800-498-5701**
	:	**Transportation: 1-800-424-9300 or +1-703-527-3887**
	:	(24 hours/day, 7 days/week)

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Form	:	gaseous
Color	:	clear
Odor	:	slight
Hazard Summary	:	Warning! Container under pressure. Flammable gas. Gas reduces oxygen available for breathing. Causes asphyxiation in high concentrations. The victim will not realize that he/she is suffocating. Inhalation may cause central nervous system effects. May cause drowsiness and dizziness. May cause skin irritation. May cause eye irritation. May cause respiratory tract irritation. Do not breathe vapour. Avoid contact with skin, eyes and clothing. At higher temperatures, (>250 C), decomposition products may include hydrofluoric acid (HF) and carbonyl halides. The ACGIH Threshold Limit Values (2007) for Hydrogen Fluoride are TLV-TWA 0.5 ppm and Ceiling Exposure Limit 2 ppm.

Potential Health Effects

Skin	:	Avoid skin contact with leaking liquid (danger of frostbite). May cause frostbite. May cause skin irritation.
Eyes	:	May cause frostbite.

May irritate eyes.

Ingestion : Unlikely route of exposure.
Effects due to ingestion may include:
Gastrointestinal discomfort

Inhalation : May be harmful if inhaled.
May cause respiratory tract irritation.
Gas reduces oxygen available for breathing.
Causes asphyxiation in high concentrations. The victim will not realize that he/she is suffocating.
Inhalation may cause central nervous system effects.
Vapours may cause drowsiness and dizziness.

Chronic Exposure : None known.

Carcinogenicity

No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP, IARC, or OSHA.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Weight %
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	100.00

SECTION 4. FIRST AID MEASURES

General advice : First aider needs to protect himself. Take off all contaminated clothing immediately.

Inhalation : Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Use oxygen as required, provided a qualified operator is present. Call a physician.

Skin contact : After contact with skin, wash immediately with plenty of water. Rapid evaporation of the liquid may cause frostbite. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Call a physician. Wash contaminated clothing before re-use.

Eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In case of frostbite water should be lukewarm, not hot. Call a physician.

Ingestion : Unlikely route of exposure. As this product is a gas, refer to the

inhalation section. Do not induce vomiting without medical advice. If conscious, drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Notes to physician

Treatment	:	Treat frost-bitten areas as needed. Treat symptomatically.

SECTION 5. FIRE-FIGHTING MEASURES

Flash point	:	not applicable
Ignition temperature	:	405 °C (761 °F)
Lower explosion limit	:	6.2 %(V)
Upper explosion limit	:	12.3 %(V)
Suitable extinguishing media	:	In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Specific hazards during fire fighting	:	Flammable gas. Contents under pressure. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Vapors may travel to areas away from work site before igniting/flashing back to vapor source. Fire or intense heat may cause violent rupture of packages. Cool closed containers exposed to fire with water spray. Do not allow run-off from fire fighting to enter drains or water courses. In case of fire hazardous decomposition products may be produced such as: Hydrogen fluoride Carbonyl halides Carbon monoxide Carbon dioxide (CO2)
Special protective equipment for fire-fighters	:	In the event of fire and/or explosion do not breathe fumes. Wear self-contained breathing apparatus and protective suit. No unprotected exposed skin areas.
Additional advice	:	In case of fire: Evacuate area. Fight fire remotely due to the risk

of explosion.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Immediately evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Wear personal protective equipment. Unprotected persons must be kept away. Wear self-contained breathing apparatus and protective suit. Eliminate all ignition sources if safe to do so. Avoid skin contact with leaking liquid (danger of frostbite). Ventilate the area. Vapors may travel to areas away from work site before igniting/flashing back to vapor source. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Avoid accumulation of vapours in low areas. Unprotected personnel should not return until air has been tested and determined safe. Ensure that the oxygen content is >= 19.5%.
Environmental precautions	:	Prevent further leakage or spillage if safe to do so. The product evaporates readily. Discharge into the environment must be avoided.
Methods for cleaning up	:	Use explosion-proof equipment. No sparking tools should be used. Ventilate the area. Allow to evaporate.
Additional advice	:	Inform the responsible authorities in case of gas leakage, or of entry into waterways, soil or drains. Pay attention to the spreading of gases especially at ground level (heavier than air) and to the direction of the wind.

SECTION 7. HANDLING AND STORAGE

Handling

Handling	:	Handle with care. Wear personal protective equipment. Do not breathe vapour. Avoid contact with skin, eyes and clothing. Use only in well-ventilated areas. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Follow all standard safety precautions for handling and use of compressed gas cylinders. Use authorized cylinders only.

Protect cylinders from physical damage.
Do not puncture or drop cylinders, expose them to open flame or excessive heat.
Do not remove screw cap until immediately ready for use.
Always replace cap after use.

Advice on protection against fire and explosion	:	Container hazardous when empty. Prevent the creation of flammable or explosive concentrations of vapour in air and avoid vapour concentration higher than the occupational exposure limits. Keep product and empty container away from heat and sources of ignition. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Take measures to prevent the build up of electrostatic charge. Electrical equipment should be protected to the appropriate standard. Use explosion-proof equipment. No sparking tools should be used. No smoking.

Storage

Requirements for storage areas and containers	:	Pressurized container: Protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Storage rooms must be properly ventilated. Ensure adequate ventilation, especially in confined areas. Protect cylinders from physical damage. Store away from incompatible substances. Store in original container.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective measures	:	Ensure that eyewash stations and safety showers are close to the workstation location. Do not breathe vapour. Avoid contact with skin, eyes and clothing.
Engineering measures	:	Use with local exhaust ventilation.
Eye protection	:	Safety goggles
Hand protection	:	Protective gloves Gloves must be inspected prior to use.

Replace when worn.

Skin and body protection	:	Avoid skin contact with leaking liquid (danger of frostbite). Wear suitable protective equipment.
Respiratory protection	:	No personal respiratory protective equipment normally required. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Use NIOSH approved respiratory protection.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety practice. Ensure adequate ventilation, especially in confined areas. When using, do not eat, drink or smoke. Remove and wash contaminated clothing before re-use. Keep working clothes separately. Do not breathe vapour. Avoid contact with skin, eyes and clothing.

Exposure Guidelines

2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	HONEYWELL	TWA	400 ppm

We are not aware of any national exposure limit.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Form	:	gaseous
Color	:	clear
Odor	:	slight
Molecular Weight	:	114 g/mol
pH	:	no data available
Boiling point/boiling range	:	-30 °C (-22 °F)
Vapor pressure	:	6,067 hPa at 21.1 °C (70.0 °F)
Vapor pressure	:	14,203 hPa at 54.4 °C (129.9 °F)
Relative vapour density	:	4 (Air = 1.0)
Density	:	1.1 g/cm3

		at 25 °C (77 °F)
Water solubility	:	198.2 mg/l at 24 °C (75 °F) 92/69/EEC, A.6
Partition coefficient: n-octanol/water	:	log Pow: 2.15 92/69/EEC, A.8

SECTION 10. STABILITY AND REACTIVITY

Conditions to avoid	:	Keep away from heat and sources of ignition. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Decomposes under high temperature. Some risk may be expected of corrosive and toxic decomposition products.
Materials to avoid	:	Strong oxidizing agents Aluminium Magnesium Zinc
Hazardous decomposition products	:	Risk of formation of toxic pyrolysis products containing fluorine. In case of fire hazardous decomposition products may be produced such as: Hydrogen fluoride Carbonyl halides Carbon monoxide Carbon dioxide (CO2)
Hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity	:	LC50 rat Dose: > 400000 ppm Exposure time: 4 h
Repeated dose toxicity	:	Inhalation rat 2 week inhalation study, NOEL - 50,000 ppm
Repeated dose toxicity	:	Inhalation rat 4 week inhalation study, NOAEL (No observed adverse effect level) - 50,000 ppm

Repeated dose toxicity	:	Inhalation rat 13 week inhalation study, NOAEL (No observed adverse effect level) - 50,000 ppm
Genotoxicity in vitro	:	Ames test 20% and higher, positive in TA 100 and e. coli WP2 uvrA, negative in TA98, TA100, and TA1535.
Genotoxicity in vitro	:	Chromosome aberration test in vitro Human lymphocytes negative Dose 760,000 ppm
Genotoxicity in vivo	:	Species: mouse Cell type: Micronucleus Dose: up to 200,000 ppm (4 hour) negative
Genotoxicity in vivo	:	Unscheduled DNA synthesis Dose: up to 50,000 ppm (4 week) negative
Genotoxicity in vivo	:	Species: rat Cell type: Micronucleus Dose: up to 50,000 ppm (4 week) negative
Teratogenicity	:	rat Dose: NOAEL (No observed adverse effect level) - 50,000 ppm
Teratogenicity	:	rabbit Dose: NOAEL (No observed adverse effect level) - 4,000 ppm
Additional advice	:	Cardiac Sensitization (dog): No effects for exposures up to 12% (120,189 ppm)

SECTION 12. ECOLOGICAL INFORMATION

Biodegradability	:	Not readily biodegradable.
Toxicity to fish	:	LC50 Species: Cyprinus carpio (Carp) Dose: > 197 mg/l Exposure time: 96 h OECD Test Guideline 203 No demonstrable toxic effect in saturated solution.
Toxicity to daphnia and	:	EC50

other aquatic invertebrates.		Species: Daphnia magna (Water flea) Dose: > 83 mg/l Exposure time: 48 h OECD Test Guideline 202
Toxicity to algae	:	EC50 Species: Scenedesmus capricornutum (fresh water algae) Dose: > 100 mg/l

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Information: Observe all Federal, State, and Local Environmental regulations.

SECTION 14. TRANSPORT INFORMATION

DOT	UN-Number	:	3161
	Proper shipping name	:	Liquefied gas, flammable, n.o.s. (2,3,3,3-Tetrafluoroprop-1-ene)
	Class		2.1
	Packing group		
	Hazard Label		2.1
IATA	UN Number	:	3161
	Description of the goods	:	Liquefied gas, flammable, n.o.s. (2,3,3,3-Tetrafluoroprop-1-ene)
	Class	:	2.1
	Hazard Label	:	2.1
	Packing instruction (cargo aircraft)	:	200
IMDG	Substance No.	:	UN 3161
	Description of the goods	:	Liquefied gas, flammable, n.o.s. (2,3,3,3-TETRAFLUOROPROP-1-ENE)
	Class	:	2.1
	Hazard Label	:	2.1
	EmS Number	:	F-D
	Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

Inventories

US. Toxic Substances Control Act	:	This material must be used in compliance with the TSCA Research and Development Exemption requirements (40 CFR

720.36).
: 2,3,3,3-Tetrafluoroprop-1-ene 754-12-1

National regulatory information

SARA 311/312 Hazards : Fire Hazard
Acute Health Hazard
Sudden Release of Pressure Hazard

California Prop. 65 : This product does not contain any chemicals known to State of California to cause cancer, birth, or any other reproductive defects.

New Jersey RTK : 2,3,3,3-Tetrafluoroprop-1-ene 754-12-1

Pennsylvania RTK : 2,3,3,3-Tetrafluoroprop-1-ene 754-12-1

WHMIS Classification : B1
A

SECTION 16. OTHER INFORMATION

		HMIS III	NFPA
Health Hazard	:	1	2
Flammability	:	4	4
Physical Hazard	:	0	
Instability	:		0