

# Trifluoroacetic acid

sc-216010

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key: **EXTREME** **HIGH** **MODERATE** **LOW**

## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

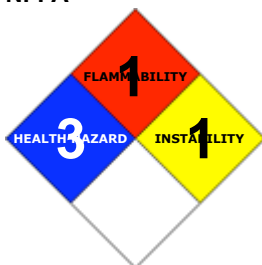
### PRODUCT NAME

Trifluoroacetic acid

### STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

### NFPA



### SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

2145 Delaware Ave

Santa Cruz, CA 95060

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: CHEMWATCH: From within the US and Canada:

877-715-9305

Emergency Tel: From outside the US and Canada: +800 2436 2255

(1-800-CHEMCALL) or call +613 9573 3112

### PRODUCT USE

Strong non-oxidising acid, laboratory reagent, solvent, catalyst. Intermediate

### SYNONYMS

C2-H-F3-O2, CF3COOH, "perfluoroacetic acid", "trifluoroethanoic acid", "acetic acid, trifluoro-", "Hewlett-Packard Protein Sequencing Reagent R3"

## Section 2 - HAZARDS IDENTIFICATION

### CANADIAN WHMIS SYMBOLS



### EMERGENCY OVERVIEW

#### RISK

Harmful by inhalation.

Toxic if swallowed.

Causes severe burns.

Risk of serious damage to eyes.

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

## POTENTIAL HEALTH EFFECTS

### ACUTE HEALTH EFFECTS

#### SWALLOWED

- The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion.
- Toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual.
- Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and esophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. Swelling of the epiglottis may make it difficult to breathe which may result in suffocation. More severe exposure may result in vomiting blood and thick mucus, shock, abnormally low blood pressure, fluctuating pulse, shallow respiration and clammy skin, inflammation of stomach wall, and rupture of esophageal tissue. Untreated shock may eventually result in kidney failure. Severe cases may result in perforation of the stomach and abdominal cavity with consequent infection, rigidity and fever. There may be severe narrowing of the esophageal or pyloric sphincters; this may occur immediately or after a delay of weeks to years. There may be coma and convulsions, followed by death due to infection of the abdominal cavity, kidneys or lungs.

#### EYE

- The material can produce severe chemical burns to the eye following direct contact. Vapors or mists may be extremely irritating.
- If applied to the eyes, this material causes severe eye damage.
- Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns. Mild burns of the epithelia generally recover rapidly and completely. Severe burns produce long-lasting and possibly irreversible damage. The appearance of the burn may not be apparent for several weeks after the initial contact. The cornea may ultimately become deeply opaque resulting in blindness.

#### SKIN

- The material can produce severe chemical burns following direct contact with the skin.
- Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
- Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

#### INHALED

- Inhalation of vapors or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.
- The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.
- Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset.
- Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.

### CHRONIC HEALTH EFFECTS

- Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs. Chronic exposure may inflame the skin or conjunctiva. Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

For perfluorinated carbons (PFCs):

PFCs are inert fluids composed of a complex combination of organic compounds resulting from the distillation of electrochemically fluorinated (ECF) compounds. This class consists of branched, linear and cyclic perfluorinated hydrocarbons having carbon numbers predominantly in the range of C5-C18 and boiling in the range of approximately 25 C-255 C (77 F-491 F). Perfluorinated amine and ether compounds may also be present

Acute oral and inhalation toxicity tests with perfluoroalkanes show no toxicity at any dose tested, and even extremely high-dose intraperitoneal injection resulted in no lethality. In contrast, perfluoroalkenes (such as octafluorocyclopentene, perfluoroisobutylene, hexafluoropropene) have shown evidence of inhalation toxicity, in some cases, extreme.

PFCs are among the least toxic of all known organic chemicals. PFCs don't oxidise or hydrolyse. They have no functional reactive groups. PFCs owe their low toxicity to the combination of the following properties:

- Chemical inertness
- Low solubility in biological media (blood, cell membranes, etc.)
- High volatility
- Resistance to biological activation (reductive and oxidative metabolism)

Because PFCs are chemically inert, if inhaled and absorbed they do not react chemically with any biological molecules; they simply partition between blood and various organs and tissues.

As PFCs have limited ability to dissolve in biological media, they do not reach appreciable concentrations in the tissues of air-exposed animals. As PFCs are highly volatile chemicals and have high air-blood partition coefficients, any fluorochemical remaining after exposure will be rapidly eliminated in the breath. Consequently, all such PFCs have:

- Very high rodent LC50s (very low acute toxicity)
- Very high cardiac sensitisation EC50s (very low toxicity)

In fact, most PFCs do not induce narcosis (sleep) or cardiac sensitisation at maximum achievable concentration (saturation). Inhalation exposure at levels up to 50,000 ppm for thirteen weeks produced no effects in rats, nor did oral exposure for thirty days at 2,000 mg/kg/day.

All PFCs that have undergone evaluation by the ACGIH or WEEL committees in the US have been granted an exposure guideline of 1000 ppm (8-hr TWA). NASA has evaluated the toxicity information associated with PFCs including those that can be used as heat transfer agents and fire extinguishing agents in spacecraft and has established a Space Maximum Allowable Concentration (SMAC) of 11,000 ppm for up to

180 days (24 hours/day)

PFCs are neutral molecules and because they are maximally fluorinated, they cannot undergo biological oxidation-reduction reactions to form reactive aldehydes, acid fluorides, radicals or acids that have been associated with several types of toxicity.

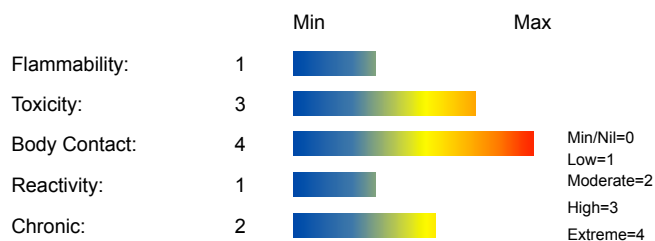
Genetic toxicity: As PFCs are not reactive directly with biological tissue and PFCs cannot form reactive metabolites, these fluorochemicals have tested negative in bacterial mutagenicity assays. Ames testing showed no genotoxicity.

Hydrofluoroethers and hydrofluoropolyethers are highly fluorinated ethers having properties intermediate between the perfluoroethers and hydrocarbon ethers. They are low in toxicity, nonflammable, with densities of 1.4-1.7 g/cm<sup>3</sup>, surface tensions of 13-16 dyn/cm and low kinematic viscosity. The hydrofluoropolyethers are used as heat-transfer fluids. The hydrofluoroethers are used as heat-transfer fluids as well as precision cleaning solvents and solvents for specialty applications such as coating deposition.

Perfluorinated compounds are potent peroxisome proliferators and were found to induce 8-hydroxydeoxyguanosine in the liver of treated rats. Long chain perfluorinated carboxylic acid (PFCAs) are present in the environment of most developed countries and have the potential to adversely affect animal and human health. In tests on laboratory animals, one PFOA (perfluorooctanoic acid, PFOA) has been shown to be tumorigenic and immunotoxic and to elicit moderate reproductive or developmental toxicity and moderate-to-high subchronic oral toxicity. It has been assumed that despite the absence of robust toxicity results for longer chain PFCAs, these substances are reasonably expected to be of greater concern than PFOA, as a result of their known slower clearance rates and higher bioaccumulation potential.

## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

### HAZARD RATINGS



NAME	CAS RN	%
trifluoroacetic acid	76-05-1	>99

## Section 4 - FIRST AID MEASURES

### SWALLOWED

- For advice, contact a Poisons Information Center or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Transport to hospital or doctor without delay.

### EYE

- If this product comes in contact with the eyes:
  - Immediately hold eyelids apart and flush the eye continuously with running water.
  - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
  - Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
  - Transport to hospital or doctor without delay.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

### SKIN

- If skin or hair contact occurs:
  - Immediately flush body and clothes with large amounts of water, using safety shower if available.
  - Quickly remove all contaminated clothing, including footwear.
  - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Center.
  - Transport to hospital, or doctor.

### INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

Inhalation of vapors or aerosols (mists, fumes) may cause lung edema. Corrosive substances may cause lung damage (e.g. lung edema, fluid in the lungs). As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested. Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered. This must definitely be left to a doctor or person authorized by him/her. (ICSC13719).

#### NOTES TO PHYSICIAN

• For acute or short term repeated exposures to strong acids:

- Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
- Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- DO NOT attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:

- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. DO NOT use neutralizing agents or any other additives. Several liters of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).

[Ellenhorn and Barceloux: Medical Toxicology].

## Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHg):	106.734 @ 25 degC
Upper Explosive Limit (%):	Not Available
Specific Gravity (water=1):	1.535
Lower Explosive Limit (%):	Not Available

#### EXTINGUISHING MEDIA

- 
- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

#### FIRE FIGHTING

- 
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

#### GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

- 
- Combustible.
- Slight fire hazard when exposed to heat or flame.
- Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
- Heating may cause expansion or decomposition leading to violent rupture of rigid containers.
- May emit acrid smoke and corrosive fumes.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), hydrogen fluoride, other pyrolysis products typical of burning organic material.

#### FIRE INCOMPATIBILITY

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

#### PERSONAL PROTECTION

Glasses:

Chemical goggles.  
 Full face- shield.  
 Gloves:  
 Respirator:  
 Type AE-P Filter of sufficient capacity

## Section 6 - ACCIDENTAL RELEASE MEASURES

### MINOR SPILLS

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- Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
- Check regularly for spills and leaks.
- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labeled container for waste disposal.

### MAJOR SPILLS

• Chemical Class:acidic compounds, organic

For release onto land: recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
<b>LAND SPILL - SMALL</b>				
wood fiber - pillow	1	throw	pitchfork	R, P, DGC, RT
cross-linked polymer - particulate	1	shovel	shovel	R,W,SS
cross-linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
sorbent clay - particulate	2	shovel	shovel	R, I, P
foamed glass - pillow	2	throw	pitchfork	R, P, DGC, RT
wood fiber - particulate	3	shovel	shovel	R, W, P, DGC
<b>LAND SPILL - MEDIUM</b>				
cross-linked polymer -particulate	1	blower	skiploader	R, W, SS
polypropylene - particulate	2	blower	skiploader	W, SS, DGC
sorbent clay - particulate	2	blower	skiploader	R, I, P
cross-linked polymer - pillow	3	throw	skiploader	R, DGC, RT
polypropylene - mat	3	throw	skiploader	W, SS, DGC
expanded mineral - particulate	3	blower	skiploader	R, I, W, P, DGC

#### Legend

DGC: Not effective where ground cover is dense

R; Not reusable

I: Not incinerable

P: Effectiveness reduced when rainy

RT:Not effective where terrain is rugged

SS: Not for use within environmentally sensitive sites

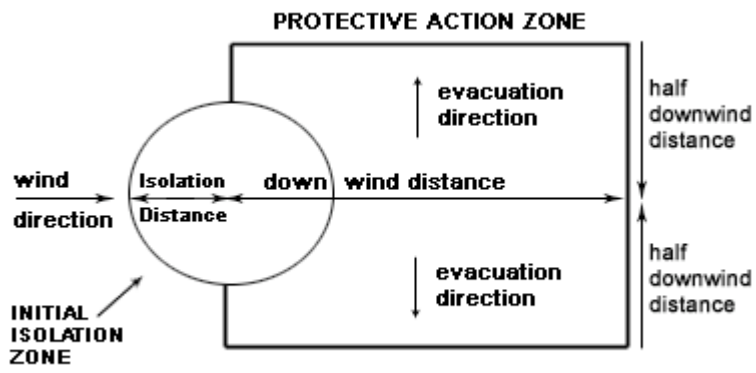
W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;

R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988.

- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

### PROTECTIVE ACTIONS FOR SPILL



From IERG (Canada/Australia)

Isolation Distance 25 meters

Downwind Protection Distance 250 meters

## 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 154 is taken from the US DOT emergency response guide book.

6 IERG information is derived from CANUTEC - Transport Canada.

## ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

## Section 7 - HANDLING AND STORAGE

### PROCEDURE FOR HANDLING

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- DO NOT allow clothing wet with material to stay in contact with skin
- WARNING: Contact with water generates heat.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

### RECOMMENDED STORAGE METHODS

• DO NOT use aluminum or galvanized containers.

Check regularly for spills and leaks.

Glass container.

- Lined metal can, Lined metal pail/drum
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.

For low viscosity materials

- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.

For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):

- Removable head packaging;
- Cans with friction closures and
- low pressure tubes and cartridges may be used.

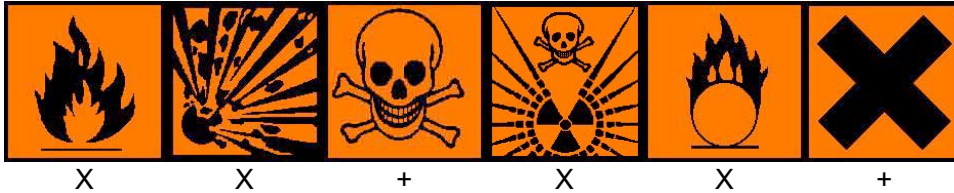
- Where combination packages are used, and the inner packages are of glass, porcelain or stoneware, there must be sufficient inert cushioning material in contact with inner and outer packages unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic.

## STORAGE REQUIREMENTS

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- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

## SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

The following materials had no OELs on our records

- trifluoroacetic acid: CAS:76-05-1

### MATERIAL DATA

TRIFLUOROACETIC ACID:

• 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.

Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard.

OEL STEL (Russia): 2 mg/m<sup>3</sup> Skin

### PERSONAL PROTECTION



Consult your EHS staff for recommendations

### EYE

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- Chemical goggles.
- Full face shield.
- Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

### HANDS/FEET

- Elbow length PVC gloves.



- When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

- Neoprene gloves

## OTHER

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

## RESPIRATOR

• Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	AE-1 P	-
1000	50	-	AE-1 P
5000	50	Airline*	-
5000	100	-	AE-2 P
10000	100	-	AE-3 P
	100+		Airline* *

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

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

## ENGINEERING CONTROLS

• Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator. Correct fit is essential to obtain adequate protection an approved self contained breathing apparatus (SCBA) may be required in some situations. Provide adequate ventilation in warehouse or closed storage area.

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:
solvent, vapors, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 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 favorable 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

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 m/s (200-400 f/min) for extraction of solvents generated in a tank 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

### PHYSICAL PROPERTIES

Liquid.  
Mixes with water.  
Corrosive.  
Acid.

State	Liquid	Molecular Weight	114.03
Melting Range (°F)	4.55	Viscosity	Not Available
Boiling Range (°F)	162.32	Solubility in water (g/L)	Miscible
Flash Point (°F)	Not Available	pH (1% solution)	<1
Decomposition Temp (°F)	Not Available	pH (as supplied)	<1
Autoignition Temp (°F)	Not Available	Vapor Pressure (mmHg)	106.734 @ 25 degC
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	1.535
Lower Explosive Limit (%)	Not Available	Relative Vapor Density (air=1)	3.9
Volatile Component (%vol)	Not available.	Evaporation Rate	Not available

### APPEARANCE

Clear colourless hygroscopic liquid with a sharp, biting vinegar-like odour. Fumes on contact with air. Mixes with water with evolution of heat.

## Section 10 - CHEMICAL STABILITY

### CONDITIONS CONTRIBUTING TO INSTABILITY

- 
- Contact with alkaline material liberates heat
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

### STORAGE INCOMPATIBILITY

• Reacts with mild steel, galvanized steel / zinc producing hydrogen gas which may form an explosive mixture with air. Avoid reaction with oxidizing agents, bases and strong reducing agents.

Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

Trifluoroacetic acid:

- reacts violently with strong bases
- is incompatible with sulfuric acid and other strong acids (causes decomposition), ammonia, amines, isocyanates, alkylene oxides, epichlorohydrin, magnesium tetrahydroaluminate
- is incompatible with dimethyl sulfoxide
- attacks metals

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

## Section 11 - TOXICOLOGICAL INFORMATION

trifluoroacetic acid

### TOXICITY AND IRRITATION

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

TOXICITY	IRRITATION
Oral (rat) LD50: 200 mg/kg	Nil Reported
Inhalation (rat) LC50: 10000 mg/m <sup>3</sup>	

• Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough

and mucus production.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.

The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

#### **For perfluorinated carbons (PFCs):**

PFCs are inert fluids composed of a complex combination of organic compounds resulting from the distillation of electrochemically fluorinated (ECF) compounds. This class consists of branched, linear and cyclic perfluorinated hydrocarbons having carbon numbers predominantly in the range of C5-C18 and boiling in the range of approximately 25 C-255 C (77 F-491 F). Perfluorinated amine and ether compounds may also be present

Acute oral and inhalation toxicity tests with perfluoroalkanes show no toxicity at any dose tested, and even extremely high-dose intraperitoneal injection resulted in no lethality. In contrast, perfluoroalkenes (such as octafluorocyclopentene, perfluoroisobutylene, hexafluoropropene) have shown evidence of inhalation toxicity, in some cases, extreme.

PFCs are among the least toxic of all known organic chemicals. PFCs don't oxidise or hydrolyse. They have no functional reactive groups. PFCs owe their low toxicity to the combination of the following properties:

- Chemical inertness
- Low solubility in biological media (blood, cell membranes, etc.)
- High volatility
- Resistance to biological activation (reductive and oxidative metabolism)

Because PFCs are chemically inert, if inhaled and absorbed they do not react chemically with any biological molecules; they simply partition between blood and various organs and tissues.

As PFCs have limited ability to dissolve in biological media, they do not reach appreciable concentrations in the tissues of air-exposed animals. As PFCs are highly volatile chemicals and have high air-blood partition coefficients, any fluorochemical remaining after exposure will be rapidly eliminated in the breath. Consequently, all such PFCs have:

- Very high rodent LC50s (very low acute toxicity)
- Very high cardiac sensitisation EC50s (very low toxicity)

In fact, most PFCs do not induce narcosis (sleep) or cardiac sensitisation at maximum achievable concentration (saturation). Inhalation exposure at levels up to 50,000 ppm for thirteen weeks produced no effects in rats, nor did oral exposure for thirty days at 2,000 mg/kg/day.

All PFCs that have undergone evaluation by the ACGIH or WEEL committees in the US have been granted an exposure guideline of 1000 ppm (8-hr TWA). NASA has evaluated the toxicity information associated with PFCs including those that can be used as heat transfer agents and fire extinguishing agents in spacecraft and has established a Space Maximum Allowable Concentration (SMAC) of 11,000 ppm for up to 180 days (24 hours/day)

PFCs are neutral molecules and because they are maximally fluorinated, they cannot undergo biological oxidation-reduction reactions to form reactive aldehydes, acid fluorides, radicals or acids that have been associated with several types of toxicity.

Genetic toxicity: As PFCs are not reactive directly with biological tissue and PFCs cannot form reactive metabolites, these fluorochemicals have tested negative in bacterial mutagenicity assays. Ames testing showed no genotoxicity.

Hydrofluoroethers and hydrofluoropolyethers are highly fluorinated ethers having properties intermediate between the perfluoroethers and hydrocarbon ethers. They are low in toxicity, nonflammable, with densities of 1.4-1.7 g/cm<sup>3</sup>, surface tensions of 13-16 dyn/cm and low kinematic viscosity. The hydrofluoropolyethers are used as heat-transfer fluids. The hydrofluoroethers are used as heat-transfer fluids as well as precision cleaning solvents and solvents for specialty applications such as coating deposition.

Perfluorinated compounds are potent peroxisome proliferators and were found to induce 8-hydroxydeoxyguanosine in the liver of treated rats. The material may produce peroxisome proliferation. Peroxisomes are single, membrane limited, cytoplasmic organelles that are found in the cells of animals, plants, fungi and protozoa. Peroxisome proliferators include certain hypolipidaemic drugs, phthalate ester plasticisers, industrial solvents, herbicides, food flavours, leukotriene D4 antagonists and hormones. Numerous studies in rats and mice have demonstrated the hepatocarcinogenic effects of peroxisome proliferators, and these compounds have been unequivocally established as carcinogens. However it is generally conceded that compounds inducing proliferation in rats and mice have little, if any, effect on human liver except at very high doses or extreme conditions of exposure.

## **Section 12 - ECOLOGICAL INFORMATION**

Refer to data for ingredients, which follows:

TRIFLUOROACETIC ACID:

- Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
  - Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
- Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

- For perfluorinated carboxylic acids (PFCAs):

Environmental fate:

PFCAs are chemicals that can be unintentionally formed through the transformation of fluorotelomer-based substances. Fluorotelomer-based substances are commonly used as water and grease repellents for materials such as paper, fabric, leather and carpets. Substances that can be sources of PFCAs are referred to as precursors.

PFCA precursors can enter the environment through two routes:

- Through their release, because they are present as "residual" unreacted building blocks of fluorotelomer-based substances; and

- Through their release upon degradation of fluorotelomer-based substances. There are uncertainties regarding mechanisms and rates of degradation; consequently, the relative contribution of this source to environmental levels of PFCAs is uncertain. To address this uncertainty, degradation of fluorotelomer-based substances is the focus of ongoing research activity.

The PFCAs formed from fluorotelomer-based substances contain a range of carbon chain lengths. Many governments produce Action Plans to limit entry of PFCAs into the environment. These plans focus on the long chain PFCAs, i.e. those with nine or more carbons. However, consideration may be given to the inclusion of other chain lengths if information that justifies it becomes available.

Long chain PFCAs are present in the environment of most developed countries and have the potential to adversely affect animal and human health. In tests on laboratory animals, one PFCA (perfluorooctanoic acid, PFOA) has been shown to be tumourigenic and immunotoxic and to elicit moderate reproductive or developmental toxicity and moderate-to-high subchronic oral toxicity. It has been assumed that despite the absence of robust toxicity results for longer chain PFCAs, these substances are reasonably expected to be of greater concern than PFOA, as a result of their known slower clearance rates and higher bioaccumulation potential. Although the current environmental concentrations of PFCAs are low, concern arises from the evidence indicating a rapid upward trend in the levels observed in the environment.

Furthermore, available evidence indicates that PFCAs are environmentally persistent and the longer chain PFCAs (= 9 carbons) bioaccumulate. PFCAs are present in the environment as a result of human activity.

- Prevent, by any means available, spillage from entering drains or watercourses.
- DO NOT discharge into sewer or waterways.

### Ecotoxicity

Ingredient trifluoroacetic acid	Persistence: Water/Soil LOW	Persistence: Air	Bioaccumulation LOW	Mobility HIGH
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## Section 13 - DISPOSAL CONSIDERATIONS

### US EPA Waste Number & Descriptions

A. General Product Information

Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)

### Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

- Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Treat and neutralize at an approved treatment plant. Treatment should involve: Neutralization with soda-ash or soda-lime followed by: Burial in a licensed land-fill or Incineration in a licensed apparatus
- Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

## Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	8
Identification Numbers:	UN2699	PG:	I
Label Codes:	8	Special provisions:	A3, A6, A7, B4, N3, N34, N36, T10, TP2
Packaging: Exceptions:	None	Packaging: Non-bulk:	201
Packaging: Exceptions:	None	Quantity limitations: Passenger aircraft/rail:	0.5 L

Quantity Limitations: Cargo aircraft only: 2.5 L Vessel stowage: Location: B

Vessel stowage: Other: 12, 40

Hazardous materials descriptions and proper shipping names:

Trifluoroacetic acid

**Air Transport IATA:**

ICAO/IATA Class: 8 ICAO/IATA Subrisk: None

UN/ID Number: 2699 Packing Group: I

Special provisions: None

Shipping Name: TRIFLUOROACETIC ACID

**Maritime Transport IMDG:**

IMDG Class: 8 IMDG Subrisk: None

UN Number: 2699 Packing Group: I

EMS Number: F-A,S-B Special provisions: None

Limited Quantities: None

Shipping Name: TRIFLUOROACETIC ACID

## Section 15 - REGULATORY INFORMATION

**trifluoroacetic acid (CAS: 76-05-1) is found on the following regulatory lists;**

"Canada Ingredient Disclosure List (SOR/88-64)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - New Jersey Right to Know Hazardous Substances", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US Toxic Substances Control Act (TSCA) - Inventory"

## Section 16 - OTHER INFORMATION

**LIMITED EVIDENCE**

- Skin contact may produce health damage\*.
- Cumulative effects may result following exposure\*.
- Limited evidence of a carcinogenic effect\*.

\* (limited evidence).

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- Classification of the mixture 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 controls must be considered.

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