

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 1 of 18

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

TRICHLOROETHYLENE

OTHER NAMES

C₂H-Cl₃, H(Cl)C=CCl₂, trichlorethylene, "acetylene trichloride", "ethylene trichloride", trichloroethene, "1, 1, 2-trichloroethene", "1-chloro-2, 2-dichloroethylene", "1, 1-dichloro-2-chloroethylene"

PROPER SHIPPING NAME

TRICHLOROETHYLENE

PRODUCT USE

Mainly used for vapour degreasing; solvent in textile and electronics industries; for adhesives, lubricants and consumer products (such as spot removers and rug cleaners).

Until recently, it was used to make hop extracts for beer, decaffeinated coffee and spice extracts.

SUPPLIER

Company: S D FINE- CHEM LIMITED

Address:

315- 317, T.V. INDUSTRIAL ESTATE,

248, WORLI,

MUMBAI- 400030.INDIA.

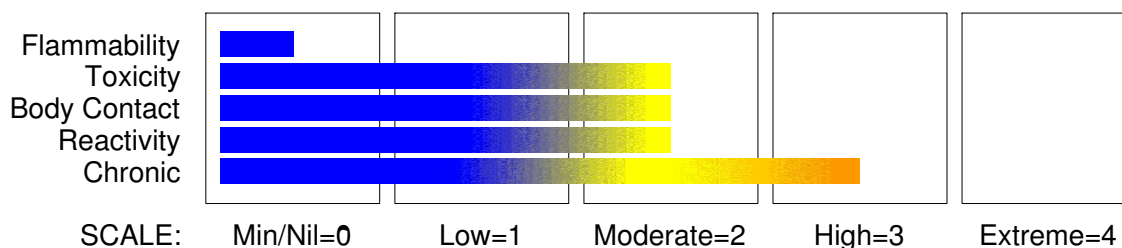
technical@sdfine.com

Telephone: 91- 22- 24959898

Telephone: 91- 22- 24959899

Fax: 91- 22- 24937232

HAZARD RATINGS



continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0
Page 2 of 18

Section 2 - HAZARDS IDENTIFICATION

GHS Classification

Carcinogen Category 1B
Chronic Aquatic Hazard Category 3
Eye Irritation Category 2A
Reproductive Toxicity Category 1B
Respiratory Effects Category 3
Respiratory Irritation Category 3
Skin Corrosion/Irritation Category 2



EMERGENCY OVERVIEW

HAZARD

DANGER
Determined by using GHS criteria:
H335 H336 H315 H319 H350 H360 H412
May cause respiratory irritation
May cause drowsiness and dizziness
Causes skin irritation
Causes serious eye irritation
May cause CANCER
May damage the unborn child
Harmful to aquatic life with long lasting effects

PRECAUTIONARY STATEMENTS

Prevention

Obtain special instructions before use.
Wash thoroughly after handling.
Use personal protective equipment as required.
Do not handle until all safety precautions have been read and understood.
Wash hands thoroughly after handling.

Response

Wear eye/face protection.
If skin irritation occurs, seek medical advice/attention.
If exposed or concerned: Get medical attention advice.
If eye irritation persists, get medical advice/attention.
Wash/Decontaminate removed clothing before reuse.
Remove/Take off immediately all contaminated clothing
IF ON SKIN: Gently wash with plenty of soap and water.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Storage

Store locked up.

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 3 of 18

Section 2 - HAZARDS IDENTIFICATION

Disposal

Dispose of contents and container in accordance with relevant legislation.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
trichloroethylene	79-01-6	> 99
stabilizer		< 1

Section 4 - FIRST AID MEASURES

SWALLOWED

- 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.
 - Seek medical advice.
- Avoid giving milk or oils.
Avoid giving alcohol.

EYE

- If this product comes in contact with the eyes:
- Wash out immediately with fresh 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.
 - If pain persists or recurs seek medical attention.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

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

INHALED

- 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.

NOTES TO PHYSICIAN

Treat symptomatically.

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

Following acute or short-term continued exposures to trichloroethylene:

- Trichloroethylene concentration in expired air correlates with exposure. 8 hours exposure to 100 ppm produces levels of 25 ppm immediately and 1 ppm 16 hours after exposure.
- Most mild exposures respond to removal from the source and supportive care. Serious

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 4 of 18

Section 4 - FIRST AID MEASURES

toxicity most often results from hypoxemia or cardiac dysrhythmias so that oxygen, intubation, intravenous lines and cardiac monitoring should be started initially as the clinical situation dictates.

- Ipecac syrup should be given to alert patients who ingest more than a minor amount and present within 2 hours.
- The efficacy of activated charcoal and cathartics is unclear.
- The metabolites, trichloroacetic acid, trichloroethanol and to a lesser degree, chloral hydrate, may be detected in the urine up to 16 days postexposure.

[Ellenhorn and Barceloux; Medical Toxicology]

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
1. Trichloroacetic acid in urine	10 mg/gm creatinine	End of work- week	NS
2. Trichloroacetic acid AND Trichloroethanol in urine	300mg/mg creatinine	End of shift at end of work- week	NS
3. Free Trichloroethanol in blood	4 mg/L	End of shift at end of work- week	NS
4. Trichloroethylene in end- exhaled air			SQ
5. Trichloroethylene in blood			SQ

NS: Non-specific determinant; also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

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

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.
- 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.

FIRE/EXPLOSION HAZARD

- Non flammable liquid.
- However vapour will burn when in contact with high temperature flame.
- Ignition ceases on removal of flame.

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 5 of 18

Section 5 - FIRE FIGHTING MEASURES

- May form a flammable / explosive mixture in an oxygen enriched atmosphere
- Heating may cause expansion/vapourisation with violent rupture of containers
- Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.

FIRE INCOMPATIBILITY

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

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS

- Clean up all spills immediately.
- Avoid breathing vapours 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 labelled container for waste disposal.

MAJOR SPILLS

After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.

Chemical Class: aliphatics, halogenated

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

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
LAND SPILL - SMALL				
cross- linked polymer - particulate	1	shovel	shovel	R, W, SS
cross- linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
wood fiber - pillow	2	throw	pitchfork	R, P, DGC, RT
treated wood fibre - particulate	2	shovel	shovel	R, W, DGC
sorbent clay - particulate	3	shovel	shovel	R, I, P
foamed glass - pillow	3	throw	pitchfork	R, P, DGC, RT
LAND SPILL - MEDIUM				
cross- linked polymer - particulate	1	blower	skiploader	R, W, SS
cross- linked polymer - pillow	2	throw	skiploader	R, DGC, RT
sorbent clay - particulate	3	blower	skiploader	R, I, P

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 6 of 18

Section 6 - ACCIDENTAL RELEASE MEASURES

polypropylene - particulate	3	blower	skiploader	W, SS, DGC
foamed glass - pillow	3	throw	skiploader	R, P, DGC, RT
expanded mineral - particulate	4	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.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

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

life-threatening health effects is:

trichloroethylene 5000 ppm

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

trichloroethylene 500 ppm

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

trichloroethylene 100 ppm

The threshold concentration below which most people will experience no appreciable risk of health effects:

trichloroethylene 100 ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+)	$\geq 0.1\%$	Toxic (T)	$\geq 3.0\%$
R50	$\geq 0.25\%$	Corrosive (C)	$\geq 5.0\%$
R51	$\geq 2.5\%$		
else	$\geq 10\%$		

where percentage is percentage of ingredient found in the mixture

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

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

DO NOT allow clothing wet with material to stay in contact with skin.

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 7 of 18

Section 7 - HANDLING AND STORAGE

- DO NOT allow material to contact humans, exposed food or food utensils.
- 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.

SUITABLE CONTAINER

DO NOT use aluminium or galvanised containers.

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

Inhibited grades may be stored in metal drums.

STORAGE INCOMPATIBILITY

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidisable and polymerisable.

BREThERICK L.: Handbook of Reactive Chemical Hazards.

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

Avoid reaction with oxidising agents.

Avoid strong bases.

Avoid storage with strong oxidisers (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, acetone, sodium/sodium-potassium alloys, zinc.

Avoid contact with water as the slow formation of hydrochloric acid results.

Attacks natural rubber.

STORAGE REQUIREMENTS

- 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



X



+



X



X



+

+: May be stored together

O: May be stored together with specific preventions

X: Must not be stored together

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 8 of 18

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m ³)	Revised IDLH Value (ppm)
trichloroethylene		1, 000 [Unch]

ODOUR SAFETY FACTOR (OSF)

OSF=1.8 (TRICHLOROETHYLENE)

Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.

The Odour Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm

Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV- TWA for example) is being reached, even when distracted by working activities
B	26- 550	As " A" for 50- 90% of persons being distracted
C	1- 26	As " A" for less than 50% of persons being distracted
D	0.18- 1	10- 50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As " D" for less than 10% of persons aware of being tested

MATERIAL DATA

Odour Threshold Value: 82 ppm (detection), 108 ppm (recognition)

NOTE: Detector tubes for trichloroethylene, measuring in excess of 10 ppm, are commercially available. Long-term measurements (4 hrs) may be conducted to detect concentrations exceeding 2.5 ppm.

Organs systems reported to be affected by excessive exposures of humans and animals to TCE are the central nervous system (CNS) (nausea, ataxia, headache, euphoria, analgesia, anaesthesia); liver (degeneration, hepatocellular carcinomas, mice only); kidney (degeneration); lung (oedema, tachypnea); heart (arrhythmias); skin (irritation, vesication) and paralysis of the fingers following immersion.

Exposure at or below the recommended TLV-TWA is thought to minimise the potential for headache, fatigue and irritability. A STEL has been advised to protect against incoordination and other anaesthetic effects. Control of concentrations to these limits should also provide a substantial margin of safety in the prevention of liver and other systemic damage.

The lower limit (REL-TWA) recommended by NIOSH is based on acute central nervous system (CNS) effects, headache and fatigue observed in health

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 9 of 18

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

hazard evaluations at levels of 25 ppm to 50 ppm and upon the potential for cancer in humans (hepatocellular carcinomas in mice exposed by chronic gastric lavage is cited).

Notes on Trichloroethylene Toxicity:

Concentration	Clinical Effects
100 ppm unacclimated	Odour Threshold barely perceptible to the
200 ppm	Odour apparent, not unpleasant; slight eye irritation
400 ppm (3 hours)	Odour very definite, not unpleasant; slight eye irritation and minimal light-headedness
1000-1200 ppm (6 min)	Very strong odour, unpleasant; definite eye and nasal irritation with light-headedness and dizziness
2000 ppm (5 min)	Odour very strong, not tolerable; marked eye and respiratory irritation with drowsiness, dizziness and nausea.

PERSONAL PROTECTION



EYE

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

HANDS/FEET

Polyethylene gloves.

Suitability and durability of glove type is dependent on usage. Factors such as:

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

are important in the selection of gloves.

Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

OTHER

- Overalls.
- Eyewash unit.

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0
Page 10 of 18

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

- Barrier cream.
- Skin cleansing cream.

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".

The effect(s) of the following substance(s) are taken into account in the computer-generated selection: trichloroethylene

Protective Material:

PE/EVAL/PE	A
PVA	A
TEFLON	A
VITON	B
VITON/NEOPRENE	C
VITON/NITRILE	C
HYPALON	C
NEOPRENE	C
PVC	C
NITRILE	C

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

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	A- AUS	-
1000	50	-	A- AUS
5000	50	Airline *	-
5000	100	-	A- 2
10000	100	-	A- 3
	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.

For further information consult your
Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

- Employees exposed to confirmed human carcinogens should be authorized to do so by the employer, and work in a regulated area.
- Work should be undertaken in an isolated system such as a "glove-box". Employees

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 11 of 18

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

should wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

- Within regulated areas, the carcinogen should be stored in sealed containers, or enclosed in a closed system, including piping systems, with any sample ports or openings closed while the carcinogens are contained within.
- Open-vessel systems are prohibited.
- Each operation should be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation.
- Exhaust air should not be discharged to regulated areas, non-regulated areas or the external environment unless decontaminated. Clean make-up air should be introduced in sufficient volume to maintain correct operation of the local exhaust system.
- For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood. Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood.
- Except for outdoor systems, regulated areas should be maintained under negative pressure (with respect to non-regulated areas).
- Local exhaust ventilation requires make-up air be supplied in equal volumes to replaced air.
- Laboratory hoods must be designed and maintained so as to draw air inward at an average linear face velocity of 150 feet/ min. with a minimum of 125 feet/ min. Design and construction of the fume hood requires that insertion of any portion of the employees body, other than hands and arms, be disallowed.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Colourless liquid with a sweetish, chloroform-like odour; does not mix with water (solubility 0.11%), miscible with most organic solvents.

PHYSICAL PROPERTIES

Liquid.

Does not mix with water.

Sinks in water.

Molecular Weight: 131.38

Melting Range (°C): - 87 - 73

Solubility in water (g/L): Immiscible

pH (1% solution): Not applicable.

Volatile Component (%vol): 100

Relative Vapour Density (air=1): 4.54

Lower Explosive Limit (%): 12.5 cont.ign.

Autoignition Temp (°C): 410

State: Liquid

Boiling Range (°C): 86- 88

Specific Gravity (water=1): 1.47

pH (as supplied): Not applicable

Vapour Pressure (kPa): 7.87 @ 20C

Evaporation Rate: Not available

Flash Point (°C): Not applicable.

Upper Explosive Limit (%): 90 cont. ign.

Decomposition Temp (°C): Not Available

Viscosity: Not Available

log Kow (Sangster 1997):

2.42

log Kow: 2.2-3.3

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 12 of 18

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

- Hazardous polymerisation will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Accidental ingestion of the material may be damaging to the health of the individual.

EYE

Evidence exists, or practical experience predicts, that the material may cause eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Repeated or prolonged eye contact may cause inflammation characterised by a temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.

SKIN

Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.

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.

The material produces severe skin irritation; evidence exists, or practical experience predicts, that the material either:

- produces severe inflammation of the skin in a substantial number of individuals following direct contact, and/or
- produces significant and severe inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period.
- Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.

NOTE: Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

INHALED

Inhalation may produce health damage*.

Acute effects from inhalation of high concentrations of vapour are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterised by headache and dizziness, increased reaction time, fatigue and loss of co-ordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.

Limited evidence or practical experience suggests that the material may produce irritation of the respiratory system, in a significant number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas

continued...

TRICHLOROETHYLENE

Section 11 - TOXICOLOGICAL INFORMATION

exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.

Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.

Inhalation hazard is increased at higher temperatures.

Anaesthetics and narcotic effects (with dulling of senses and odour fatigue) are a consequence of exposure to chlorinated solvents.

Individual response varies widely; odour may not be considered objectionable at levels which quickly induce central nervous system effects. High vapour concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death.

Systemic effects of trichloroethylene (TCE) exposure involve the central nervous system and produce headache, light-headedness, dizziness, ataxia, euphoria, confusion, drowsiness, and coma. Other adverse findings include nausea, vomiting, hypotension, bradycardia or tachycardia and hepatitis. Deaths may occur from ventricular arrhythmias as a result of sensitisation of the myocardium to adrenaline or other catecholamines.

Recovery from narcotic effects is usually rapid following cessation of exposure.

Trigeminal nerve impairment and peripheral neuropathy have been reported following TCE exposure.

Evidence of acute human toxicity comes mainly from the use of TCE as an anaesthetic.

Tachypnea and ventricular arrhythmias are experienced at inhaled concentrations exceeding 15000 ppm. Systemic toxicity is low following anaesthesia. Occasional hepatotoxicity (liver dysfunction) has been reported; this is probably due to the breakdown of TCE to dichloroacetylene and phosgene by soda-lime present in some anaesthetic devices.

The effects of TCE appear to be enhanced in some individuals by simultaneous exposure to caffeine, ethanol and other drugs. "Degreaser's Flush" describes a reddening of facial, neck and back skin and is seen by certain individuals after exposure to TCE.

At sufficiently high doses the material may be nephrotoxic (i.e. poisonous to the kidney).

At sufficiently high doses the material may be hepatotoxic (i.e. poisonous to the liver).

At sufficiently high doses the material may be neurotoxic (i.e. poisonous to the nervous system).

CHRONIC HEALTH EFFECTS

On the basis, primarily, of animal experiments, the material may be regarded as carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to the material may result in cancer on the basis of:

- appropriate long-term animal studies
- other relevant information.

There is some evidence that human exposure to the material may result in developmental toxicity. This evidence is based on animal studies where effects have been observed in the absence of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not secondary non-specific consequences of the other toxic effects. Exposure to the material may result in a possible risk of irreversible effects. The material may produce mutagenic effects in man. This concern is raised, generally, on the basis of

appropriate studies using mammalian somatic cells in vivo. Such findings are often supported by positive results from in vitro mutagenicity studies.

The carcinogenicity of halogenated oxiranes may lie in the reactivity of an epoxide intermediate. It is reported that 1,1-dichloroethylene, vinyl chloride, trichloroethylene, tetrachloroethylene and chloroprene, for example, are carcinogens in vivo.

Symmetrically substituted oxiranes such as 1,2-dichloroethylene and 1,1,2,2-

-tetrachloroethylene are more stable and less mutagenic than unsymmetrical chlorinated oxiranes such as 1,1-dichloroethylene, 1,1,2-trichloroethylene and monochloroethylene (vinyl chloride).

The carcinogenicity of 1,1-dichloroethylene has primarily been associated with inhalation exposure while that of vinyl chloride, trichloroethylene and tetrachloroethylene occurs

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 14 of 18

Section 11 - TOXICOLOGICAL INFORMATION

following exposure by both inhalation and oral routes.

National Toxicology Program Toxicity Report Series Number 55; April 2002

Various studies report an association between cancer and industrial exposure to tetrachloroethylene; IARC concluded that this evidence is sufficient to assign appropriate warnings. Similar warnings have been issued by IARC for vinyl fluoride.

Vinyl bromide exhibited neoplastic and tumourigenic activity in rats exposed by inhalation and is classified by various bodies as potentially carcinogenic.

Substances such as chloroprene (2-chloro-1,3-butadiene), are reported to produce an increased frequency of chromosomal aberrations in the lymphocytes of Russian workers.

Russian epidemiological studies also suggest an increased incidence of skin and lung cancer following exposure to chloroprene, a result which is not supported by other studies.

Generally speaking, the monohalogenated substances exhibit higher carcinogenic potential than their dihalogenated counterparts. Whether additional substitution lessens such hazard is conjectural. Tetrafluoroethylene, for example, produced clear evidence of carcinogenic activity in a two-year inhalation study in rats and mice.

National Toxicology Program Technical Report Series 450, April 1997.

TOXICITY AND IRRITATION

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

TOXICITY

Oral (human) LDLo: 7000 mg/kg

Oral (man) TDLo: 2143 mg/kg

Oral (rat) LD50: 5650 mg/kg

Inhalation (man) LCLo: 2900 ppm

Inhalation (human) TDLo: 812 mg/kg

Inhalation (human) TCLo: 6900 mg/m³/10 m

Inhalation (man) TCLo: 2900 ppm

Inhalation (man) TCLo: 110 ppm/8h

Inhalation (man) TCLo: 160 ppm/83 m

IRRITATION

Skin(rabbit): 500 mg/24h - SEVERE

Eye(rabbit): 20 mg/24h - SEVERE

The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) thickening of the epidermis.

Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis. Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Section 12 - ECOLOGICAL INFORMATION

Hazardous Air Pollutant:	Yes
Fish LC50 (96hr.) (mg/l):	40.7- 66.8
Algae IC50 (72hr.) (mg/l):	63- 1000
log Kow (Sangster 1997):	2.42
Half- life Soil - High (hours):	8640
Half- life Soil - Low (hours):	4320
Half- life Air - High (hours):	272
Half- life Air - Low (hours):	27
Half- life Surface water - High (hours):	8640
Half- life Surface water - Low (hours):	4320
Half- life Ground water - High (hours):	39672
Half- life Ground water - Low (hours):	7704
Aqueous biodegradation - Aerobic - High (hours):	8640
Aqueous biodegradation - Aerobic - Low (hours):	4320
Aqueous biodegradation - Anaerobic - High (hours):	39672
Aqueous biodegradation - Anaerobic - Low (hours):	2352

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 15 of 18

Section 12 - ECOLOGICAL INFORMATION

Photooxidation half- life air - High (hours):	272
Photooxidation half- life air - Low (hours):	27
First order hydrolysis half- life (hours):	7704

Substances containing unsaturated carbons are ubiquitous in indoor environments. They result from many sources (see below). Most are reactive with environmental ozone and many produce stable products which are thought to adversely affect human health. The potential for surfaces in an enclosed space to facilitate reactions should be considered.

Source of unsaturated substances Occupants (exhaled breath, ski oils, personal care products)	Unsaturated substances (Reactive Emissions) Isoprene, nitric oxide, squalene, unsaturated sterols, oleic acid and other unsaturated fatty acids, unsaturated oxidation products	Major Stable Products produced following reaction with ozone. Methacrolein, methyl vinyl ketone, nitrogen dioxide, acetone, 6MHQ, geranyl acetone, 4OPA, formaldehyde, nonanol, decanal, 9- oxo- nonanoic acid, azelaic acid, nonanoic acid.
Soft woods, wood flooring, including cypress, cedar and silver fir boards, houseplants	Isoprene, limonene, alpha-pinene, other terpenes and sesquiterpenes	Formaldehyde, 4- AMC, pinoaldehyde, pinic acid, pinonic acid, formic acid, methacrolein, methyl vinyl ketone, SOAs including ultrafine particles
Carpets and carpet backing	4- Phenylcyclohexene, 4-vinylcyclohexene, styrene, 2-ethylhexyl acrylate, unsaturated fatty acids and esters	Formaldehyde, acetaldehyde, benzaldehyde, hexanal, nonanal, 2 - nonenal
Linoleum and paints/polishes containing linseed oil	Linoleic acid, linolenic acid	Propanal, hexanal, nonanal, 2-heptenal, 2- nonenal, 2-decenal, 1- pentene- 3 - one, propionic acid, n- butyric acid
Latex paint Certain cleaning products, polishes, waxes, air fresheners	Residual monomers Limonene, alpha- pinene, terpinolene, alpha- terpineol, linalool, linalyl acetate and other terpinoids, longifolene and other sesquiterpenes	Formaldehyde Formaldehyde, acetaldehyde, glycoaldehyde, formic acid, acetic acid, hydrogen and organic peroxides, acetone, benzaldehyde, 4- hydroxy- 4-methyl- 5- hexen- 1- al, 5 - ethenyl- dihydro- 5- methyl- 2(3H)- furanone, 4- AMC, SOAs including ultrafine particles
Natural rubber adhesive	Isoprene, terpenes	Formaldehyde, methacrolein, methyl vinyl ketone
Photocopier toner, printed paper, styrene polymers	Styrene	Formaldehyde, benzaldehyde
Environmental tobacco smoke	Styrene, acrolein, nicotine	Formaldehyde, benzaldehyde, hexanal, glyoxal, N-methylformamide, nicotinaldehyde, cotinine
Soiled clothing, fabrics, bedding	Squalene, unsaturated sterols, oleic acid and other saturated fatty acids	Acetone, geranyl acetone, 6MHO, 4OPA, formaldehyde, nonanal, decanal, 9 - oxo- nonanoic acid, azelaic acid, nonanoic acid
Soiled particle filters	Unsaturated fatty acids from plant waxes, leaf litter, and other vegetative debris; soot; diesel particles	Formaldehyde, nonanal, and other aldehydes; azelaic acid; nonanoic acid; 9- oxo- nonanoic acid and other oxo- acids;

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 16 of 18

Section 12 - ECOLOGICAL INFORMATION

Ventilation ducts and duct liners	Unsaturated fatty acids and esters, unsaturated oils, neoprene	compounds with mixed functional groups (=O, - OH, and - COOH) C5 to C10 aldehydes
" Urban grime"	Polycyclic aromatic hydrocarbons	Oxidized polycyclic aromatic hydrocarbons
Perfumes, colognes, essential oils (e.g. lavender, eucalyptus, tea tree)	Limonene, alpha- pinene, linalool, linalyl acetate, terpinene- 4- ol, gamma - terpinene	Formaldehyde, 4- AMC, acetone, 4- hydroxy- 4- methyl- 5- hexen- 1- al, 5- ethenyl - dihydro- 5- methyl- 2(3H) furanone, SOAs including ultrafine particles
Overall home emissions	Limonene, alpha- pinene, styrene	Formaldehyde, 4- AMC, pinonaldehyde, acetone, pinic acid, pinonic acid, formic acid, benzaldehyde, SOAs including ultrafine particles

Abbreviations: 4-AMC, 4-acetyl-1-methylcyclohexene; 6MHQ, 6-methyl-5-heptene-2-one, 4OPA, 4-oxopentanal, SOA, Secondary Organic Aerosols

Reference: Charles J Weschler; Environmental Health Perspectives, Vol 114, October 2006.

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.

DO NOT discharge into sewer or waterways.

log Kow: 2.2-3.3

log Koc: 2

Koc: 87-150

Henry's atm m³ /mol: 0.0103

BCF: 17-1160

Toxicity Fish: 71-55-6

Toxicity invertebrate: 1,1,1-trichloroethane

Bioaccumulation: LC50(96)43.7-126mg/L

Nitrif. inhib.: LC50(48)7.5-530mg/L

Anaerobic effects: not sig

Degradation Biological: v slow degrad

little, slow

no hydrol,RxnOH*,photox

Trichloroethylene quickly reacts in air, especially under smog conditions; atmospheric residence time is up to 5 days.

Phosgene, dichloroacetylchloride, and formyl chloride may form.

Photo-oxidative degradation may occur (half-life 7 days).

Biodegrades in water.

Spills, on soil, will evaporate quickly, or may be highly mobile leaching into ground water; trichloroethylene has a low potential for adsorption.

Trichloroethylene exhibits moderate bioconcentration.

Drinking Water Standards:

trichloroethylene: 30 mg/l (UK max.)

70 mg/l (WHO provisional guideline)

hydrocarbon total: 10 ug/l (UK max.)

Soil Guidelines: Dutch Criteria:

0.001 mg/kg (target)

60 mg/kg (intervention)

Air Quality Standards:

1 mg/m³ averaging time 24 hours (WHO Guideline)

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0
Page 17 of 18

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible or consult manufacturer for recycling options.
 - Consult State Land Waste Authority for disposal.
 - Bury or incinerate residue at an approved site.
 - Recycle containers if possible, or dispose of in an authorised landfill.
 - Containers may still present a chemical hazard/ danger when empty.
 - Return to supplier for reuse/ recycling if possible.
- Otherwise:
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
 - Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

Section 14 - TRANSPORTATION INFORMATION



Labels Required: TOXIC
HAZCHEM: 2Z

UNDG:

Dangerous Goods Class:	6.1	Subrisk:	None
UN Number:	1710	Packing Group:	III
Shipping Name: TRICHLOROETHYLENE			

Air Transport IATA:

ICAO/IATA Class:	6.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1710	Packing Group:	III
Special provisions:	None		
Shipping Name: TRICHLOROETHYLENE			

Maritime Transport IMDG:

IMDG Class:	6.1	IMDG Subrisk:	None
UN Number:	1710	Packing Group:	III
EMS Number:	F- A, S- A	Special provisions:	None
Shipping Name: TRICHLOROETHYLENE			

Section 15 - REGULATORY INFORMATION

REGULATIONS

trichloroethylene (CAS: 79-01-6) is found on the following regulatory lists;
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk
International Agency for Research on Cancer (IARC) Carcinogens
OECD Representative List of High Production Volume (HPV) Chemicals
WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water

continued...

TRICHLOROETHYLENE

GHS Safety Data Sheet

Version No:2.0

Page 18 of 18

Section 16 - OTHER INFORMATION

REPRODUCTIVE HEALTH GUIDELINES

Established occupational exposure limits frequently do not take into consideration reproductive end points that are clearly below the thresholds for other toxic effects. Occupational reproductive guidelines (ORGs) have been suggested as an additional standard. These have been established after a literature search for reproductive no-observed-adverse effect-level (NOAEL) and the lowest-observed-adverse-effect-level (LOAEL). In addition the US EPA's procedures for risk assessment for hazard identification and dose-response assessment as applied by NIOSH were used in the creation of such limits. Uncertainty factors (UFs) have also been incorporated.

Ingredient	ORG	UF	Endpoint	CR	Adeq TLV
trichloroethylene	5.5 mg/m ³	100	D	NA	-

These exposure guidelines have been derived from a screening level of risk assessment and should not be construed as unequivocally safe limits. ORGS represent an 8-hour time-weighted average unless specified otherwise.

CR = Cancer Risk/10000; UF = Uncertainty factor:

TLV believed to be adequate to protect reproductive health:

LOD: Limit of detection

Toxic endpoints have also been identified as:

D = Developmental; R = Reproductive; TC = Transplacental carcinogen

Jankovic J., Drake F.: A Screening Method for Occupational Reproductive

American Industrial Hygiene Association Journal 57: 641-649 (1996).

MSDS SECTION CHANGES

The following table displays the version number of and date on which each section was last changed.

Section Name	Version	Date	Section Name	Version	Date	Section Name	Version	Date
First Aid (eye)	6	30- Apr- 2007	Storage (storage requirement)	6	30- Apr- 2007	Instability Condition	6	30- Apr- 2007
First Aid (inhaled)	6	30- Apr- 2007	Storage (suitable container)	6	30- Apr- 2007	Acute Health (eye)	6	30- Apr- 2007
First Aid (swallowed)	6	30- Apr- 2007	Engineering Control	6	30- Apr- 2007	Acute Health (inhaled)	6	30- Apr- 2007
Fire Fighter (fire fighting)	6	30- Apr- 2007	Exposure Standard	4	22- Jul- 2005	Acute Health (skin)	6	30- Apr- 2007
Fire Fighter (fire incompatibility)	6	30- Apr- 2007	Personal Protection (eye)	6	30- Apr- 2007	Acute Health (swallowed)	6	30- Apr- 2007
Spills (major)	6	30- Apr- 2007	Personal Protection (hands/feet)	6	30- Apr- 2007	Chronic Health	6	30- Apr- 2007
Spills (minor)	6	30- Apr- 2007	Personal Protection (other)	6	30- Apr- 2007	Toxicity and Irritation (Other)	6	30- Apr- 2007
Handling Procedure	6	30- Apr- 2007	Appearance	6	30- Apr- 2007	Environmental	6	30- Apr- 2007
Storage (storage incompatibility)	6	30- Apr- 2007	Physical Properties	6	30- Apr- 2007	Disposal	6	30- Apr- 2007

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

Issue Date: 30-Apr-2018