

# TRICHLOROETHYLENE

## Overview

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Trichloroethylene is a non-flammable liquid chlorinated hydrocarbon used as an industrial solvent. It is often referred to as TCE, Trike, or tri and is sold under numerous brand names.

### Just the facts

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#### Physical Information

Name: Trichloroethylene, 1,1,2-Trichloroethene, 1,1-Dichloro-2-Chloroethylene, 1-Chloro-2,2-Dichloroethylene, Acetylene Trichloride, TCE, Trethylene, Triclene, Tri, Trimar, Trilene

Trade Names: Acetylene trichloroethylene, Algylen, Anameth, Benzinol, Chlorilen, CirCosolv, Germalgene, Lethurin, Perm-a-chlor, Petzinol, Philex, TRI-Plus M and Vitran

Use: Solvent

Source: Industrial, environmental

Recommended daily intake: None

Absorption: intestine, inhalation, skin

Sensitive individuals: Unknown

Toxicity/symptoms: Nervous system, Cancer

Regulatory facts:

General facts: Long history of use as a solvent. Common occupational hazard in certain industries. Toxicity to humans and wildlife is well documented.

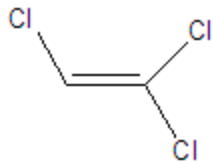
Environmental: Found in indoor and outdoor air, drinking and surface water. An important

## Physical Information

chemical found in US EPA Superfund sites.

Recommendations: Avoid, proper workplace protection

## Chemical Structure



## Physical Properties

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Molecular formula:  $C_2HCl_3$

Molar mass:  $131.39 \text{ g mol}^{-1}$

Appearance: Colorless liquid

Density:  $1.46 \text{ g / cm}^3$  (liquid) at  $20^\circ\text{C}$

Melting point:  $200 \text{ K}$  ( $-73^\circ\text{C}$ )

Boiling point:  $360 \text{ K}$  ( $87^\circ\text{C}$ )

Solubility in water:  $0.1 \text{ g/100 cm}^3$  at  $25^\circ\text{C}$

Solubility: ether, ethanol, Chloroform

## Pharmacology and Metabolism

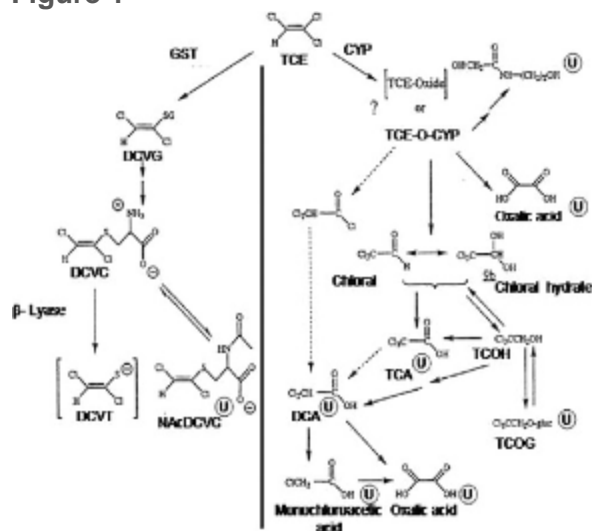
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Understanding the absorption, distribution, metabolism, and elimination of trichloroethylene is critical to the qualitative and quantitative assessment of human health risks from environmental exposures. Qualitatively, pharmacokinetics is helpful in identifying the chemical species that

might be causally associated with observed toxic responses. This is particularly important for trichloroethylene because many of its toxic effects are thought to be due to metabolites rather than to trichloroethylene. The delineation of interspecies and intraspecies pharmacokinetic differences can provide insights into how laboratory animal and epidemiologic data might reveal overall human health risks and the basis for individual differences in susceptibility. Furthermore, physiologically based pharmacokinetic models can quantify the relationship between external measures of exposure and internal measures of a toxicologically relevant dose. Selecting the appropriate dose metric for use in risk assessment depends on the understanding of the target tissue, active chemical, and mode of action for a particular toxic effect as well as the reliability of physiologically based pharmacokinetic models (#National Research Council, 2006).

Trichloroethylene is rapidly and extensively absorbed by all routes of environmental exposures, including ingestion, inhalation, and dermal contact. Once absorbed, trichloroethylene distributes throughout the body via the circulatory system. Most trichloroethylene taken into the body is metabolized; direct exhalation of the parent compound is the other major route of elimination.

**Figure 1**



Metabolism of trichloroethylene. Metabolites marked with U are known urinary metabolites. Arrows with broken lines indicate other possible steps in forming dichloroacetic acid. Abbreviations: CYP, cytochrome P-450; DCA, dichloroacetic acid; DCVC, *S*-(1,2-dichlorovinyl)-L-cysteine; DCVG, *S*-(1,2-dichlorovinyl)glutathione; DCVT, *S*-(1,2-dichlorovinyl)thiol; GST, glutathione *S*-transferase; NAcDCVC, *N*-acetyl-*S*-(1,2-dichlorovinyl)-L-cysteine; TCA, trichloroacetic acid; TCE, trichloroethylene; TCE-O-CYP, trichloroethylene-oxide-cytochrome

P-450 complex; TCOH, trichloroethanol; TCOG, trichloroethanol glucuronide. (From (1)).

Figure 1 presents a postulated scheme for the pathways of trichloroethylene metabolism, adapted from the work of Clewell et al. (2000), Lash et al. (2000a), and recent studies described below. Trichloroethylene metabolism occurs through two main, irreversible pathways---oxidation via the microsomal mixed-function oxidase system (cytochrome P-450s [CYPs]) primarily to chloral [ $C_2HCl_3O$ ] or chloral hydrate [ $CCl_3CH(OH)_2$ ] and trichloroethylene oxide, and conjugation with glutathione by glutathione S-transferases to S-1,2-dichlorovinyl-L-glutathione. For trichloroethylene oxidation, CYP2E1 is thought to be most important in vivo. Subsequent important metabolic branch points include the production of trichloroethanol, regeneration of chloral and chloral hydrate from trichloroethanol, and further metabolism of S-1,2-dichlorovinyl-L-cysteine.

## Uses

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Up until 1977, trichloroethylene had direct uses for the human body. Used as a general anesthetic, skin wound and surgical disinfectant, and spice in coffee, human beings were ingesting and relying on trichloroethylene to sanitize their injuries. In 1977, these uses of trichloroethylene were banned by the FDA for their harm.

Today, there are different uses for trichloroethylene. As of 1986, 80% of the Trichloroethylene in the United States was used as vapor degreasing during production of metal parts.

Trichloroethylene was also used as a chemical intermediate and some was even produced for export. Trichloroethylene's purpose in vapor degreasing of metal parts is highly important. Used by automotive and metal industries, trichloroethylene proves to be powerful in the removal of grease, oil, fat, wax and tar.

Trichloroethylene has also been used by textile industries. Their main use of trichloroethylene is to clean cotton, wool and other fabrics. It is also used as a solvent for waterless dyeing.

Trichloroethylene is also found and used in products such as dyes, printing inks, paints, adhesives, paint removers, typewriter correction fluids, as well as spot removers.

About 10 million pounds of trichloroethylene are used each year in the manufacture of poly Vinyl Chloride.

It is an unstable and dangerous liquid that is non-flammable. When dealing with water, TCE is slightly soluble, while in most other organic Solvents - Chemical Profiles and External Links, TCE is very soluble. TCE is a colorless, or blue organic liquid, which has an odor somewhat like chloroform. The odor is sweet, and it has a sweet, yet burning taste.

Source : <http://www.toxipedia.org/display/toxipedia/Trichloroethylene>