

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

# ToxGuide™

for

# Tetrachloroethylene



CAS# 127-18-4

October 2014

U.S. Department of Health and Human Services  
Public Health Service  
Agency for Toxic Substances and Disease Registry  
[www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)

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### General Populations

- Contaminated air and water are the most important sources of exposure to tetrachloroethylene.
- Tetrachloroethylene in contaminated soil can migrate to indoor air through subsurface air spaces, including cracks in foundations.
- Dermal exposure can occur from contact with contaminated water such as during showering.
- Tetrachloroethylene readily volatilizes from shower and bath water and can be inhaled.
- Exposure to tetrachloroethylene may result from living in proximity to sites where it is produced or waste sites contaminated with the chemical.
- Using tetrachloroethylene-containing products such as printing ink, glues, sealants, polishes, lubricants, and silicones can result in exposure.
- Close proximity to clothing that was dry cleaned using tetrachloroethylene may lead to exposure of adults and children.

### Occupational Populations

- Workers involved in the manufacture of tetrachloroethylene.
- Workers using degreasers and other products containing tetrachloroethylene.
- Workers in the dry cleaning industry.

### Toxicokinetics

- Tetrachloroethylene is readily absorbed from the lung, gastrointestinal tract, and skin.
- Tetrachloroethylene is widely distributed throughout the body via the blood, regardless of the route of exposure; relatively high concentrations are found in fat, liver, and kidney.
- Metabolism of absorbed tetrachloroethylene is thought to occur mainly in the liver, lung, and kidney. Metabolism results in variety of metabolites, some of which may be toxic.
- Most absorbed tetrachloroethylene is excreted unchanged in the exhaled air regardless of route of exposure. Tetrachloroethylene metabolites (primarily trichloroacetic acid in humans) are mainly excreted in the urine.

### Normal Human Levels

- Tetrachloroethylene levels in blood of the general population generally range from below the instrumentation detection limit to as much as 0.23 parts per billion; blood levels in people living in rural areas are lower than those in people living in urban and industrial areas.

### Biomarkers

- Tetrachloroethylene can be measured in exhaled air, blood, or urine. However, tetrachloroethylene is rapidly metabolized to other substances which are not specific to tetrachloroethylene exposure.

### Environmental Levels

#### Air

- Tetrachloroethylene concentrations across the United States are generally less than 0.15 ppb, but may be higher near tetrachloroethylene-contaminated sites.

#### Water

- Tetrachloroethylene concentrations in drinking water in the United States are generally less than 5 ppb, but average levels of 17-28 ppb were measured in some California drinking water sources.

#### Food

- Tetrachloroethylene can migrate from air to food and concentrate to relatively high levels, particularly in areas where tetrachloroethylene air levels are high.

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2014. Toxicological Profile for Tetrachloroethylene (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.



## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### Tetrachloroethylene is a Liquid

- Tetrachloroethylene is a colorless liquid with an ethereal odor.
- Tetrachloroethylene is used commercially as a dry cleaning agent, metal degreaser, and as a chemical intermediate.
- Tetrachloroethylene is an excellent extraction solvent for greases, oils, fats, and waxes.
- Tetrachloroethylene is used to scour fabrics during production, and as a solvent in waterless drying and finishing operations.

- Inhalation – Significant route of exposure for workers in the dry cleaning industry; indoor and outdoor air exposure occurs among the general population.
- Oral – Important route of exposure for the general population through ingestion of contaminated drinking water.
- Dermal – Potential route of exposure, particularly among workers who handle substances with tetrachloroethylene.

### Tetrachloroethylene in the Environment

- In air, tetrachloroethylene breaks down slowly and can travel long distances. Levels in air depend on location; and they are usually higher in industrial and populated areas.
- Tetrachloroethylene readily partitions from surface soil and water to air. When it leaches deeper into subsurface soil, it is not readily degraded.
- Tetrachloroethylene can be slowly broken down in air by photochemical reactions.
- In water, tetrachloroethylene volatilizes to air more readily than it undergoes photooxidation or hydrolysis.
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- Tetrachloroethylene can migrate from surface soil to indoor air through cracks in foundations, etc.
- Tetrachloroethylene has a low tendency to bioaccumulate.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

### Minimal Risk Levels (MRLs)

#### Inhalation

- An MRL of 0.006 ppm has been derived for acute-duration ( $\leq 14$  days) inhalation exposure to tetrachloroethylene.
- An MRL of 0.006 ppm has been derived for intermediate-duration (15-364 days) inhalation exposure to tetrachloroethylene.
- An MRL of 0.006 ppm has been derived for chronic-duration ( $\geq 365$  days) inhalation exposure to tetrachloroethylene.

#### Oral

- An MRL of 0.008 mg/kg/day has been derived for acute-duration ( $\leq 14$  days) oral exposure to tetrachloroethylene.
- An MRL of 0.008 mg/kg/day has been derived for intermediate-duration (15-364 days) oral exposure to tetrachloroethylene.
- An MRL of 0.008 mg/kg/day has been derived for chronic-duration ( $\geq 365$  days) oral exposure to tetrachloroethylene.

### Health Effects

- The main targets of tetrachloroethylene toxicity include the central nervous system, kidney, liver, reproductive system, and developing fetus.
- Available human data provide suggestive evidence for tetrachloroethylene-induced bladder cancer, multiple myeloma, and non-Hodgkin's lymphoma.
- U.S. Environmental Protection Agency (EPA) concluded that tetrachloroethylene is likely to be carcinogenic to humans by all routes of exposure based on sufficient evidence in animals and suggestive evidence in humans. The International Agency for Research on Cancer (IARC) concluded that tetrachloroethylene is probably carcinogenic to humans based on sufficient evidence in animals and limited evidence in humans.

### Children's Health

- Children exposed to tetrachloroethylene are expected to experience effects similar to those seen in poisoned adults.
- Tetrachloroethylene has been detected in goat's milk, which indicates that it can be transferred by nursing.
- Results of some human studies suggest possible associations between *in utero* and early postnatal exposure and selected developmental abnormalities. Exposure of pregnant animals resulted in developmental abnormalities in the offspring.