

## Sources of Exposure

## Toxicokinetics and Biomonitoring

## Biomarkers/Environmental Levels

### General Populations

- The primary route of exposure for the general population is from inhalation of vehicle exhaust. However, the use of paints, varnishes, lacquers, shoe polishes, and cigarette smoke can contribute to levels indoors and personal exposures.
- Deliberate inhalation of fumes from paint thinner, glues, and other solvents containing toluene can cause serious harm.
- Toluene is not frequently detected in drinking water and food.

### Occupational Populations

- Occupational exposure to toluene is expected to be greater than the general population exposure for those often in or near vehicles (e.g., traffic police, toll attendants, automobile workers, etc.).
- Workers in nail salons, gasoline service stations, paint stripping, the printing industry or other occupations that use toluene may be exposed to higher concentrations.

### Toxicokinetics

- Absorption of toluene occurs from the lungs, the gastrointestinal tract, and skin.
- Toluene distributes widely to tissues and preferentially to fat, brain, bone marrow, liver, and kidneys.
- In animals, toluene can pass from the mother to the fetus through the placenta, but at lower concentrations than the mother's.
- Metabolism of toluene involves both microsomal enzymes and conjugation reactions.
- Most toluene is biotransformed and excreted rapidly in the urine. Some toluene is excreted unchanged in expired air and urine.

### NHANES Biomonitoring

- National surveys of the U.S. general population conducted in 2001–2006 showed that the geometric mean level of toluene in whole blood was approximately 0.135 ng/L.

### Biomarkers

- Toluene can be measured in the blood and urine.
- Urinary *ortho*-cresol, a toluene metabolite, can also be used as biomarker of toluene exposure.

### Environmental Levels

#### *Air*

- The daily arithmetic mean concentration of toluene in the air from various cities/counties in the United States in 2015 ranged from 0.29 to 45.9 ppb carbon.

#### *Sediment and Soil*

- No recent data are available for levels of toluene in sediment or soil.

#### *Water*

- In a survey of drinking-water wells by the USGS, the median concentration of toluene was 0.032 ppb when it was detected. 2% of wells had concentrations at or above 0.2 ppb.

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2017. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

# ToxGuide™

for

Toluene

C<sub>7</sub>H<sub>8</sub>

CAS# 108-83-3

June 2017

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)



**ATSDR**  
AGENCY FOR TOXIC SUBSTANCES  
AND DISEASE REGISTRY

## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### Toluene

- Toluene is a clear, colorless liquid with a distinctive smell.
- Toluene is produced in the process of making gasoline and other fuels from crude oil and in making coke from coal.
- Toluene is used as a solvent.
- Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.
- It is also used in the production of benzene, nylon, plastics, and polyurethane, and in the synthesis of trinitrotoluene (TNT), benzoic acid, benzoyl chloride, and toluene diisocyanate.
- Toluene is added to gasoline along with benzene and xylene to improve octane ratings.

- Inhalation – Principal route of exposure for the general population and those working with gasoline and other products containing toluene.
- Oral – Minor route of exposure because toluene is not frequently detected in food or water.
- Dermal – Possible route of exposure if using consumed products containing toluene (i.e., paints, paint thinners, adhesives, and nail polish).

### Toluene in the Environment

- Most of the toluene released to the environment partitions to air and degrades quickly by reactions with hydroxyl radicals.
- Toluene can enter the soil or water from spills of solvents and petroleum products, from leaking underground storage tanks, or when toluene-containing products are placed in landfills or waste sites.
- Toluene in surface water or soil will readily evaporate to the air or be degraded by bacteria.
- Toluene in subsurface water can be degraded by anaerobic microorganisms. Toluene does not usually stay in the environment long. It is not expected 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 acute-duration ( $\leq 14$  days) inhalation MRL of 2 ppm was derived for toluene.
- No intermediate-duration (15–364 days) inhalation MRL was derived for toluene.
- A chronic-duration ( $\geq 365$  days) inhalation MRL of 1 ppm was derived for toluene.

#### Oral

- An acute-duration ( $\leq 14$  days) oral MRL of 0.8 mg/kg/day was derived for toluene.
- An intermediate-duration (15–364 days) oral MRL of 0.2 mg/kg/day was derived for toluene.
- No chronic-duration ( $\geq 365$  days) oral MRL was derived for toluene.

### Health Effects

- The primary effect of toluene is on the nervous system. Low to moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite.

- Long-term exposure to toluene in the workplace may cause some hearing and color vision loss. Repeatedly breathing in toluene from glue or paint thinners may permanently damage the brain.
- Animals orally exposed to toluene had decreased thymus weight and depressed immune responses.
- Studies in workers and animals generally indicate that toluene is not carcinogenic.
- The U.S. Department of Health and Human Services has not considered the carcinogenicity of toluene. The U.S. Environmental Protection Agency (EPA) determined that there is inadequate information to assess the carcinogenic potential of toluene. The International Agency for Research on Cancer (IARC) determined that toluene is not classifiable as to its carcinogenicity in humans.

### Children's Health

- Some children and adolescents who repeatedly breathed high large amounts of toluene to get high developed loss of muscle control, loss of memory, poor balance, and decreased mental abilities.
- Pregnant women who breathed large amounts of toluene during pregnancy to get high have had children with birth defects, including retardation of mental abilities and growth.