

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™

for
Toluene
 C_7H_8

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U.S. Department of Health and Human Services
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Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

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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.
- 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 persons employed in heavy traffic occupations (e.g., toll attendants, automobile workers etc.).
- Workers in the printing industry or other industries employing toluene as a solvent may be exposed to higher concentrations.

Toxicokinetics

- Humans and animal studies indicate that toluene in air is rapidly absorbed through the lungs.
- Absorption through the gastrointestinal tract and the skin is less rapid.
- 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.
- 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.

Normal Human Levels

- National surveys of a few thousand people from the U.S. general population conducted in 2001-2006 showed that the geometric mean levels of toluene in whole blood were approximately 0.135 mg/L.

Biomarkers

- Toluene in urine can be used as biomarker for toluene exposure. *Ortho*-cresol in urine can also be used as biomarker of toluene exposure.

Environmental Levels

Air

- Levels in air in various cities/counties in the United States in 2013 were in the ppb range.

Sediment and Soil

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

Water

- Toluene was detected at the minimum reporting level of 0.2 ppb in 10 of 931 samples of groundwater and surface water sources used for drinking water supplies in the United States over a decade ago.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2015. Toxicological Profile for Toluene (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)

Toluene is a liquid

- 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 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

- Toluene enters the environment air when using materials that contain it.
- It can enter surface water and ground water from spills of solvents and petroleum products as well as leaking underground storage tanks at gasoline stations and other facilities.
- When toluene-containing products are placed in landfills or waste disposal sites, toluene can enter the soil or water near the waste site.
- Toluene in subsurface water can be degraded by anaerobic microorganisms.
- Toluene in surface water or soil will readily evaporate to the air or be degraded by bacteria.
- Toluene does not usually stay in the environment long.

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 2 ppm has been derived for acute-duration inhalation exposure (≤ 14 days).
- No MRL was derived for intermediate-duration inhalation exposure (15–364 days).
- An MRL of 1 ppm has been derived for chronic-duration inhalation exposure (15–364 days).

Oral

- An MRL of 0.8 mg/kg/day has been derived for acute-duration oral exposure (≤ 14 days).
- An MRL of 0.2 mg/kg/day has been derived for intermediate-duration oral exposure (15–364 days).
- No MRL was derived for chronic-duration oral exposure (365 days or longer).

Health Effects

- Toluene can affect 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.
- Studies in workers and animals generally indicate that toluene is not carcinogenic.
- The International Agency for Research on Cancer (IARC) determined that toluene is not classifiable as to its carcinogenicity in humans. The EPA determined there is inadequate information to assess the carcinogenic potential of toluene. The National Toxicology Program (NTP) has not considered the carcinogenic potential of toluene.

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.