

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™ for 1,3-Butadiene



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

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General Populations

- The predominant route of exposure for the general population is inhalation of contaminated air. Exposure through ingestion of food or water is expected to be low.
- People may be exposed through inhalation of air mixed with vehicle exhaust, tobacco smoke, burning wood, rubber or plastic, forest fires, or release at manufacturing plants.
- Exposure may also occur through dermal contact with gasoline or inhalation of gasoline fumes.

Occupational Populations

- Workers in the production of rubber, plastics and resins are more likely to be exposed than the general population.

Toxicokinetics

- 1,3-Butadiene is absorbed from the lungs into the bloodstream following inhalation exposure.
- The level of absorption following ingestion of 1,3-butadiene is not known.
- 1,3-Butadiene is broken down to its metabolites in the liver.
- About half of inhaled 1,3-butadiene is broken down and exhaled. The remaining chemical is broken down and excreted in the urine.

Normal Human Levels

- Background levels of 1,3-butadiene in the general population are not known.

Biomarkers

- 1,3-Butadiene metabolites in urine can be used as biomarkers of exposure.
- 1,3-Butadiene-derived hemoglobin adducts, which are surrogate biomarkers for 1,3-butadiene metabolites, have been shown to correlate with 1,3-butadiene exposure levels.

Environmental Levels

Air

- Average concentration in cities and suburban air is 0.04–1 ppb.

Sediment and Soil

- No data were located on the concentration of 1,3-butadiene in soil.

Water

- No data were located on the concentration of 1,3-butadiene in drinking water.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for 1,3-Butadiene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

Chemical and Physical Information

Routes of Exposure

Relevance to Public Health (Health Effects)

1,3-Butadiene is a Gas

- 1,3-Butadiene is a colorless gas with a mild gasoline-like odor. It is made from the processing of petroleum.
- About 60% of 1,3-butadiene produced is used to make synthetic rubber used for the production of car and truck tires.
- 1,3-Butadiene is also used in the production of high impact polystyrene and acrylonitrile-butadiene-styrene (ABS) resin plastics.

- Inhalation – Predominant route of exposure for the general and occupational populations.
- Oral – Minor route of exposure for the general population.
- Dermal – Minor route of exposure for the general population.

1,3-Butadiene in the Environment

- 1,3-Butadiene is released into the air by industrial sources, vehicle exhaust, cigarette smoke, burning of wood or plastics, and naturally through forest fires. Industrial release to water and soil is relatively low.
- In air, 1,3-butadiene is broken down in about 6 hours.
- In water and soil, 1,3-butadiene is expected to evaporate quickly into the air.
- 1,3-Butadiene is not believed to bioconcentrate in fish or aquatic organisms and does not biomagnify in the food chain.

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

Minimal Risk Levels (MRLs)

Inhalation

- No acute-, intermediate-, or chronic-duration inhalation MRLs were derived for 1,3-butadiene.

Oral

- No acute-, intermediate-, or chronic duration oral MRLs were derived for 1,3-butadiene.

Health Effects

- Numerous target organs for 1,3-butadiene toxicity have been identified in laboratory animals. Observed effects include neurological dysfunction, reproductive and developmental effects, hematological effects, lymphoreticular effects, and renal effects. Evaluation of the relevance of these effects to humans is encumbered by large species differences in the metabolism of 1,3-butadiene.
- Occupational exposure to 1,3-butadiene has been associated with increased hematology-related cancer deaths. Increased tumor incidences have also been observed in rodents. DHHS, IARC, and EPA have classified 1,3-butadiene as a human carcinogen.

Children's Health

- It is unknown whether children are more sensitive to 1,3-butadiene poisoning than adults.
- In laboratory animals, 1,3-butadiene causes skeletal abnormalities, brain growth outside of the skull, and late fetal deaths. The relevance of these developmental effects to humans is not known.