Sources of Exposure

General Populations

- The main route of carbon disulfide exposure for the general population would be through inhalation of ambient air; however, atmospheric concentrations of carbon disulfide are usually low.
- Persons living in certain source-dominated areas may be at risk for higher than background exposures to carbon disulfide. These may include persons living near industries and facilities that manufacture and use carbon disulfide.
- Carbon disulfide is also used in the production of certain pesticides (dithiocarbamates) and may be released during environmental degradation of these compounds, such as metam salts, dazomet, or thiram.

Occupational Populations

- Workers involved in the manufacture of carbon disulfide and production of products using this compound, such as viscose rayon fibers, cellophane, and cellulosic sponges, are exposed to higher levels than the general population.
- While inhalation is the predominant route of exposure in occupational settings, dermal exposure may also occur.

Toxicokinetics and Biomonitoring Levels

Toxicokinetics

- Available data from human and animal studies indicate that carbon disulfide is extensively and rapidly absorbed via inhalation, oral, and dermal routes.
- Inhalation studies indicate that a minimum of 80% of the inhaled dose in humans is absorbed. In laboratory animals, absorption was approximately 70–80% of the administered dose.
- In rats, at least 63% of an intragastric dose was absorbed.
- Absorbed carbon disulfide is distributed throughout the body. Because of its lipophilic nature, its distribution is greatest in organs such as the brain and liver.
- Carbon disulfide is also distributed to the developing fetus and into breast milk.
- Carbon disulfide is metabolized by cytochrome P-450 to an unstable oxygen intermediate that either spontaneously degrades to atomic sulfur and carbonyl sulfide or hydrolyzes to form atomic sulfur and monothiocarbonate.
- Renal excretion is the primary route of excretion of carbon disulfide metabolites.
- Unmetabolized carbon disulfide is exhaled in air, with small amounts (<1%) excreted in the urine.

NHANES Levels

- There are no data regarding levels of carbon disulfide in the general population.

Biomarkers/Environmental Levels

Biomarkers

- The most sensitive biomarker for carbon disulfide that correlates best with exposure is urinary levels of the metabolite, 2-thio-1,3 thiazolidine-4 carboxylic acid (TTCA).
- However, TTCA is not specific for carbon disulfide exposure, as it is also detected in low levels in people who eat brassica vegetable (e.g., cabbage, Brussels sprouts).

Environmental Levels

Air

- The mean concentration of carbon disulfide measured in 1,532 air samples across the United States in 2022 was 0.199 µg/m^3 (EPA Air Quality System)

Water

- In 19 surface water samples taken across the United States from 2021 to 2023, the average concentration of carbon disulfide was 0.173 ug/L (Water Quality Portal database).

Sediment and Soil

- No recent monitoring data were available for carbon disulfide levels in soil.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2024. Toxicological Profile for Carbon Disulfide (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Carbon Disulfide

CAS # 75-15-0

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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

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Carbon Disulfide

- Carbon disulfide is a clear, colorless, or faintly yellow colored volatile liquid.
- Purest distillates have sweet, pleasing, and ethereal odor; commercial and reagent grades have a foul sulfuric (rotten egg) smell.
- Carbon disulfide is released to the atmosphere naturally through process such as composting, and volcanic and geothermal activity.
- Carbon disulfide is commercially manufactured by the reaction of sulfur with charcoal or methane.
- In industry, carbon disulfide is used to solubilize fats, rubbers, phosphorus, sulfur, and other elements.
- Carbon disulfide is primarily used in the production of viscose rayon fibers.
- A historic use of carbon disulfide was in the production of carbon tetrachloride; it has not been used in this process in the United States since the early 1990s.

Routes of Exposure

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

Carbon Disulfide in the Environment

- Carbon disulfide is released to the environment from both natural sources (volcanic activity, ocean, marshes, and coastal areas) and anthropogenic sources (primarily industrial emissions).
- Carbon disulfide is expected to partition mainly to the air. In air, carbon disulfide will react with photochemically generated hydroxyl radicals and has an estimated half-life of 5.5 days.
- If released to water, carbon disulfide can hydrolyze slowly under alkaline conditions; however, volatilization to the atmosphere will be the overwhelming environmental fate process.
- In soil, carbon disulfide will rapidly volatilize to the atmosphere, but a small portion could leach into groundwater since it does not adsorb strongly to soil.
- The potential for carbon disulfide to bioconcentrate in aquatic organisms is low.

Relevance to Public Health (Health Effects)

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

Minimal Risk Levels (MRLs)

Inhalation

- A provisional acute-duration (≤14 days) inhalation MRL of 0.2 ppm was derived.
- A provisional intermediate-duration (15–364 days) inhalation MRL was not derived.
- A provisional chronic-duration (≥365 days) inhalation MRL of 0.1 ppm was derived.

Oral

- A provisional acute-duration (≤14 days) inhalation MRL of 0.03 mg/kg/day was derived.
- No provisional intermediate- or chronic-duration oral MRLs were derived for carbon disulfide.

Health Effects

- Neurological effects have consistently been reported in workers exposed to carbon disulfide, primarily peripheral neuropathy (subjective reports of altered sensation, impaired nerve conduction, decreased pain sensitivity, tremors, and abnormal movements).
- Additional health effects observed in occupational cohorts of viscose rayon factories or other workers exposed to carbon disulfide include retinal microaneurysms, elevated cholesterol and serum lipids, cardiovascular disease, and decreased male libido and sexual performance in several occupational cohorts of viscose rayon factories or other workers exposed to carbon disulfide.
- Animal studies support that the peripheral nervous system is a primary target of carbon disulfide toxicity following inhalation or oral exposure, with damage to the central nervous system at higher concentrations.
- Inhalation studies in animals also provide some evidence of altered cardiac function, altered lipid homeostasis, and altered male mating behavior following exposure to carbon disulfide.
- In animals, developmental effects were observed in both rats and rabbits following inhalation or oral exposure including increased resorptions, increased pup mortality, delayed growth and development, and increased visceral and skeletal malformations.
- The U.S. Environmental Protection Agency (EPA), National Toxicology Program, and International Agency for Research on Cancer have not evaluated the potential for carbon disulfide to cause carcinogenicity in humans.

Children's Health

- It is not known if children are more sensitive to carbon disulfide exposure than adults.