

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™ for Acrylamide



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U.S. Department of Health and
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Public Health Service
Agency for Toxic Substances
and Disease Registry
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General Populations

- The primary route of exposure for the general population is ingestion of contaminated food.
- Acrylamide is formed in foods that are rich in carbohydrates when they are fried, grilled or baked. Starchy foods such as potato-based products typically contain the highest levels of acrylamide, whereas protein-based foods contain smaller amounts.
- In places near plastic and dye plants, drinking water may contain acrylamide.
- Exposure may also occur through inhalation of tobacco smoke (including second-hand smoke).

Occupational Populations

- People involved in the production or use of acrylamide and acrylamide-containing products are more likely to be exposed than the general population.
- Exposure may also occur in laboratories utilizing polyacrylamide gels.

Toxicokinetics

- Animal data indicates that acrylamide is readily and rapidly absorbed following inhalation and oral exposure, and somewhat less rapidly following dermal exposure.
- Once absorbed, acrylamide is widely distributed throughout the body.
- Acrylamide is rapidly metabolized; glycidamide is the principal toxicologically significant metabolite.
- Acrylamide is excreted from the body as metabolites in the urine.

Normal Human Levels

- No data available.

Biomarkers

- Results of epidemiological studies support the use of hemoglobin adducts of acrylamide and/or glycidamide as biomarkers of exposure.

Environmental Levels

Air

- Limited data indicate that acrylamide concentrations in the atmosphere are very low.

Sediment and Soil

- Concentrations in soil near acrylamide/polyacrylamide producers range from <0.02 to <0.08 µg/g.

Water

- Concentration of acrylamide in river and tap water is <5 µg/L.

Reference

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

Chemical and Physical Information

Routes of Exposure and Acrylamide in the Environment

Relevance to Public Health (Health Effects)

Acrylamide

- Acrylamide is a colorless, odorless, crystalline solid that can react violently when melting. When it is heated, acrid fumes may be released.
- Acrylamide is used to make polyacrylamide, which is mainly used to treat effluent from water treatment plants and industrial processes.
- In addition, acrylamide and polyacrylamides are used in the production of dyes and organic chemicals, contact lenses, cosmetics and toiletries, permanent-press fabrics, paper and textile production, pulp and paper production, ore processing, sugar refining, and as a chemical grouting agent and soil stabilizer for the construction of tunnels, sewers, wells and reservoirs.

Route of Exposure

- Inhalation – Minor route of exposure for the general population; major route for individuals exposed to tobacco smoke. Major route of occupational exposure through inhalation of dust or aerosols.
- Oral – Predominant route of exposure for general population through ingestion of contaminated food.
- Dermal – Primary route of occupational exposure through contact with handling bags and drums of the chemical.

Acrylamide in the Environment

- Acrylamide is most commonly found in water and soil, but is rarely found in air.
- It is not considered highly persistent in the environment and is expected to be highly mobile in soil and water.
- When released to land, acrylamide does not bind to soil, and will move rapidly through the soil column and into ground water. It is removed from soil through enzyme-catalyzed hydrolysis.
- Acrylamide is not expected to significantly bioconcentrate in aquatic organisms.

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 have been derived for acrylamide

Oral

- An MRL of 0.01 mg/kg/day has been derived for acute-duration oral exposure (≤ 14 days).
- An MRL of 0.001 mg/kg/day has been derived for intermediate-duration oral exposure (15–364 days).
- An MRL of 0.001 mg/kg/day has been derived for chronic-duration oral exposure (≥ 365 days).

Health Effects

- The primary targets of acrylamide toxicity are the nervous system and reproductive system.
- Central-peripheral neuropathy has been observed in humans and laboratory animals. In humans, the hallmark symptoms are ataxia and skeletal muscle weakness.
- Pre- and postimplantation losses and decreased number of live fetuses have been observed in animals; effects are likely male-mediated. Decreased sperm mobility, degenerative effects in spermatids and testicular atrophy have also been observed in animals.
- Acrylamide has caused several types of cancer in animals. DHHS considers acrylamide reasonably anticipated to be a human carcinogen, IARC consider it a probable human carcinogen, and EPA has characterized it as likely to be carcinogenic to humans.

Children's Health

- Acrylamide is expected to affect children in the same manner as adults.
- Acrylamide can cross the placenta and has been detected in breast milk.
- Neurodevelopmental effects have been observed in the offspring of animals exposed to acrylamide during pregnancy.