

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

# ToxGuide™ for Acrylamide



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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](http://www.atsdr.cdc.gov)

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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 ( $\leq 14$  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 ( $\geq 365$  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.