

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

### General Populations

- Exposure of the general population to glyphosate may occur through contaminated air, water, or soil near agricultural land or residential areas where glyphosate was used.
- Exposure to small amounts of glyphosate residue on some foods may occur, although these levels are very low.

### Occupational Populations

- Farm workers, farming families, landscaping workers, and people of all ages living and/or working in agricultural sectors will incur higher exposure to glyphosate, as agriculture is the largest industry for herbicide use.
- Workers who apply herbicides are the most likely to be exposed.
- Occupational exposure is most likely to occur through inhalation or dermal contact.

### Toxicokinetics

- Glyphosate is readily absorbed through the gastrointestinal tract and likely to be absorbed through the respiratory tract, but very little glyphosate is absorbed through the skin.
- Absorbed glyphosate is distributed to the kidney, liver, and brain in humans and also circulates in the blood. However, it does not significantly accumulate in the body.
- Glyphosate does not undergo significant metabolism in mammals. The majority of glyphosate remains in the parent form until excretion.
- Urine and feces are the main routes of excretion for glyphosate in both humans and animals.

### Normal Human Levels

- No information on blood levels of glyphosate in the general U.S. population was identified.
- Studies show that agricultural workers and their families may have a range of glyphosate blood levels, depending on their contact with the chemical and how recently they were exposed to it.

### Biomarkers

Glyphosate and its metabolite AMPA can be measured in blood and urine. However, because glyphosate and AMPA are not expected to stay in the body for more than a few hours to a few days, these biomarkers can only help determine recent exposure to glyphosate.

### Environmental Levels

- Air:
  - Range <0.01–9.1 ng/m<sup>3</sup>
- Water:
  - Surface water range 0.02–427 µg/L
  - Groundwater range 0.01–4.7 µg/L

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR).2020. Toxicological Profile for Glyphosate. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

# ToxGuide™

for

# Glyphosate

C3H8NO5P

CAS# 1071-83-6

August 2020

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)



## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### Glyphosate is a white crystal or powder

- Glyphosate is present in many herbicide formulations as glyphosate isopropylamine salt.
- Glyphosate is usually used as an ingredient in herbicide formulations. The amount of glyphosate and other ingredients included in these formulations varies between products.
- Glyphosate is an odorless organic solid that is very soluble in water.
- It is a man-made chemical used to control the growth of weeds in agriculture, gardening, and lawn care.

- **Inhalation** – Inhalation exposure from glyphosate released into the atmosphere may occur on or near agricultural land. Inhalation is a primary route of exposure for workers and those who live near agricultural land.
- **Oral** – The general public is potentially exposed to low levels of glyphosate through ingestion of foods with glyphosate residues and/or through ingestion of contaminated water.
- **Dermal** – Dermal contact is a potential route of exposure for workers, especially herbicide applicators. While glyphosate is expected to be broken down by bacteria, it may also linger in the soil which may contribute to dermal exposures.

### Glyphosate in the Environment

- Glyphosate is a man-made chemical. The half-life of glyphosate ranges from 2 to 215 days in soils and from 1.5 to 130 days in water.
- Microbial degradation is an important fate process for glyphosate. It is less likely to be broken down in air.
- Glyphosate is not likely to migrate through the soil and into groundwater since it is expected to have low mobility in soils.
- Glyphosate is not likely to bioaccumulate in fish or other 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 were derived for glyphosate.

#### *Oral*

- Acute ( $\leq 14$  days) and chronic-duration ( $\geq 365$  days) oral MRLs of 1 mg/kg/day was derived for technical glyphosate.
- The chronic-duration ( $\geq 365$  days) oral MRL of 1 mg/kg/day was adopted as the intermediate-duration (15 to 364 days) oral MRL for technical glyphosate.

### Health Effects

- Information regarding the health effects of glyphosate in humans mostly relies on epidemiologic studies. Respiratory effects including rhinitis, atopic asthma, and wheeze were found in agricultural workers. Dermatological and ocular effects have also been documented, and some studies found reproductive and developmental effects.
- Glyphosate-containing herbicide formulations have also been associated with similar health effects, but these effects cannot be fully evaluated, given the additional ingredients in these herbicide formulations.

### Health Effects

- The main targets of glyphosate toxicity in animals include the gastrointestinal system, kidney, liver, eyes and growth of developing fetuses. Some studies have also found an association between glyphosate exposure and decreased body weight.
- The gastrointestinal tract has been identified as the most sensitive target of glyphosate following oral exposure. There were too few inhalation and dermal studies to draw a conclusion about health effects following those routes of exposure.
- Adverse developmental effects have also been observed in rodents. These effects include depressed offspring weight, delayed puberty in males, and increases in organ system diseases in offspring.
- The carcinogenic potential of glyphosate is not fully understood. The EPA found that glyphosate was not classifiable in terms of carcinogenicity, but that the literature supports a classification of “not likely to be carcinogenic to humans.” while the International Agency for Research on Cancer (IARC) has classified glyphosate as “probably carcinogenic to humans”.

### Children's Health

- Overall, children exposed to glyphosate would be expected to experience effects similar to those expected in adults. However, children's hand-to-mouth behavior and small size may make them more susceptible to glyphosate exposure.