

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

General Populations

- The primary sources of exposure for the general population are pesticide products containing 2,4-D.
- Dermal contact is also possible when entering grassy areas or swimming areas shortly after 2,4-D was sprayed to control weeds.
- The general population is unlikely to be exposed to high levels of 2,4-D in food, drinking water, or soil.

Occupational Populations

- Workers involved in the production of 2,4-D may be exposed by inhalation and/or dermal contact.
- Pesticide applicators may be exposed during mixing, loading, and application of 2,4-D products to control weeds.
- Families of workers may also be exposed by home surfaces contaminated from contact with an applicator's hands or clothing, and touching a person that has been applying 2,4-D very recently.

Toxicokinetics

- 2,4-D is readily absorbed following oral exposure and likely following inhalation exposure; absorption through the skin is relatively low.
- Absorbed 2,4-D is widely distributed in the body, but does not accumulate in tissues.
- 2,4-D is not readily metabolized in the body.
- 2,4-D is rapidly eliminated in the urine.

Normal Human Levels

- In the National Health and Nutrition Examination Survey (NHANES), mean 2,4-D levels were 0.193–0.521 ppb for urine samples collected during for the years 2003–2004 and 2009–2010. However, mean levels for the years 1999–2002 and 2007–2008 could not be calculated because 2,4-D was not detected in many of the urine samples.

Biomarkers

- The most reliable biomarker of exposure is 2,4-D in urine.
- There are no biomarkers of effects that would be specific to 2,4-D exposure.

Environmental Levels

Air

- Outdoor air: Up to 600 ppb near areas of heavy 2,4-D usage, but generally not detected otherwise.
- Indoor air: No reliable data

Sediment and soil

- Soil (range): 8–143 ppb

Water

- Surface water (range): 0.003–37 ppb
- Ground water (range): 0.33–50 ppb
- Drinking water (range): 0.0011–58 ppb

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2020. Toxicological Profile for 2,4-D. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™

for

2,4-D
(2,4-Dichlorophenoxy-
acetic acid)

$C_8H_6Cl_2O_3$

(CAS# 94-75-7)

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www.atsdr.cdc.gov



Chemical and Physical Information

Routes of Exposure

Relevance to Public Health (Health Effects)

2,4-D is a Man-Made Chemical

- Pure 2,4-D (2,4-dichlorophenoxyacetic acid) is an odorless or slightly phenolic white to yellow crystalline powder.
- 2,4-D is the active ingredient in many herbicidal products. It also may be combined with other herbicides in commercial products.
- There are nine forms of 2,4-D that can be used as an herbicide; these forms include salts and esters of 2,4-D.
- 2,4-D is sold commercially as emulsifiable concentrate, wettable granules, wettable powder, emulsion (esters), and aqueous solution (salts).

- Inhalation – Important route of exposure for workers involved in 2,4-D production or use, and the general population who use products containing 2,4-D.
- Oral – Potential route of exposure for the general population through ingestion of contaminated food or water, but levels are low.
- Dermal – Possible route of exposure for workers involved in 2,4-D production or use, and the general population who use products containing 2,4-D.

2,4-D in the Environment

- 2,4-D can enter the air when it is manufactured or during spray applications.
- In air, 2,4-D can be broken down by reactions with other chemicals or can settle to the ground.
- 2,4-D enters aquatic systems when sprayed on nearby plants, from runoff and soil erosion, or when it is used on water plants.
- 2,4-D in air or soil does not usually stay in the environment long.
- 2,4-D in water breaks down slowly.
- 2,4-D does not bioconcentrate in aquatic systems.

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 2,4-D.

Oral

- No acute-duration oral MRL was derived for 2,4-D.
- An intermediate-duration (15–364 days) oral MRL of 0.2 mg/kg/day was derived for 2,4-D.
- A chronic-duration (≥ 365 days) oral MRL of 0.2 mg/kg/day was derived for 2,4-D.

Health Effects

- Respiratory and nervous system effects were seen in people who purposely or accidentally swallowed large amounts of 2,4-D. These serious effects are not likely to occur at the levels of 2,4-D that are found in the environment.
- Animals given large oral doses of 2,4-D exhibited adverse effects on the blood, liver, kidney, and thyroid gland. These doses were generally much higher than environmental levels.
- A few studies of farmers or professional applicators of herbicides containing 2,4-D reported increased risk of lymphatic system cancers, particularly Non-Hodgkin's lymphoma (NHL). These workers were exposed to higher amounts of 2,4-D than most people.
- The Environmental Protection Agency (EPA) assigned 2,4-D to Class D (not classifiable as to human carcinogenicity) based on inadequate human and animal data. The International Agency for Research on Cancer classified 2,4-D as possibly carcinogenic to humans (Group 2B).

Children's Health

- Some studies of animals given 2,4-D during pregnancy found decreased weight of fetuses and young offspring and some changes in behavior of the offspring.