Sources of Exposure

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 and Normal Human Levels

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/Environmental Levels

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)

July 2020

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

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).

Routes of Exposure

- 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.

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

- 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.