1,3-DICHLOROPROPENE (1,3-D) fact sheet

What is 1,3-Dichloropropene?

photo credit: University of Georgia Plant Pathology, University of Georgia, Bugwood.org (1492127)

1,3-D is a soil fumigant.[1,2] It may also be called DCP, 1,3-dichloropropene, or dichloro-1,3-propene.[2] Manufacturers sell it under the trade name Telone.[3] In this fact sheet, we will refer to it as 1,3-D.

1,3-D was first registered as a pesticide in the United States in 1954.[3] Farmers use it as a **soil fumigant** for nematodes, symphylans, wireworms, centipedes, and other soil-dwelling pests.[4,5] Farmers inject 1,3-D into the soil before planting and by drip irrigation after planting to control soil pests.[6]

Industrial sources not related to pesticides may release 1,3-D into surface waters. Sewage treatment plant wastewater has had 1,3-D in it. 1,3-D may form in water discharged from power plants when the cooling water is treated with chlorine. Manufacturing plants that process paint and ink have released wastewater containing 1,3-D.[7]

Technical Grade 1,3-D: This fact sheet refers to the technical grade, or "pure" 1,3-D only. Products you buy from the store include other ingredients as well. While many of the chemicals used as other ingredients may not pose health or environmental risks, some of them can be toxic. In some cases, the other ingredients can pose greater risks than the active ingredient itself.

What are some products that contain 1,3-D?

Products with 1,3-D are sold as pressurized gas, emulsifiable concentrate, pressurized liquid, ready-to-use liquid, and flowable concentrates. Companies have roughly 20 products registered with the U.S. Environmental Protection Agency (U.S. EPA).[5] More than one company distributes some of these products.

1,3-D is a restricted-use pesticide, or RUP. Only people who are certified to apply 1,3-D may buy or use it. The U.S. EPA has not registered 1,3-D for residential areas.[4]

Farmers use products containing 1,3-D for soil fumigation on several crops. These include berries, vegetables, tree fruits and nuts, nursery crops, grapevines, ornamental trees and shrubs, corn, and alfalfa.[5] Farmers often use it with other soil fumigants such as chloropicrin to increase control of pests.[4]

Farmers ***cannot*** use 1,3-D in **organic agriculture**.[8]

IMPORTANT: Always ***follow label instructions*** and take steps to ***avoid exposure***. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 800-222-1222. If you wish to discuss a ***pesticide problem***, please call 1-800-858-7378.

How does 1,3-D work?

Scientists don't know exactly how 1,3-D works.[6] They think that 1,3-D kills pests by blocking enzymes the pests need to survive.[9,10]

How might I be exposed to 1,3-D?

You may be exposed to 1,3-D if you get it on your skin, breathe it in, or if you eat or drink it. This is true of any pesticide. For a pesticide exposure to harm you, you must be exposed to enough of it. If a pesticide is very toxic, it may cause harm from only a small exposure.

If you are close to an application site, 1,3-D could get on your skin or you could breathe it in if the **pesticide drifts** or evaporates from the application site.[11] Because 1,3-D easily turns into a gas, exposure is most likely to be from breathing in vapors.[12]

What are pesticide tolerances?

The EPA sets legal limits for how much pesticide is allowed in food and drinking water. In food, those limits are called "tolerances." Every pesticide has its own tolerance for each crop it can be used on. In water, those limits may be called Maximum Contaminant Levels (MCLs), health advisories (HA), or other names. The amount allowed in water is specifically regulated for some pesticides. Health advisories are issued for others.

You may be exposed to very low levels of 1,3-D **residues** on or in food because farmers use products containing 1,3-D on crops such as grapes and fruit trees.[5] The U.S. EPA expects these residues to be well below the level that could cause harm. **See the text box about pesticide tolerances.**

What are some signs and symptoms from a brief exposure to 1,3-D?

People have been exposed to 1,3-D when it drifted off-site during an application. People have been exposed after applications when 1,3-D vaporized from soil and drifted into areas near the treated fields.[11] **See the text box about pesticide risk.**

1,3-D has a "sharp, sweet, penetrating odor."[7] Volunteers could smell 1,3-D at concentrations as low as 1 ppm but on average people detected 1,3-D at concentrations of 4.4 ppm.[13] **See the text box about ppm.**

Pesticide Risk: Any chemical, including any pesticide, can pose risks to people, pets, or the environment. Understanding *pesticide risk* will help you take *steps to minimize it*. The risk of a pesticide depends on two things, exposure (how much?) and toxicity (how poisonous?). The exposure is the amount you get in or on your body, or the amount that is released into the environment. The toxicity of a pesticide is a measure of how poisonous it is to people or the environment. Even products that are low in toxicity can be hazardous if the exposure is high enough. Take steps to lower your chance of exposure to reduce your risk.

parts per million (ppm): parts per million (ppm) measures very small concentrations. It is how many parts of a contaminant are present per million parts of soil, water, or other substance like food. It may sometimes be equivalent to mg/kg or mg/L if it refers to how much of the substance was consumed relative to body weight (*see text box on mg/kg*). However, if ppm refers to a concentration in food or water, it is not the same as the dose given to a test animal or eaten by a person because it does not account for their body weight.

If inhaled

People who breathed in 1,3-D have reported:

- irritated mucous membranes;
- irritated, watery eyes and runny nose; and
- nausea, headache, vomiting, chest discomfort, and dizziness.[1,6,9]
- Some people reported headaches, chest and abdominal discomfort that lasted for up to two years after an accident that exposed them to vapors.[12]

People have reported coughing and burning eyes after exposure to 1,3-D vapor. The warning agent added to 1,3-D may have caused their symptoms.[11]

Rats who breathed in 1,3-D vapor had signs of eye and nasal irritation and they smelled like garlic.[13] Rats also had diarrhea and lethargy after breathing in 1,3-D. Other rats who inhaled 1,3-D had tremors, convulsions, and runny eyes. They also drooled.[12]

If on the skin

People had severe irritation and inflammation when they got 1,3-D on their skin.[9,12] 1,3-D can cause an allergic reaction if it gets on someone's skin repeatedly. This is called skin sensitization.[12]

Scientists put 1,3-D on the skins of rabbits for four hours. Their skin developed redness and "moderate to severe" buildup of fluid in the skin.[13]

If swallowed

People who accidentally swallowed 1,3-D had:

- congestion and fluid buildup in their lungs,
- central nervous system depression, and
- gastro-intestinal distress.[9]

One person died several hours after accidentally drinking a product containing 1,3-D. The person experienced vomiting, abdominal pain, fluid buildup in their lungs, and muscle twitches.[2,9]

If in the eyes

1,3-D caused severe irritation in the outermost surface of rabbits' eyes and inside their eyelids. The rabbits had moderate damage to their corneas. The corneas healed 8 days after exposure.[2]

What happens to 1,3-D when it enters the body?

The body quickly and easily absorbs 1,3-D. The body discharges most of it within two days. The kidneys excrete one form of 1,3-D mostly in urine. The lungs expel nearly a quarter of the other form while the kidneys get rid of the rest.

Absorption and Distribution

1,3-D can be absorbed into the body from the skin, respiratory tract, stomach, and intestines.[2,15]

- When scientists gave rats 1,3-D by mouth, the rats absorbed 90% of the dose.[2] They excreted 80-90% of it within a day.[16]
- Human volunteers inhaled 1 ppm of 1,3-D vapor for 6 hours. The 1,3-D had a half-life in blood of less than 10 minutes.[12]
- Volunteers exposed to 1,3-D vapor absorbed 2-5% through their skin.[12] 1,3-D reached stable levels in the blood of other volunteers who inhaled it within 10 minutes.[6]

Metabolism and Excretion

1,3-D breaks down into several chemicals in the body. The kidneys excrete most of the breakdown chemicals in the urine.[2,12] 1,3-D disappears from the body within minutes to hours.[12] 1,3-D itself is not found in urine because it gets broken down first.[14]

- Several studies on laboratory animals found that animals got rid of 80% of the oral dose within 24 hours, and more than 95% after four days.[2,12,16] Animals passed most of the dose in 24 to 48 hours.[2]

The highlighted/shaded boxes in the table below reflect the toxicity classification (high, moderate, low, or very low) of exposure by the route indicated in the left-hand column.

TOXICITY CLASSIFICATION: 1,3-D (see the text box about **mg/kg**)

	High Toxicity	Moderate Toxicity	Low Toxicity	Very Low Toxicity
Acute Oral LD_{50}	≤ 50 mg/kg[2]	**> 50 – 500 mg/kg[3]**	> 500 – 5000 mg/kg	> 5000 mg/kg
Inhalation LC_{50}	≤ 0.05 mg/L	> 0.05 – 0.5 mg/L	> 0.5 – 2.0 mg/L	**> 2.0 mg/[14]**
Dermal LD_{50}	≤ 200 mg/kg	**> 200 - 2000 mg/kg[3]**	> 2000 – 5000 mg/kg	> 5000 mg/kg
Primary Eye Irritation	Corrosive (irreversible destruction of ocular tissue) or corneal involvement or irritation persisting for more than 21 days	**Corneal involvement or other eye irritation clearing in 8 - 21 days[14]**	Corneal involvement or other eye irritation clearing in 7 days or less	Minimal effects clearing in less than 24 hours
Primary Skin Irritation	Corrosive (tissue destruction into the dermis and/or scarring)	**Severe irritation at 72 hours (severe erythema or edema)[14]**	Moderate irritation at 72 hours (moderate erythema)	Mild or slight irritation at 72 hours (no irritation or erythema)

You may be wondering why the "High Toxicity" column has smaller numbers than the "Low Toxicity" column. This is because if a smaller amount of the pesticide caused a health effect, it's more toxic. If it takes a larger amount of the pesticide to cause a health effect, it's less toxic.

Modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Statements. https://www.epa.gov/sites/default/files/2018-04/documents/chap-07-mar-2018.pdf

LD_{50}/LC_{50}:A common measure of acute toxicity is the lethal dose (LD_{50}) or lethal concentration (LC_{50}) that causes death (resulting from a single or limited exposure) in 50 percent of test animals. LD_{50} is generally expressed as the dose in milligrams (mg) of chemical per kilogram (kg) of body weight. LC_{50} is often expressed as mg of chemical per volume (e.g., liter (L)) of medium (i.e., air or water) the animal is exposed to. Chemicals are considered highly toxic when the LD_{50}/LC_{50} is small and less toxic when the value is large.

- When rats inhaled concentrations of 1,3-D ranging from 30-900 ppm for 3 hours, the half-life of 1,3-D in their blood was 6 to 43 minutes.[17]
- Lung tissue released small amounts of 1,3-D after scientists gave it to rats by mouth. The rats' lungs released 23% of the *trans* isomer but the *cis* isomer was excreted mostly in urine.[2,16] **See the text box about Chemical Forms of 1,3-D.**
- Human volunteers inhaled 1 ppm of 1,3-D vapor for 6 hours. Their bodies absorbed 80% of the 1,3-D. Blood levels fell rapidly after the exposure stopped. The half-life in blood was less than 10 minutes. The volunteers had excreted 80% of the dose by 36 hours.[12]
- In another study where human volunteers inhaled 1,3-D, the half-life in urine had two phases. The initial half-life was 4 hours and 12 minutes for the *cis* isomer and 3 hours and 12 minutes for the *trans* isomer. The second phase half-lives were 12 hours and 18 minutes for the *cis* isomer and 17 hours and 6 minutes for the *trans* isomer.[6]

Chemical Forms of 1,3-D

Dichloropropene is a molecule made up of three carbon atoms and two chlorine atoms. It has several forms. The numbers in the chemical name refer to which carbon atom has the chlorine atoms. 1,3-D has its chlorine atoms attached to the first and third carbon atoms. 2,3-D has its chlorine atoms on the second and third carbon atoms. The location of the chlorine atoms affects the chemical's behavior. 1,3-D is used as a pesticide. 2,3-D is used in manufacturing.[26]

1,3-D is a mix of very similar chemicals called isomers. The isomers have the same basic structure, but the two chlorine atoms differ in how they attach to their carbon atom relative to each other.[27]

Imagine an ant wearing a shoe on its left front leg and its left rear leg. The shoe is the chlorine atom. That is what a *cis* isomer looks like. Now imagine the ant with one shoe on its left front leg, but the other shoe on its right rear leg. That is called the *trans* isomer. The isomers have different properties even though they are the same chemical.[9] Commercial products are mixes of the two isomers in similar amounts.[6]

Are children more sensitive to 1,3-D than adults?

No research was found that suggested that **children** are more affected by 1,3-D exposure than adults. The U.S. EPA found no studies examining the effects of 1,3-D on children or young animals, although developmental studies suggest that 1,3-D likely does not affect development.[7]

Young children may act in ways that put them at greater risk of being exposed to pesticides. For example, they may spend more time near the floor. They may also be more likely to place their hands in their mouths after touching treated surfaces or pets.

Is 1,3-D likely to contribute to the development of cancer?

Several agencies have classified 1,3-D as a possible or probable carcinogen based on both human and animal data. For more information, visit NPIC's webpage: **Can pesticides cause cancer?**

- EPA classified 1,3-D as "suggestive evidence of carcinogenic potential" based on recent studies.[4]
- The International Agency for Research on Cancer (IARC) classified 1,3-D as "possibly carcinogenic to humans" based on animal studies.[18]
- 1,3-D has been classified as a "probable human carcinogen" by the International Program on Chemical Safety.[1]

Animal studies

Scientists have studied 1,3-D in both live animals and in tissue cultures. They have exposed laboratory animals to 1,3-D by stomach tube, in their food, and in their air. Animals had abnormal growths and benign, non-cancerous tumors in some studies. Although 1,3-D may damage DNA in isolated cells, it does not seem to cause genetic damage in living animals.

- Scientists gave rats the commercial product Telone II by stomach tube three times a week for two years. Rats given doses of either 25 or 50 mg/kg per day had increased cases of abnormal growths in their forestomaches and livers.[2] **See the text box about mg/kg**.
- Scientists fed rats and mice 1,3-D in the commercial product Telone II for two years. The rats received doses of up to 25 mg/kg body weight per day, and the mice received up to 50 mg/kg per day. The scientists found some evidence of increased benign liver tumors in the rats fed the highest dose.[19]

What is milligrams per kilogram (mg/kg)?

"mg/kg" is a way to measure a chemical dose. This can tell us how toxic a chemical is. "mg" means milligrams of a chemical. "kg" means one kilogram of an animal's body weight. Something that is highly toxic may kill a person with a very small amount of chemical. If something is very low in toxicity, it may take much more for that same person to become very sick or die.

- Rats inhaled vapors of Telone II at concentrations of up to 60 ppm for two years. They did not have more tumors than unexposed rats.[2]
- Scientists reviewed studies that looked at whether 1,3-D could damage DNA in tissues. This is called genotoxicity. They concluded that there is no clear evidence that 1,3-D is genotoxic or reacts with DNA. Other chemicals mixed with 1,3-D in the older tests may have led to positive results.[12,20]
- Other scientists reviewed evidence from tests of isolated cells. They concluded that there is evidence that 1,3-D can be genotoxic to cells that are isolated from living animals. In addition, some of 1,3-D's break-down products are genotoxic.[6]
- More recent work exposed mice and rats to 1,3-D in their air and food. The scientists did not see increases in cell mutations in the lungs, kidneys, or livers. They concluded that 1,3-D is detoxified by the body, so it does not cause mutations in living animals.[20]

Humans

The U.S. EPA reviewed evidence that 1,3-D exposure may be related to pancreatic cancer. They concluded that "there is insufficient epidemiological evidence at this time to conclude" that 1,3-D exposure is linked to pancreatic cancer.[11]

Similarly, the U.S. EPA concluded that "there is no epidemiological evidence at this time to conclude" that occupational 1,3-D exposure is linked to prostate cancer.[11]

Has anyone studied non-cancer effects from long-term exposure to 1,3-D?

1,3-D has a high vapor pressure and a short half-life in food and water. For this reason, scientists have had to use special formulations or force-feed the lab animals to test for long-term exposure effects.[12]

Animal studies

Many studies have exposed mice, rats, dogs, rabbits, and guinea pigs to air mixed with 1,3-D or commercial products containing 1,3-D for up to two years.[2]

Scientists observed:

- increased cell growth of respiratory tissue and stomach lining,
- slight changes in the kidneys[2], and
- test animals did not grow as well.[2,12]

Other researchers fed rats, mice, and beagle dogs 1,3-D or commercial products for 13 weeks.

- The rats and mice had thickening of stomach linings and heavier kidneys.[12,21]
- Rats whose stomach lining had thickened showed improvement four weeks after dosing stopped. Researchers thought that the thickening was because 1,3-D is irritating.[21]
- The beagles developed anemia and lost weight. The anemia seemed to be from iron deficiency.[22]

Human studies

The U.S. EPA reviewed research that examined whether exposure to 1,3-D could affect the kidneys or liver, cause respiratory effects, or lead to Parkinson's disease. The agency did not find that exposure to 1,3-D could be linked to these health effects.[11]

Does 1,3-D exposure cause reproductive or developmental effects?

No studies were found that linked 1,3-D exposure to reproductive or developmental effects in humans. Most studies in animals found 1,3-D did not cause reproductive or developmental effects, even at doses that made the parent animals visibly sick.[7,12]

Animal studies

- Scientists treated mother rats with air containing up to 120 ppm of 1,3-D for 6 hours a day during their pregnancies.
    - The baby rats had delayed bone development in their spines at the highest dose.
    - At this dose, the mother rats ate less food and drank less water.[2,23]
    - The fetal effects occurred at levels of exposure that made the mother rats visibly sick.[23]
- Mother rabbits inhaled up to 120 ppm of 1,3-D for 6 hours a day during their pregnancy. Their babies were the same as baby rabbits born to untreated mothers, but the mother rabbits gained less weight.[2,23]

- Scientists exposed two generations of rats to 1,3-D vapors for 6 hours a day, 5 days a week at concentrations of up to 90 ppm.
  - The scientists saw no negative effects on reproduction, or the growth and survival of the baby rats.
  - Rats at the highest dose weighed less and had damaged mucous membranes in their noses.[24]
- Rats inhaled 1,3-D at concentrations up to 94 ppm for 5 days a week for over 10 weeks. Scientists saw no effects on reproduction and fertility.[2]
- In another study, rats inhaled concentrations of up to 90 ppm of Telone II for 10 weeks before breeding began and for two more weeks when the rats began breeding. Scientists then exposed the pups for 12 more weeks in the same way after the pups were weaned.
  - The researchers saw no effects on reproduction.
  - However, the rats born to exposed mothers didn't conceive as many pups when they were adults.
  - Rats at the highest dose had damage to the lining of their respiratory tracts and decreased body weight.[2]

Human studies

- The California Department of Pesticide Regulation reviewed animal studies that looked at reproductive and developmental effects. They concluded that inhaling 1,3-D is not expected to cause reproductive or developmental effects in humans.[6]
- The U.S. EPA reviewed research exploring links between 1,3-D exposure and autism spectrum disorder or neurodevelopmental effects in children. It concluded that "there is no epidemiological evidence at this time" to associate 1,3-D exposure with either autism spectrum disorder or neurodevelopmental effects.[11]
- Scientists measured sperm and hormone levels in men who worked at a factory that made 1,3-D and similar chemicals. The men's sperm and hormone levels were not different from men who did not work at the factory. The scientists concluded that there had been no impacts on the men's fertility.[25]

What happens to 1,3-D in the environment?

1,3-D is a colorless or pale-yellow clear liquid at temperatures of up to 95 °F (35 °C). It begins to turn into a gas at 95 °F. This is called the flash point. 1,3-D is a gas at 219-226 °F (103-108 °C).[28] 1,3-D has a high vapor pressure.[9] This means it evaporates easily. It is denser than water. The vapors are heavier than air.[28] The solubility in water is 2 g/L.[6]

Soil

1,3-D is broken down by soil organisms or reactions with water. It is lost from soil from evaporation and from leaching.[7,15] It moves through soil mostly as a gas.[29] What happens to 1,3-D in the soil depends on soil conditions.

- When it is in the soil, 1,3-D can exist as a vapor or dissolve in water. It can also stick to the soil particles.[30] This is called adsorption.
- 1,3-D can evaporate from soil. It also can dissolve back into the thin film of water that surrounds soil particles.[6]
- It binds to soil more tightly when it is a gas.[7]

- About 40% of 1,3-D evaporated from soil in 2-3 weeks following an application.[6]
- When researchers applied 1,3-D to wet soil at temperatures between 36-68 °F (2-20 °C), 80-90% of it adsorbed to the soil, 10-20% dissolved in the water in the soil, and less than 1% was vapor.[30]

The soil **half-life** of 1,3-D is affected by temperature, soil type, and pH. It breaks down faster with increased soil temperature and soil moisture. The soil type affects the speed.[7,29] Soil bacteria digest 1,3-D and the chemicals it breaks down into.[31,32,33,34] Water itself can break down 1,3-D. This is called hydrolysis.[29]

- Half-lives in soil range from 3 days to 23 weeks.[7,9]
- Researchers estimated the half-life to be 19 days. 1,3-D broke down more rapidly than they expected after 30 days.[35]
- The more 1,3-D in soil, the longer it took for the 1,3-D to break down.[35] Another study found that a large increase of 1,3-D led to a small increase in half-life.[29]
- 1,3-D becomes 3-chloroallyl alcohol and 3-chloroacrylic acid in moist soil.[32,33] Soil bacteria also break down these other chemicals.[34]
- Adding manure to soil increased breakdown rates.[7]
- When 1,3-D is injected into soil, it can move downward. In California, 1,3-D injected into soil at a depth of 32 inches (81 cm) was found two weeks later at soil depths of 8 feet (244 cm).[2] However, researchers have not found 1,3-D residues beyond that depth.[29]

Water

1,3-D can evaporate from water. It can be broken down by water itself, or by bacteria living in the water.[7] The warmer the water, the more rapidly 1,3-D disappears.[27,36] The half-lives in water range from a few hours to two days.[2,37] If it is not exposed to light, half-lives ranged from 3 days at 86 °F (30 °C) to 51 days at 50 °F (10 °C).[36] 1,3-D has not been detected in drinking water.[7]

- One study reported that 1,3-D would be more likely to evaporate from soil than to leach into water.[9] However, another study found that less than 1% of an application in soil evaporated.[30]
- Movement of 1,3-D in soil is likely from diffusion rather than leaching. Researchers have not found residues in soil deeper than 9 feet (3 meters).[29]
- Scientists measured the evaporation half-life of 1,3-D from water as 29.6 minutes in a laboratory.[37] A computer model estimated the evaporation half-life as 46-50 hours.[7]
- Water breaks 1,3-D down into 3-chloroallyl alcohol.[7]
- In 2008, the U.S. EPA concluded that 1,3-D is not a public health concern in drinking water based on monitoring of public water supplies from 1988-1997. National random surveys and a more focused survey conducted 1991-2001 did not detect 1,3-D in drinking water.[7]

Air

1,3-D that evaporates is broken down in the air. It may also wash out of the atmosphere with rainfall. This is called wet deposition. 1,3-D may break down quickly in air, but it could last for months.[7]

- 1,3-D in air is broken down by hydroxyl radicals formed by sunlight.[7] Hydroxyl radicals are also known as free radicals and are highly reactive.

- The half-life of 1,3-D exposed to free radicals, is 7 hours for the *trans* isomer and 12 hours for the *cis* isomer.[14] **See the text box about Chemical Forms of 1,3-D.**
- Light intensity, atmospheric particles, and nitrogen dioxide also help break down 1,3-D in the atmosphere.[6]
- Ozone reacts with 1,3-D. The *trans* isomer has a half-life of 12 days, and the *cis* isomer has a half-life of 52 days in the presence of ozone. Light alone does very little.[14]
- The maximum half-life of 1,3-D in air was estimated as 76 days.[7]
- Break-down products included 3-chloroproionyl chloride, 3-chloropropirionic acid, carbon dioxide, and phosgene.[14]

Plant uptake

1,3-D can be taken up by plant roots and can move throughout the plant. Plants may absorb 1,3-D through their leaves. 1,3-D in plant tissues breaks down quickly, but very low residues may remain.

- Carrots, bush beans, and tomatoes absorbed 1,3-D from the liquid, vermiculite, or sand that they were growing in. Beans also absorbed 1,3-D that was applied to their leaves. 1,3-D moved throughout the plant.[34]
- Uptake by the plants peaked 4 to 6 hours after exposure. All traces of 1,3-D and its breakdown products were gone after 48 to 72 hours. Half-lives of 1,3-D in plant tissue were 1.5 hours, and the main breakdown product, 3-chloroallyl alcohol, had a half-life of 4 hours and 24 minutes.[34]
- Scientists planted potato plants in soil that had been treated with 1,3-D in a formulated product six months before planting. The potatoes contained very low residues of 1,3-D at harvest, 7 µg/kg.[14,33]

Can 1,3-D affect birds, fish, or other wildlife?

The U.S. EPA considered exposure risks to 1,3-D for terrestrial plants and **animals**. The agency noted that birds and mammals would have to be in or near the treated area soon after the application because 1,3-D rapidly disappears in the **environment**.[4]

Soil life

1,3-D has reduced soil fungal abundance and microbial enzyme activity at doses of 30-60 mg/kg. Activity recovered usually within a week. Scientists did not see decreases in all soil types. Microbial activity increased in some studies.[14] **See the text box about mg/kg.**

Although 1,3-D is toxic to earthworms, it is not expected to have lasting impacts on worm populations because it breaks down quickly. New earthworms are expected to migrate into treated areas very soon after treatment.[38]

Fish and other aquatic life

1,3-D is moderately toxic to fish, but it is highly toxic to invertebrates.[3]

Scientists have measured the toxicity of 1,3-D to several aquatic species.

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NATIONAL PESTICIDE INFORMATION CENTER

ECOTOXICOLOGY CLASSIFICATION - 1,3-DICHLOROPROPENE[3]

	High Toxicity	Moderate Toxicity	Low Toxicity	Very Low Toxicity
Avian (single dose)Oral LD_{50}	≤ 50 mg/kg	> 50-500 mg/kg	> 500-2000 mg/kg	> 2000 mg/kg
Fish LC_{50}	≤ 1 mg/L	> 1 - 10 mg/L	> 10 – 100 mg/L	> 100 mg/L
Aquatic Invertebrate LC_{50}	≤ 1 mg/L	> 1 - 10 mg/L	> 10 – 100 mg/L	> 100 mg/L

HONEYBEE RATINGS[14]

	High Toxicity	Moderate Toxicity	Low Toxicity
Honeybee (direct contact or oral exposure) Acute LD_{50}	≤ 2 µg/bee	> 2-11 µg/bee	> 11 µg/bee

The shaded boxes reflect the effects on birds, fish, and other wildlife mentioned in this fact sheet. Modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Ecotoxicity Categories for Terrestrial and Aquatic Organisms.

https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0

You may be wondering why the "High Toxicity" column has smaller numbers than the "Low Toxicity" column. This is because if a smaller amount of the pesticide caused a health effect, it's more toxic. If it takes a larger amount of the pesticide to cause a health effect, it's less toxic.

- The 96-hour LC_{50} was 3.9 mg/L for rainbow trout, and 7.1 mg/L for bluegill sunfish.
- The 48-hour LC_{50} for water fleas (Daphnia) was 6.2 mg/L.
- 1,3-D is considered slightly toxic to algae.[38] **See the text box about LD_{50}/LC_{50}.**

Because 1,3-D is not likely to persist in water, it poses low long-term risk to aquatic life.[14]

Terrestrial wildlife (land animals)

1,3-D is moderately toxic to birds and mammals.[3] The LD_{50} for bobwhite quail is 152 mg/kg.[38] The LC_{50} for 8-day exposure was >10,000 mg/kg in mallard ducks and bobwhite quail.[14]

Bees

The U.S. EPA could not characterize risks of 1,3-D to honeybees because there was no reliable data for how toxic 1,3-D is to them. However, the agency believed the risk to be low because of how 1,3-D is used and how quickly it volatilizes and breaks down in air.[4] The 48-hour and 90-hour LD_{50} for bees was given as 6.6 µg per bee in other sources.[14,38]

Where can I get more information?

NPIC aims to use the best scientific resources available at the time fact sheets are written. NPIC does not have the resources to keep all its fact sheets entirely up to date. All NPIC documents indicate when the material was last updated. For more information on how NPIC selects scientific resources, visit our web page **Writing NPIC Fact Sheets**.

1,3-DICHLOROPROPENE (1,3-D) fact sheet

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