

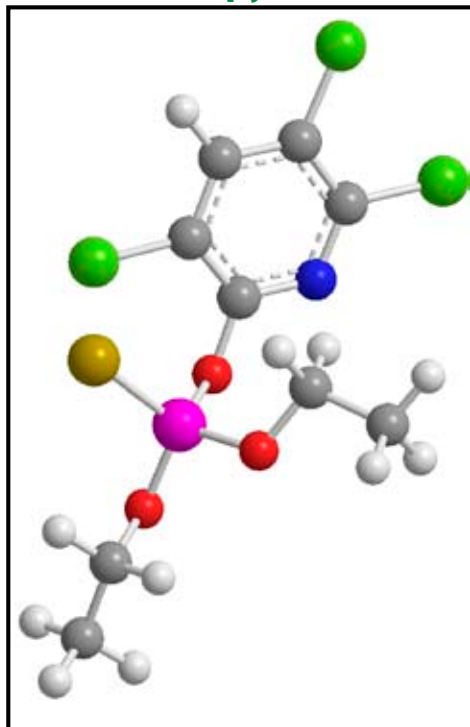
Thank you for visiting the National Pesticide Information Center's fact sheets.

Some of the information in the following fact sheet (scroll down) is out-of-date. NPIC has started a *NEW* set of fact sheets, and chlorpyrifos is high on our list of priorities. If you would like to be notified when NPIC releases new publications, send an email to npicupdates@ace.orst.edu with "subscribe" in the subject line.

Check out our new technical fact sheet on [resmethrin!](#)

Please call NPIC with any questions you have about pesticides at **1-800-858-PEST (7378)**.

Molecular Structure - Chlorpyrifos



NPTN Technical Fact Sheets are designed to provide information that is technical in nature for individuals with a scientific background or familiarity with the regulation of pesticides by the U.S. Environmental Protection Agency (US EPA). This document is intended to be helpful to professionals and to the general public for making decisions about pesticide use.

National
Pesticide
Telecommunications
Network

Chlorpyrifos

(Technical Fact Sheet)

For less technical information please refer to the General Fact Sheet

The Pesticide Label: Labels provide directions for the proper use of a pesticide product. *Be sure to read the entire label before using any product.* A signal word on each product label indicates the product's short-term toxicity.

CAUTION- low toxicity

WARNING- moderate toxicity

DANGER- high toxicity

What is chlorpyrifos?

- Chlorpyrifos is an insecticide (kills or controls insects), that was first registered in the United States in 1965. Currently, over 850 registered chlorpyrifos products are on the market.
- Chlorpyrifos belongs to a class of insecticides known as organophosphates.
- Chlorpyrifos is one of the most commonly used insecticides.

How does chlorpyrifos work?

- Chlorpyrifos can kill insects by direct contact or ingestion. Chlorpyrifos kills insects by disrupting their normal nervous system functions.
- Chlorpyrifos disrupts the nervous system by phosphorylating the active site of the acetylcholinesterase enzyme, rendering it inactive (1).
- The acetylcholinesterase enzyme is necessary for stopping the transmission of the chemical neurotransmitter acetylcholine across the nerve synapse. When the enzyme is inhibited, a surplus of acetylcholine builds up, overstimulating the nervous system.

What types of products contain chlorpyrifos?

- Liquid termite barriers (soil injection)
- Lawn/garden granules, dusts, and sprays
- Household aerosols, baits, dusts, and sprays
- Agricultural sprays and granules
- Animal flea collars, dips, and sprays

What are some products that contain chlorpyrifos?

- Dursban™
- Empire 20™
- Equity™
- Lorsban™

Laboratory Testing: Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term and long-term health effects. In these tests, laboratory animals are purposely fed a pesticide at high doses to cause toxic effects. These tests help scientists judge how these chemicals might affect humans, domestic animals, and wildlife in cases of overexposure. When pesticide products are used according to label directions, toxic effects are not likely to occur because the amount of pesticide that people and animals may be exposed to is low compared to the doses fed to laboratory animals.

How toxic is chlorpyrifos?

Animals

- Chlorpyrifos is moderately toxic to both male and female rats. The oral LD50 in male and female rats range from 82 mg/kg to 245 mg/kg. See boxes on **Laboratory Testing**, **LD50**, and **Toxicity Category**.
- Chlorpyrifos is highly toxic to chickens. The acute oral LD50 in chickens is 34.8 mg/kg.
- Chlorpyrifos is only slightly toxic to rabbits. The acute oral LD50 in rabbits is >1000 mg/kg (1).
- Skin-applied chlorpyrifos has low toxicity to rabbits and rats (2). The dermal LD50 in rabbits range from 1000 to 2000 mg/kg. The dermal LD50 in rats is 2000 mg/kg.
- Chlorpyrifos is more toxic to cats than dogs.
- The signs of chlorpyrifos poisoning include behavioral changes, muscle tremors, twitching, diarrhea, salivation, breathing difficulties, and in more severe cases, paralysis and death (3).

Humans

- Depending on the formulation, chlorpyrifos-containing products are low to highly toxic to humans. See **Toxicity Category** box.
- The symptoms associated with chlorpyrifos poisoning include headache, nervousness, blurred vision, weakness, nausea, cramps, diarrhea, difficulty breathing, and chest pain (4).
- The signs associated with chlorpyrifos poisoning include sweating, pin-point pupils, tearing, salivation, clear nasal discharge and sputum, vomiting, muscle twitching, muscle weakness, and in severe poisonings convulsions, coma, and death (4).

LD50/LC50: A common measure of toxicity is the lethal dose (LD50) or lethal concentration (LC50) which causes death (resulting from a single or limited exposure) in 50 percent of the treated animals. LD50 is generally expressed as the dose in milligrams (mg) of chemical per kilogram (kg) of body weight. LC50 is often expressed as mg of chemical per volume (e.g., liter (l)) of medium (i.e., air or water) the organism is exposed to. Chemicals are considered highly toxic when the LD50/LC50 is small and practically non-toxic when the value is large. However, the LD50/LC50 does not reflect any effects from long-term exposure (i.e., cancer, birth defects or reproductive toxicity) which may occur at doses below those used in short-term studies.

Toxicity Category (Signal Word) (6)

	High Toxicity (<i>Danger</i>)	Moderate Toxicity (<i>Warning</i>)	Low Toxicity (<i>Caution</i>)	Very Low Toxicity (<i>Caution</i>)
Oral LD50	Less than 50 mg/kg	50 - 500 mg/kg	500 - 5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Less than 0.2 mg/l	0.2 - 2 mg/l	2 - 20 mg/l	Greater than 20 mg/l
Dermal LD50	Less than 200 mg/kg	200 - 2000 mg/kg	2000 - 5000 mg/kg	Greater than 5000 mg/kg
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible within 7 days	No irritation
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

Exposure: Effects of chlorpyrifos on human health and the environment depend on how much chlorpyrifos is present and the length and frequency of exposure. Effects also depend on the health of a person and/or certain environmental factors.

- The red blood cell cholinesterase test can document an acute chlorpyrifos poisoning. Exposure can be measured by analyzing a 24-hour urine for the chlorpyrifos metabolite 3,5,6-trichloro-2-pyridinol.
- Severe acute organophosphate poisoning may rarely be associated with chronic neurological effects (5).

Does chlorpyrifos break down and leave the body?

Animals

- Chlorpyrifos is detoxified quickly in rats, dogs, and other animals (2).
- In a rat study the chlorpyrifos was rapidly absorbed and excreted in the urine (90%) and feces (10%) (1).

Humans

- Chlorpyrifos is eliminated rapidly from blood with a half-life of about 1 day. However, a small portion of chlorpyrifos is stored in the fat, but it is eliminated with a half-life of about 62 hours (1). See **Half-life** box.

Does chlorpyrifos cause cancer?

Animals

- There is no evidence of cancer in rats or mice fed large amounts of chlorpyrifos over their life time (6). See **Cancer** box.

Humans

- Chlorpyrifos does not increase the risk of cancer in humans. The EPA has categorized chlorpyrifos as a Group E carcinogen, its lowest carcinogen ranking (6). This means that chlorpyrifos has evidence of non-carcinogenicity for humans.

Does chlorpyrifos cause developmental or teratogenic effects?

Animals

- Pregnant animals fed high doses of chlorpyrifos did not have offspring with birth defects (7).
- In some cases, high doses acutely toxic to the pregnant mother resulted in fetal death or lower birth weight of the offspring (7).

Humans

- There is no evidence that human exposure to chlorpyrifos interferes with pregnancy or causes birth defects (8).

What happens to chlorpyrifos in the environment?

- Chlorpyrifos residues on plant foliage dissipate with half-lives of < 1 to 7 days. The dislodgeable residues on plant foliage dissipate even faster with half-lives of 0.1 to 3.4 days (9).
- Soil persistence varies by soil type. Chlorpyrifos half-lives range from 1.9 days in sandy-clay-loam soil to 1,575 days in sandy soil (9). Chlorpyrifos has an average soil half-life of 30 days (10).

Half-life is the time required for half of the compound to degrade or be eliminated from the body.

1 half-life	=	50% remaining
2 half-lives	=	25% remaining
3 half-lives	=	12% remaining
4 half-lives	=	6% remaining
5 half-lives	=	3% remaining

Remember that the amount of chemical remaining after a half-life will always depend on the amount of the chemical originally applied.

Cancer: The U.S. EPA has strict guidelines that require testing of pesticides for their potential to cause cancer. These studies involve feeding laboratory animals large daily doses of the pesticide over most of the lifetime of the animal. Based on these tests, and any other available information, EPA gives the pesticide a rating for its potential to cause cancer in humans. For example, if a pesticide does not cause cancer in animal tests, then the EPA considers it unlikely the pesticide will cause cancer in humans. Testing for cancer has not been done on human subjects.

- Chlorpyrifos has a very low potential for movement through the soil to groundwater (10).
- Chlorpyrifos will persist indoors for weeks to months (11).

What effect does chlorpyrifos have on wildlife?

- Chlorpyrifos is extremely toxic to birds and other wildlife. The oral LD50 in the Ring necked pheasant is 8.41 (male) and 17.7 mg/kg (female)(12).
- Fish and marine organisms are very sensitive to chlorpyrifos, so pesticide applicators should be careful when using chlorpyrifos near water ways.
- General agricultural uses of chlorpyrifos pose a serious hazard to honeybees (2).

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NPTN at <http://ace.orst.edu/info/nptn/> EXTTOXNET at <http://ace.orst.edu/info/exttoxnet/>

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