

### What is naled?

Naled is in a family of [insecticides](#) called organophosphates. Products that contain naled are used outdoors in some agricultural and residential locations. It is only used by trained professionals.

Naled is used to control public health pests like [mosquitoes](#) and biting flies, as well as crop-damaging insects.<sup>1</sup> It is one of the most commonly used pesticides for aerial [mosquito control](#).<sup>2</sup> Naled was first registered for use in the United States in 1959.<sup>3</sup>



photo credit: James Gathany, CDC

### What are some products that contain naled?

All [products](#) containing naled are liquid. They may be diluted from soluble or emulsifiable concentrates. Currently, there are six products that are registered for use in the United States. All of these products are known as Restricted Use Pesticides (RUP) and require a license to purchase or apply the product. Naled can be applied aerially in urban or rural areas, in greenhouses, and on some crops.<sup>1</sup> There are no approved uses for naled indoors or on pets.<sup>1</sup>

Always [follow label instructions](#) and take steps to minimize 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 1-800-222-1222. If you wish to [discuss a pesticide problem](#), please call 800-858-7378.

### How does naled work?

Naled quickly affects insects when they touch, eat, or breathe it.<sup>4</sup> Naled is a cholinesterase inhibitor, which causes the insect's nerves to continuously 'fire'.<sup>3</sup> Usually this firing is stopped chemically inside the insect, but a breakdown product of naled prevents enzymes in the insect from working correctly. The insect's nerves are then stimulated constantly, and eventually the insect dies.

### How might I be exposed to naled?

Naled can be used on some crops to control insects.<sup>3</sup> Should you eat food that was treated, you could be exposed to low levels of naled or its breakdown products in the plant. The U.S. Environmental Protection Agency (EPA) sets legal limits for pesticides on food. These limits help ensure food safety.

For mosquito and public health pest control, naled is used aerially or sprayed from trucks. To protect public health, the EPA limits the amount that can be applied. These applications are called "Ultra Low Volume (ULV)", meaning a small amount is used over a large area. This limit is currently about 2 to 4 tablespoons of formulated product per acre, which is no more than 0.1 pounds of naled per acre.<sup>3</sup> That's about the same as using 1-2 ounces in an area about the size of a football field.



photo credit: Airman 1st Class Stephany Miller, U.S. Air Force

Using naled pesticide products properly and legally requires a license and expertise. Although not required, the following steps may reduce your risk. You may choose to:

- Stay inside during the active application.
- Think about what items have been left outside. Cover or move toys, pet items, bird feeders and baths, play structures, and grills.
- Close doors and windows of your home when possible. Close car or other vehicle windows left open.
- If your air system pulls in outside air, turn off your heater or air conditioner to prevent naled from being moved indoors.
- Cover edible plants beforehand or wash fruits and vegetables after the application.

If you are outside during or very soon after the application, you could contact very small amounts of the product on your skin, breathe it in, or get it in your eyes. Contact is unlikely, but wearing long clothing could limit exposure to the chemical. Pets and people could also be exposed to small amounts of naled if they eat or touch grass that was very recently sprayed. If direct contact happens, go inside to wash your skin and eyes and call Poison Control at 800-222-1222.

### **What are some signs and symptoms from a brief exposure to naled?**

Naled is moderately toxic if eaten, gets on the skin, or breathed in. In addition, naled is severely irritating if a person gets it in their eyes or on skin.<sup>3</sup> It is considered corrosive and direct contact could lead to permanent damage.<sup>3,5</sup>

After rats breathed low doses of naled for four hours, they experienced diarrhea. Another group of rats breathing moderate doses of naled experienced decreased activity, body tremors, diarrhea, and difficulty walking.<sup>6</sup> Similar to other organophosphates, overexposure from direct inhalation could lead to tightness in the chest, wheezing, cough, increased saliva, runny nose, blurred vision, tearing, and headache.<sup>7</sup>

After spills or other direct skin exposures, symptoms may include itching, redness, rash, and irritation.<sup>6</sup>

Rats fed low doses of naled experienced diarrhea, tremors, salivation, increased urination, and decreased activity.<sup>6</sup> Symptoms reported after human exposures to organophosphates like naled included headache, nausea, dizziness, and sweating, as well as increased saliva, tearing, and runny nose.<sup>8</sup> If a person has a large exposure, severe naled poisonings could include feeling lightheaded, slurred speech, muscle twitching, irregular heartbeat, convulsions, paralysis, coma, and death.<sup>9</sup>

Children may exhibit different common symptoms to organophosphates than adults. Muscle weakness, salivation, constricted pupils, seizures, lethargy, and coma were found more often in children than adults.<sup>8</sup>

## What happens to naled when it enters the body?

Through all routes of exposure, naled may be absorbed into the bloodstream. Naled is then broken down in the liver.<sup>10</sup> It is excreted from the body in urine, exhaled air, and feces. A feeding study with rats found that 70 to 80 percent of the dose was excreted within 48 hours.<sup>6</sup> Naled and its breakdown products are not expected to build up in human or animal bodies.<sup>3</sup>

Several groups of rats had naled applied to their skin for various times, from 30 minutes to 24 hours. About 21 to 23 percent of the original dose was absorbed through the skin.<sup>3</sup> Scientists have recommended that a rate of 35 percent be used to estimate human skin absorption.<sup>11</sup>

Following exposure in rats, naled was distributed to the gut, liver, and blood at higher concentrations than other tissue. In chickens, naled moved to the kidneys more than other areas of the body. In the same study, naled was also found in eggs at lower amounts.<sup>5</sup>

Chickens and goats treated with naled have shown detectable levels of breakdown products in eggs and milk.<sup>5</sup> Holstein cows sprayed with naled for 14 days did not have detectable residues in their milk.<sup>7</sup>

## Is naled likely to contribute to the development of [cancer](#)?

The EPA has classified naled as demonstrating "evidence of noncarcinogenicity".<sup>3</sup> Mice fed naled for 89 weeks did not develop tumors at a higher rate than untreated animals. Male rats that were fed naled for two years showed a slight increase in mammary cancers, but not enough to be considered significantly different from non-dosed rats.<sup>5</sup>

Dichlorvos (or DDVP) is a metabolite of naled, and has been classified as a possible carcinogen by the International Agency for Research on Cancer.<sup>12</sup> The EPA has determined that there is "suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential" for DDVP.<sup>13,14</sup> Rats fed DDVP over a two-year study had an increased risk of cancer in the pancreas and leukemia (a form of blood cancer). Female mice in the same study also had a higher risk of stomach cancer. In another study, rats that inhaled DDVP for two years were not found to have an increased risk of cancer. No evidence of an increased cancer risk from DDVP has been found in people.<sup>12,15,16</sup>

## Has anyone studied non-cancer effects from long-term exposure to naled?

In two studies, young rats and rabbits did not show adverse effects after their mothers were fed naled during pregnancy. Naled has been found in human umbilical cords after birth, but it has not been shown to affect human genes.<sup>6,17</sup> The EPA has not yet tested naled for its potential to disrupt endocrine function.<sup>3</sup>

Inhalation of naled by rats for 13 weeks found that a high dose caused tremors, salivation, nasal discharge, and abnormal breathing. Increased food consumption, changes in blood chemistry, and increased liver weights were also found. Rats fed a medium dose of naled for 28 days found reduced weight gain, increased liver and adrenal weights, skin irritation, and blood and nerve cell inhibition in the brain. Changes in blood were found in rats exposed to naled on the skin for 21 days. Male rats were also found to have increased liver and testicle weights from a high dose.<sup>3,5</sup>

If aerial applications are performed correctly, asthma and asthma attacks are not expected to occur.<sup>18</sup>

Because naled is non-persistent, the risk from exposure in food and drinking water does not exceed EPA's level of concern. Due to this, exposure to naled is not of concern for people other than naled mixers, loaders, and applicators.

### Are children more sensitive to naled than adults?

In general, [children may be especially sensitive to pesticides](#) compared to adults. Scientific data indicate that children are not more sensitive to naled than adults.<sup>2,3</sup>

Young children may also act in ways that put them at greater risk of being exposed. For example, they may spend more time near the ground. They may also be more likely to place their hands in their mouths after touching treated surfaces. If naled is being applied in your area, [here](#) are some ideas to help you minimize the risk to yourself and others.

### What happens to naled in the environment?

Naled is non-persistent, and is broken down by soil microorganisms, water, and by light, indirectly.<sup>3</sup> It also binds weakly to soil and is moderately mobile in soil. Both naled and DDVP have been found to be less mobile in soil that is clay-rich, and more mobile in sandy soil. Naled in soil rapidly degrades, with half-lives ranging from about 30 minutes to 1.4 hours in sandy loam soil.<sup>5,19</sup> On inert surfaces exposed to direct sunlight, Naled has a half-life of about 1-2 hours.<sup>20</sup>



photo credit: Chesapeake Bay Program

In water, naled dissolves very poorly.<sup>7</sup> The [half-life](#) of naled in water is dependent upon pH (acidity), with ranges of 96 hours (pH 5, more acidic) to 15.4 hours (pH 7) to 1.6 hours (pH 9, less acidic). No groundwater studies have been evaluated to determine the potential for naled to pose a risk to groundwater.<sup>19</sup> However, estimated concentrations of naled in groundwater do not exceed EPA's level of concern for short or long-term exposures.<sup>3</sup>

Naled can be taken up by plants after application and quickly broken down.<sup>4</sup> In one study, lettuce, wheat, and carrots were grown in soil treated with naled. The concentration of residues found in the vegetables did not indicate build-up over time. Following an application of naled onto grounded apples, cabbage, tomatoes, cantaloupe, grapes, and alfalfa, less than 50 percent of naled was found one hour after treatment.<sup>5</sup>

On the surface of grape leaves, naled residue was found up to five days after application. After three days, several samples had undetectable levels.<sup>21</sup> Naled applied to cotton and cucumber leaves was not found in other parts of the plant 1 to 7 days after application.<sup>5</sup> When applied to crops, it is not expected to be persistent enough for residues to pose a risk in later plantings.

Naled tends to rapidly diffuse into the atmosphere prior to degradation. When exposed to natural sunlight, calculated half-lives of naled ranged from 57.8 to 60.7 hours in air, and 99 hours in dark conditions.<sup>10</sup> Naled evaporates quickly after application.<sup>19</sup>

When naled was applied in fish tanks, DDVP was found to temporarily accumulate in fish tissue within an hour of application. After seven days of exposure, extremely small amounts of DDVP were found in the fish. This indicates that naled is not expected to build up in their bodies.<sup>19,22</sup>

### Can naled affect birds, fish, or other [wildlife](#)?

The toxicity of naled is highly dependent upon the type of organism affected. Ingestion and skin exposure of naled is moderately toxic to mammals such as rats and mice.<sup>10</sup> Naled is moderately to highly toxic when eaten by birds such as mallards, Canada geese, and sharp-tailed grouse. Mallards also showed a reduction in egg production, egg survival, and hatchling survival following long-term repeated exposures to naled.<sup>3</sup>

Naled is also highly toxic to bees through direct contact (LD<sub>50</sub> of 0.48 micrograms/bee). Indirect contact with plants was found to be highly toxic one hour after application and practically non-toxic one day after application.<sup>3</sup> During a field application, naled was low to moderate in toxicity to honeybees after three hours.



photo credit: Tafelsuesse, pixabay

It is moderately to very highly toxic to freshwater fish and is very highly toxic to freshwater invertebrates like water fleas, stoneflies, and scuds. Naled is moderately toxic to saltwater fish and highly to very highly toxic to saltwater invertebrates like shrimp, oysters, and mysid shrimp.<sup>3</sup>

Although long term exposure to naled is unlikely due to its short half-life, repeated exposure for wildlife could occur in the right environment. Naled used regularly on crops such as almonds, citrus, cole, and seed alfalfa has been found to exceed EPA's level of concern for birds. Crops such as citrus, grapes, and seed alfalfa are high-exposure sites for mammals, and potentially exceed EPA's level of concern for chronic exposure to naled. Mosquito applications exceed the acute exposure level of concern for mammals.<sup>3</sup>

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## Where can I get more information?

For more detailed information about naled please visit the list of [referenced resources](#) or call the National Pesticide Information Center, between 8:00 AM and 12:00 PM Pacific Time (11:00 AM to 3:00 PM Eastern Time), Monday - Friday, at 1-800-858-7378 or visit us on the web at [npic.orst.edu](http://npic.orst.edu). NPIC provides objective, science-based answers to questions about pesticides.

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