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NPIC 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 (U.S. EPA). This document is intended to be helpful to professionals and to the general public for making decisions about pesticides.

# Hydramethylnon

## (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.* Signal words, listed below, are found on the front of each product label and indicate the product's potential hazard.

**CAUTION - low toxicity**

**WARNING - moderate toxicity**

**DANGER - high toxicity**

## What is hydramethylnon?

- Hydramethylnon is an insecticide that belongs to a family of chemicals known as amidinohydrazones (1).
- Technical-grade hydramethylnon is yellow-tan in color and has an odor similar to vegetable oil (2).
- Hydramethylnon was first registered for use in the United States by the Environmental Protection Agency in 1980 (1).
- Currently, 28 products containing hydramethylnon are actively-registered with the EPA (1, 3).

## How is hydramethylnon used?

- Hydramethylnon is used to control ants, cockroaches, termites, crickets, and silverfish (1).
- Products may be approved for use outdoors on pastures, rangeland, ornamental plants, turf, anthills, and non-crop areas or indoor areas such as residential dwellings, restaurants, and institutional areas such as hospitals (3).
- Products containing hydramethylnon are formulated as granules or impregnated materials such as baits or gels (1).
- Hydramethylnon is a registered chemical alternative for chlorpyrifos for use as a termiticide. It is also used against ants, crickets, and cockroaches around the home and lawn (4).

## What are some products that contain hydramethylnon?

- Amdro®
- Combat®
- Maxforce®
- Siege®
- Sensible®

## What is the mechanism of action for hydramethylnon?

- Hydramethylnon must be ingested to be effective. It shows selective toxicity to insects with chewing or sponging mouthparts (5).
- Hydramethylnon acts upon the mitochondria where it disrupts cellular respiration by inhibiting the electron transport chain (ETC) at the cytochrome *b-c<sub>1</sub>* complex (6).
- Inhibition of the ETC by hydramethylnon increases at a dose-dependent rate over time until a point is reached where suppression of cellular respiration is of a sufficient magnitude and death occurs (6).
- Insects that ingest hydramethylnon become lethargic within 24 hours and die after 3-4 days (7).
- Delayed mechanisms of toxicity, such as that associated with hydramethylnon, are desirable when controlling social insects so they may live long enough to return to the colony to share the toxicant among other members (8).

**Laboratory Testing:** Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed high enough 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 the label directions, toxic effects are not likely to occur because the amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

**LD50/LC50:** A common measure of acute toxicity is the lethal dose (LD50) or lethal concentration (LC50) that 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) that may occur at levels below those that cause death.

## What is the acute toxicity of hydramethylnon?

### Oral

- Hydramethylnon is low in toxicity when ingested. When administered to rats, the LD50 of hydramethylnon ranged from 817-1131 mg/kg in males and 1300-1502 mg/kg in females (1, 10). See boxes on **Laboratory Testing**, **LD50/LC50**, and **Toxicity Category**.

### Dermal

- Researchers observed no signs of toxicity after applying hydramethylnon to the skin of rabbits. The dermal LD50 in rabbits exceeded 2000 mg/kg, the limit of the test (1).
- Scientists observed no signs of irritation when they applied hydramethylnon to the skin of rabbits and guinea pigs (9).
- Hydramethylnon is not a skin sensitizer in guinea pigs (1).
- Hydramethylnon caused temporary eye irritation in rabbits (1, 10).

Toxicity Category

	High Toxicity (Danger)	Moderate Toxicity (Warning)	Low Toxicity (Caution)	Very Low Toxicity (Caution)
<b>Oral LD50</b>	Less than 50 mg/kg	50 - 500 mg/kg	500 - 5000 mg/kg	Greater than 5000 mg/kg
<b>Dermal LD50</b>	Less than 200 mg/kg	200 - 2000 mg/kg	2000 - 5000 mg/kg	Greater than 5000 mg/kg
<b>Inhalation LC50 - 4hr</b>	Less than 0.05 mg/l	0.05 - 0.5 mg/l	0.5 - 2 mg/l	Greater than 2 mg/l
<b>Eye Effects</b>	Corrosive	Irritation persisting for 7 days	Irritation reversible within 7 days	Minimal effects, gone within 24 hrs
<b>Skin Effects</b>	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling  
<http://www.epa.gov/opppod01/labeling/lrm/chap-07.pdf>

## Inhalation

- Hydramethylnon is very low in toxicity when inhaled by rats, with an LC50 of 2.9 mg/L (1).

## Signs of Toxicity - Animals

- Rats ingesting near lethal doses of hydramethylnon showed excessive salivation, decreased activity, anorexia, bloody nose, and difficulty with coordination and balance (1).

## Signs of Toxicity - Humans

- No occupational studies or medical reports were found on the effects of hydramethylnon on humans. See box on **Exposure**.

## What is the fate of hydramethylnon in the body?

- Scientists dosed male and female rats orally with radiolabeled hydramethylnon and monitored them over 7 days. Of the administered dose, 85-98% of the chemical was excreted unchanged in the feces and 1-2% appeared in the urine (1).
- Less than 10% of hydramethylnon administered to rats by gavage remained in the tissue. A slightly greater amount accumulated in the bodies of the female rats (1).
- Goats and cattle fed hydramethylnon at 0.2 mg/kg for 8 days and 0.05 mg/kg for 21 days, respectively. There were no detectable residues in either their tissue or milk (10).

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

## Does hydramethylnon cause reproductive or teratogenic effects?

### Animals

- Scientists found hydramethylnon to be non-teratogenic when up to 30 mg/kg/day was administered by gavage to rats and rabbits during days 6-15 of gestation (11).
- Rats were dosed with 200 and 400 ppm hydramethylnon over the course of two generations to determine reproductive effects. Male rats were less inclined to mate, and evidence of testicular degeneration occurred at all but the lowest dose. Fewer females became pregnant and implantation rates were reduced (11).
- Hydramethylnon primarily affects the testes (12). Rats exposed to high levels of hydramethylnon may have prostate atrophy, testicular degeneration, and germ cell damage (11). Exposures of this magnitude may also result in small, soft testes of reduced weight (1).

### Humans

- Common exposure levels of hydramethylnon are unlikely to contribute to any adverse reproductive effects in humans (12).

## Could chronic exposure to hydramethylnon cause health effects?

- Holstein calves given 113.5g of a product composed of 0.5% hydramethylnon in treated corn each day for 7 weeks developed significant leukopenia, lymphopenia, eosinopenia (13).

## Is hydramethylnon a carcinogen?

### Animals

- Hydramethylnon was administered to rats in their diet for 2 years. Rats at the highest dose level (200 ppm) developed tumors in the uterus and adrenals. The magnitude of this dose is not considered to be relevant to human exposures (1). See box on **Cancer**.
- Mice given hydramethylnon in their diets had significant increases in lung adenomas and carcinomas at 50 and 100 ppm (1).
- Hydramethylnon did not cause gene mutations, conversions, or chromosome aberrations during laboratory testing (1, 11).

**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 is not done on human subjects.

### Humans

- The EPA has classified hydramethylnon as a possible (group C) human carcinogen due to lung adenomas and carcinomas (1). This classification means that, although hydramethylnon has been shown to cause cancer in one strain or sex of a laboratory animal, there is inadequate or no evidence that it may cause cancer in humans (1).

## What is the environmental fate of hydramethylnon?

### Water

- Hydramethylnon photodegrades with a half-life of 1 hour in water and 5 days in soil (7). See **Half-life** box.
- Hydramethylnon adsorbs strongly to soils and has low water solubility. The U.S. Environmental Protection Agency does not anticipate that hydramethylnon will contaminate groundwater (1).

**Half-life:** the time required for half of the compound to degrade.

**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**

The amount of chemical remaining after a half-life will always depend on the amount of the chemical present initially.

### Air

- Hydramethylnon has the potential to volatilize from water at a very low rate (7, 14).
- The low vapor pressure for hydramethylnon suggests that it is non-volatile from soil surfaces (7).

### Soil

- Hydramethylnon's high sorption coefficient causes it to bind tightly to soil and limits its movement and availability in the environment (15, 1).
- The soil half-life of hydramethylnon ranges from 375-391 days in aerobic soil (1).
- Biota in soil can increase the degradation rate of hydramethylnon. White rot fungus (*Phanaerochaete chrysosporium*) breaks down hydramethylnon, resulting in a half-life of 14-25 days (7). The half-life in sandy loam soil ranges from 7-28 days (10).
- A product containing 0.88% hydramethylnon exposed to summer conditions was stable at high temperatures and decomposed rapidly only during daylight hours. It proved ineffective for fire ant control after 12-30 hours in these conditions (15).

### Plants

- Plants do not absorb hydramethylnon from the soil. Any residues on plant surfaces typically come from direct contact during application (7).

## Does hydramethylnon affect wildlife?

- Hydramethylnon dust is practically non-toxic to honey bees. It has an oral LD50 of 68  $\mu\text{g}/\text{bee}$  (1). When 30  $\mu\text{g}$  of hydramethylnon was applied topically to bees, it was not toxic (10).
- Hydramethylnon ranges from slightly toxic to practically non-toxic when ingested by birds (depending upon the species). The oral LD50 is greater than 2510 mg/kg in mallard ducks and 1828 mg/kg in the northern bobwhite quail (1).
- Hydramethylnon is moderately to very highly toxic to freshwater fish. The 96-hour LC50 for rainbow trout, channel catfish, and bluegill sunfish is 0.15 mg/L, 0.09 mg/L, and 1.70 mg/L respectively. These LC50 values were found using an organic solvent as a carrier due to the insoluble nature of hydramethylnon (1).
- Hydramethylnon is moderately toxic to freshwater invertebrates with a 48-hour LC50 of 1.14  $\mu\text{g}/\text{L}$  (1).
- Hydramethylnon can bioaccumulate in fish because of high organic binding and octanol/water partitioning. Fish are not likely to be exposed to hydramethylnon because it photodegrades rapidly and is not soluble in water (7).

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