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NPTN General Fact Sheets are designed to answer questions that are commonly asked by the general public about pesticides that are regulated by the U.S. Environmental Protection Agency (US EPA). This document is intended to be educational in nature and helpful to consumers for making decisions about pesticide use.

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**N**ational  
**P**esticide  
**T**elecommunications  
**N**etwork

# DEET

## (General Fact Sheet)

For more technical information please refer to the Technical 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 DEET?

- DEET (short for N,N-diethyl-m-toluamide) is a commonly used insect repellent for several types of biting and sucking insects, including mosquitos, flies and ticks.
- DEET is one of the few pesticides that can be applied to human skin or clothes.
- DEET does not actually kill insects, but repels them from treated areas.

## How does DEET work?

- Even though it has been in use for over 40 years, scientists are not completely sure how DEET repels biting insects.
- DEET most likely affects the insect's ability to locate animals to feed on. Scientists believe that DEET disturbs the function of special receptors in mosquito antennae that sense chemicals that are produced by humans and other animals (*1*).

## What products contain DEET?

- Aerosol products that are intended for use on human skin and clothing.
- Liquid products for human skin and clothing.
- Skin lotions.
- Impregnated materials such as towelettes, wristbands, and tablecloths.
- Products registered for use on animals and surfaces.

## How toxic is DEET?

### Animals

- DEET is slightly toxic to rats when ingested or applied to skin. DEET is very low in toxicity when rats breathe in the vapors (2) **See Laboratory Testing box.**
- DEET does not cause permanent eye damage in rabbits, although it causes some irritation. DEET does not cause skin irritation or skin sensitization (2).
- In long term toxicity studies, dogs and rats fed low levels of DEET daily in the diet do not suffer any long term health effects (2).
- Animals of both sexes fed high levels of DEET exhibit weight loss and excessive salivation (2).

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

### Humans

- Because DEET is used directly on human skin, scientists have thoroughly studied its toxicity (2). Over its long use history, relatively few confirmed incidents have been reported when DEET is used properly (2).
- Some cases of seizures potentially related to DEET exposure have been reported. However, the percentage of DEET users reporting seizures is extremely low (2).

**Laboratory Testing:** Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term and long-term 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.

**Toxicity Category (Signal Word)**

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

**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.

## Does DEET cause developmental or birth defects?

### Animals

- DEET does not cause birth defects in rats (3).
- Rats and rabbits suffer no adverse birth complications except when fed high doses of DEET. Pups experience reduced body weights at high doses (3). Unborn and baby rats suffer increased mortality rates when exposed to high doses of DEET (4).
- DEET causes birth defects in chicks when injected directly into chicken eggs (4).

### Humans

- Scientists have gathered no evidence that indicates DEET causes harmful reproductive effects to users.

## Does DEET cause cancer?

### Animals

- Rats and mice did not develop cancer when fed high daily doses of DEET over their lifetime (2). **See Cancer box.**

### Humans

- No direct relationship between DEET use and carcinogenicity in humans has been established (2).
- U.S. EPA has classified DEET as a group D carcinogen (not classifiable as to human carcinogenicity). The U.S. EPA needs further animal testing data to completely evaluate DEET (2).

**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.

## Does DEET break down and leave the body?

### Animals

- For a wide variety of test animals, DEET in the body is broken down and eliminated. Mice eliminate the majority DEET absorbed through their skin in 1 to 3 days. Trace amounts of DEET were discovered in the mouse tissue 1 to 3 months after application (4).
- DEET is broken down in the body prior to elimination. Elimination occurs mostly in the urine (4).

### Humans

- DEET can penetrate through human skin. Once in the body, it is eliminated in the urine. Peak concentrations in the urine occur several hours after application. Based on this information and animal studies, DEET is not expected to accumulate in the body (3).

## What happens to DEET in the environment?

- Because of its limited use pattern, EPA has required very little testing to be done on environmental fate of DEET (2).
- DEET does not readily degrade by hydrolysis at environmental pHs (2).
- DEET that is released into the soil breaks down fairly slowly (4).
- Residues of DEET in the atmosphere degrade fairly quickly (3).
- DEET has a moderate potential to move through soil and into groundwater (4).

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

**1 half-life = 50% degraded**  
**2 half-lives = 75% degraded**  
**3 half-lives = 88% degraded**  
**4 half-lives = 94% degraded**  
**5 half-lives = 97% degraded**

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

## What effect does DEET have on wildlife?

- DEET is slightly toxic to fish, birds, and aquatic invertebrates (2).
- DEET is practically non-toxic to mammals (2).
- Based on information from a study of carp fish, scientists believe DEET will not bio-accumulate in a food chain (3).

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### For more information contact: NPTN

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## References

- (1) McIver, S. B. A model for the mechanism of action of the repellent DEET N,N-diethyl-m-toluamide on aedes aegypti (diptera: culicidae). *Journal of Medical Entomology* **1981**, Vol. 18, pp 357-361.
- (2) *DEET: Reregistration Eligibility Decision.*, U.S. Environmental Protection Agency, Office of Pesticide Programs, U.S. Government Printing Office: Washington D.C., 1998.
- (3) DEET. In *Hazardous Substances Data Bank (HSDB)* [CD-ROM]; Department of Health and Human Services: Bethesda, MD, July 1999.
- (4) *Handbook of Pesticide Toxicology*; Hayes, W. J., Jr.; Laws, E. R. J., Eds.; Academic Press, Inc.: San Diego, CA, 1991, Vol. 2, pp 816-822.

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