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

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

# Pesticides in Indoor Air of Homes

## (General Fact Sheet)

Please refer to the **Technical Fact Sheet** for more technical information.

**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 potential hazard by ingestion, inhalation, dermal contact, and eye exposure.

**CAUTION - low toxicity**

**WARNING - moderate toxicity**

**DANGER - high toxicity**

## Why might pesticides in indoor air of homes be a concern?

- Many household products are pesticides, such as lawn and garden products, insect sprays and baits, disinfectants, and rat poison. Examples of pests that pesticides control include insects, plants, rodents, and microorganisms (1, 2).
- The acute toxicity of the pesticide product is indicated by a signal word (Caution, Warning, or Danger). The signal word reflects the combined toxicity of active and other ingredients. Subchronic and chronic toxicity such as reproductive, developmental, and cancer effects may be of concern depending on the specific active ingredient and the exposure (route, length, and timing). See boxes on **The Pesticide Label** and **Cancer**.
- People spend the majority of time indoors, possibly greater than 90% of their day. The average percent of time spent indoors at home has been estimated from 60-90% (3).
- People are exposed to pesticides primarily in the home (3). Approximately 90% of all households in the United States use pesticides (4). The number and concentration of pesticides detected in indoor air have been shown to be typically greater than those detected in outdoor air (5).

**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 at large doses, then the EPA considers it unlikely the pesticide will cause cancer in humans. Testing for cancer is not done on human subjects.

- People are exposed to pesticides are by inhaling them, accidentally eating them, and getting them on their skin (6). Inhaling pesticides can be a major route of exposure (5, 7-11). *Note: This fact sheet does not address indoor exposures other than inhalation nor any routes of exposures occurring outdoors.*
- The majority of pesticide exposures in the home as a result of applications made according to the product labels are at levels below those anticipated to cause adverse health effects.

**Dose-response.** The effect of pesticides on human health depends on how much chemical is present, the length and frequency of exposure, and the toxicity of the pesticide. Effects also depend on the health of a person when exposure occurs. Laboratories can detect pesticides in indoor air at extremely low levels that *may* not necessarily be harmful to humans.

## How do pesticides get into the indoor air of homes?

- Pesticides enter indoor areas via indoor use and storage, track-in by people and pets from outdoor areas, or outdoor air entering the home (12-15). Pesticides may be found indoors even when there is no known use of pesticides on the property (16).
- Once in air, pesticides may exist as gases, liquids, or solids, or as an aerosol (17).

**Air Levels.** The level of pesticide in air is the amount of pesticide present in a fixed volume of air. The amount of pesticide is often represented in milligrams (mg) or micrograms ( $\mu\text{g}$ ) and volume in liters (L) or cubic meters ( $\text{m}^3$ ). Pesticides in air may also be measured in parts per million (ppm) or billion (ppb). This means the pesticide occupies one volume for every million or billion volumes of air (18).

## What are the health risks from pesticides in the indoor air of homes?

- The risk with breathing pesticides depends on the toxicity of the pesticide and the level of exposure. See boxes on **Dose-response**, **Air Levels**, and **Breathing Rate**.
- When breathing pesticides, the respiratory tract is the first organ system that pesticides contact. This system extends from the nose and mouth to the lungs (20). The respiratory system is important in distributing inhaled pesticides (21).
- Breathing pesticides may affect multiple organ systems or just the respiratory system (21).
- An individual's health status affects his/her response to inhaled pesticides (22). Individuals with preexisting health conditions or impaired health status, particularly respiratory diseases, may be more susceptible to inhaled pesticides.

**Breathing Rate.** Breathing rate is the amount of air inhaled per time. A person's age, gender, weight, health status, and activity level (sleeping, walking, running, etc.) affect breathing rates. Higher breathing rates increase the exposure to pesticides in indoor air and *may* translate into greater risk (19).

## What factors influence the level and fate of pesticides in the indoor air of homes?

- The pesticide level in indoor air is determined by the amount of pesticide in the home and how fast the pesticide leaves the air by venting outdoors, degradation, or settling to the ground (23).
- The volatility of a pesticide affects the level of pesticides in air (24). Temperature, humidity, and formulation type influence the volatility of a pesticide (5, 24-26). See box on **Volatility**.

**Volatility.** Volatility is the tendency of a pesticide to convert a liquid or solid into a gas. The greater the volatility of a pesticide, the more likely the substance will be present as a gas.

- Different application methods may result in different levels of pesticides in air (9, 27, 28). The frequency of application also influences air levels.
- Seasonal changes cause variations in the presence and levels of pesticides indoors. The season influences pesticide use and changes in the heating, cooling, or ventilation of air. Seasons also influence people’s activity levels (5).
- Building characteristics impact indoor pesticide air levels (23). Exhaust fans and heating and air conditioning systems influence air movement within the home and the exchange of indoor air with outdoor air (“leakiness” of the home) (23).
- People and pets track-in and distribute pesticides indoors from pesticide-treated lawns (12, 13). Indoor activities such as walking in a pesticide-treated area or vacuuming can temporally increase pesticide levels in air (23, 29).
- Pesticides distribute in indoor air from indoor or outdoor sources. Levels of pesticides in indoor air may vary within a room and between rooms (7, 14, 30-32).
- Pesticides in the air settle out onto surfaces. Once they are on the surface, the pesticide may stay there or be resuspended in air (7, 9-11, 23, 25, 28, 32, 33).
- Pesticides may degrade indoors. Faster degradation rates typically result in lower air levels and less persistence of pesticides in air (24). Degradation rates for pesticides indoors may be slower than outdoor rates, resulting in prolonged presence indoors (34). The degradation rate is often represented as a half-life. See the box on **Half-life**.
- Opening windows and using fans to ventilate the area reduces indoor air levels of pesticides (9-11, 24, 25, 32, 35). Researchers suggest that indoor pesticide air levels may depend on ventilation (10, 11).

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

<b>1 half-life</b>	<b>= 50% degraded</b>
<b>2 half-lives</b>	<b>= 75% degraded</b>
<b>3 half-lives</b>	<b>= 88% degraded</b>
<b>4 half-lives</b>	<b>= 94% degraded</b>
<b>5 half-lives</b>	<b>= 97% degraded</b>

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

## What is the risk when I smell pesticides inside my house?

- An odor is evidence of exposure to a pesticide in air, but it is not necessarily evidence of toxicity (28). The odor can be unpleasant and it may cause nasal irritation, nausea, or headaches (28, 36).
- Odor from a pesticide may be caused by one or several chemicals contained in a pesticide. Detecting an odor depends on the level of pesticide present in air and an individual’s odor threshold (lowest level that you can smell a chemical) (28).

## How can I minimize exposure to pesticides in indoor air of my home?

- If possible, use nonchemical pest control methods such as good home hygiene, sealing entry points for pests and removing sources of food and water (37).
- If the pesticides are coming from outdoor sources, minimize the outside air getting inside. Close windows and shut off mechanical systems that ventilate with outdoor air. Open the windows when spraying indoors.
- To minimize pesticide track-in from outdoor treated areas, remove your shoes before you enter the home or use an outdoor shoe cleaning device prior to entering the home, and limit pet access to treated areas (12).

- Store pesticides in the original containers in secure sites outside of areas where people and animals spend large amounts of time. Keep pesticides in locations not accessible to children.
- Read the label and follow directions. Adverse health effects are not expected from pesticides used in accordance with the label. Use pesticides only in ways consistent with the label directions (37).
- Treat indoor plants and animals outside whenever possible. Mix or dilute pesticides outside or in well-ventilated areas (37).
- If you use pesticides to treat an indoor area, ventilate the area. If listed, follow the pesticide label for ventilating and reentering treated areas (37).
- Call the National Pesticide Telecommunications Network (NPTN) at 1-800-858-PEST (7378) for more information.

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**For more information contact: NPTN**

Oregon State University, 333 Weniger Hall, Corvallis, Oregon 97331-6502.

Phone: 1-800-858-7378 Fax: 1-541-737-0761 Email: [nptn@ace.orst.edu](mailto:nptn@ace.orst.edu)

NPTN at <http://nptn.orst.edu/> EXTOXNET at <http://ace.orst.edu/info/extoxnet/>

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Or:

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**U.S. EPA Indoor Air Quality Information Clearinghouse  
IAQ INFO**

P.O. Box 37133, Washington, DC 20013-7133

Copies of this factsheet are not available at this hotline.

Phone: 1-800-438-4318 Fax: 1-703-356-5386 Email: [iaqinfo@aol.com](mailto:iaqinfo@aol.com)

U.S. EPA Indoor Environments Division at <http://www.epa.gov/iaq/>

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