



Icahn  
School of  
Medicine at  
Mount  
Sinai

*Children's  
Environmental  
Health Center*

# Lawn & Garden Pesticides: What You Need to Know

## WHAT ARE PESTICIDES?

**A SUBSTANCE OR MIXTURE OF SUBSTANCES USED TO DESTROY, SUPPRESS OR ALTER THE LIFE CYCLE OF ANY PEST**

Pesticides repel or kill unwanted pests such as insects (insecticides), rodents (rodenticides), fungi (fungicides), and weeds (herbicides). All pesticides have the potential to be toxic to humans. Pesticides sold in the United States must be registered with the Environmental Protection Agency (EPA).

## HOW ARE WE EXPOSED?

### INHALATION, INGESTION & DERMAL EXPOSURES

The Centers for Disease Control and Protection detects pesticides in the bodies of nearly everyone in the United States. We come into contact with pesticides through plants, soil, air, and food. Outdoor pesticides are tracked into our homes on shoes, strollers, and the bodies of children who run and play in pesticide treated areas. How a pesticide is applied can greatly affect the risk of exposure to people during and after application.

- **Sprays:** Aerosol sprays may be directly applied to a target or more broadly distributed using a “fogger” or “bomb”. All of these products increase the risk of inhalational exposures. The use of foggers and bombs is not recommended as they can be particularly dangerous. Exposures via the skin can also occur from contact with sprayed surfaces. Spraying is almost always associated with **pesticide drift**, the dispersal of pesticides in the air beyond the target site. This means that what your neighbor applies to their lawn will likely add to your family’s pesticide exposure.
- **Granular pesticides** are typically applied to the soil surface to target pre-emergent weeds or sprinkled around areas of pest infestations. Exposure to these products is most likely via ingestion or through the skin.
- **Stationary bait traps** contain pesticide in a solid or granular form. Bait traps should always be kept out of reach of children and pets to avoid accidental ingestion and contact.

## WHO IS MOST AT RISK?

### CHILDREN, FETUSES & AGRICULTURAL WORKERS

- **Children** are at highest risk for exposure due to their proximity to the ground where pesticides settle and their age-appropriate hand-to-mouth behaviors. Their higher breathing rates also increase risk of exposure compared with adults.
- **Fetuses:** Gestation is one of the most vulnerable windows for exposure to pesticides. Studies show that exposures in-utero are associated with cognitive, behavioral, and respiratory problems during childhood and beyond.
- **Agricultural workers** and their families as well as individuals living in agricultural areas experience higher exposures than the general public. Farming communities have higher rates of certain cancers including leukemia, non-Hodgkin’s leukemia and lymphoma, soft tissue sarcoma, and skin, lip, stomach, brain, and prostate cancer.

## WHAT ARE THE HEALTH RISKS?

### NERVOUS SYSTEM, HORMONAL SYSTEMS, RESPIRATORY EFFECTS, & CANCER

Health risks differ depending on the chemicals in a product and whether the exposure is **acute** (brief, typically high dose) or **chronic** (occurring over a long period of time, typically low dose). Acute exposures are most common in agricultural workers or poisonings. Chronic exposures to low doses of pesticides are more common due to consumer practices and household use.

- **Nervous system effects:** Many classes of pesticide exert their effects by damaging the nervous system of a pest. Due to similarities across species, these pesticides have also been shown to be toxic to the nervous system of humans.
- **Hormonal system effects:** Several pesticides are classified as Endocrine Disrupting Chemicals (EDCs) due to their potential to interfere with hormones in the body. Disruption of hormonal systems can impair the development and normal functioning of the reproductive system as well as the nervous system, particularly when exposure occurs early in life.
- **Cancer:** Some pesticides have been shown to have the potential to cause cancer in laboratory and animal studies. For instance, glyphosate, the active ingredient in some pesticides is classified as a probable human carcinogen by the World Health Organization.
- **Respiratory effects:** Exposure to some pesticides during pregnancy has been shown to increase the risk of wheezing and asthma in children. Both chronic and acute occupational exposures to pesticides are associated with impaired lung function, asthma, and other respiratory diseases.

### A NOTE ABOUT “INERT” INGREDIENTS

Inert ingredients are all components of a pesticide other than the active ingredient that targets the pest. Often inert ingredients make up greater than 99% of a pesticide product. Inert ingredients are proprietary – or “trade secrets”- and often are not listed on labels. These compounds may extend shelf life, allow pesticides to remain in the environment longer, increase efficacy of the active ingredient, act as a propellant, or add scent or color. *“Inert” should not be equated with “safe”*. In fact, prenatal exposure to piperonyl butoxide (PBO), an “inert” ingredient found in pyrethrin pesticides, is associated with impaired cognition and increased incidence of cough in children (Horton et al 2011, Liu et al 2012).

## HOW CAN I REDUCE EXPOSURE?

### Eliminate pests naturally by:

- Practicing organic lawn care. See [beyondpesticides.org](http://beyondpesticides.org) for tips and [perfectearthproject.org](http://perfectearthproject.org) to learn how easy it is to maintain a beautiful organic lawn.
- Utilizing **integrated pest management** (IPM) methods that eliminate or reduce the need for synthetic lawn and garden chemicals (see <http://npic.orst.edu/pest/ipm.html>).
- Aerating your lawn to allow for healthy root growth.
- **Nourishing soil** with organic compost since nutrient-rich soil reduces pest infestations.
- Choosing **native plants** that thrive in your zone.
- **Growing your own** organic produce.
- Eliminating standing water that attracts mosquitos.
- Encouraging friends and neighbors to reduce the use of pesticides. Pesticides can cross property lines.

### If pesticides must be used for an emergency situation:

- Never apply pesticides in the presence of children; always avoid areas where they play. Keep children and pets indoors during active spraying.
- Choose the least toxic pesticides. The EPA requires one of three “signal” words on all pesticide labels. In order from least toxic to most toxic, they are: 1) Caution, 2) Warning, 3) Danger.
- Avoid application of pesticides where pesticide run off could enter ponds, streams, drinking water sources, or other bodies of water.
- Hire a licensed professional applicator. If you live in an apartment building, ensure that your landlord is using one.
- Never use a pesticide without an EPA registration number on the label. Unregistered pesticides are sold illegally in the United States and may be extremely toxic.
- Target insects at the larval stage using larvicides, which can be more effective and less toxic to humans than spraying mature insects.
- Never use a pesticide in a way other than as instructed on the label. Follow directions closely and utilize recommended personal protective equipment such as gloves, goggles, and face masks.
- Never store pesticides within reach of children.
- Never pour pesticides down the drain. Always dispose of them according to directions found on the label.
- Never store pesticides in containers other than the ones they are sold in.

Table 1. Common classes of pesticides\*

CHEMICAL	TARGET	WHERE IT'S FOUND	WHAT'S THE PROBLEM
<b>Glyphosate</b>	Weeds (nonselective)	The active ingredient in some pesticides, including weed killers. Glyphosate residues are found on foods, particularly those that contain ingredients genetically modified to be herbicide resistant.	Classified as a probable human carcinogen by the World Health Organization International Agency for Research on Cancer (IARC)
<b>2,4-D</b> (2,4-Dichlorophenoxyacetic acid)	Broadleaf weeds	Widely used for residential weed control and in agriculture. <b>Enlist Duo</b> , a combination of glyphosate and 2,4-D is becoming more common in agriculture as weeds develop glyphosate resistance.	One of the highly toxic chemicals used in "Agent Orange" during the Vietnam War. Toxic to the nervous system. Classified as a possible human carcinogen by IARC. Associated with increased risk of cancer in farm workers in some studies. Endocrine disruptor.
<b>Atrazine</b>	Broadleaf and grassy weeds	Second most widely used herbicide in the U.S. after glyphosate. Used widely in corn and sugarcane crops, on golf courses, and residential lawns.	Endocrine disruptor. Major drinking water contaminant in the U.S. Banned in the EU in 2004.
<b>Pyrethrins</b>	Insects	Naturally occurring chemicals extracted from the chrysanthemum plant. Used in farming, household, lawn and garden applications, personal repellants, and to treat scabies and lice. Residues are found on conventionally farmed foods.	Human health effects largely unknown due to lack of scientific studies. Toxic to the nervous system at high doses. Cause tumors in laboratory animals.
<b>Pyrethroids</b> e.g. permethrin, allethrin, resmethrin	Insects	Synthetic pyrethrins. Used widely in farming, lawn and garden applications, mosquito control, personal repellants, and to treat scabies and lice. Residues are found on conventionally farmed foods.	Human health effects largely unknown due to lack of scientific studies. Toxic to the nervous system at high doses. Cause tumors in laboratory animals. More toxic to mammals and persistent in the environment than naturally occurring pyrethrins. Highly toxic to aquatic wildlife, bees, and other beneficial insects.
<b>Organochlorines</b> e.g. DDT, chlordane, lindane	Insects	The organochlorine DDT was used widely in the 1960s to target mosquitos. DDT and chlordane are banned in the U.S. but we are still exposed through food and environment due to the highly persistent nature of these chemicals.	Organochlorines are highly toxic and persistent in the environment. Toxic to the nervous system. Lindane is a known human carcinogen (IARC). DDT is a probable human carcinogen (IARC). Chlordane is a possible human carcinogen (IARC).
<b>Organophosphates</b> e.g. malathion, chlorpyrifos	Insects	Residential use is limited due to high level of toxicity but agricultural use persists.	Toxic to the nervous system of insects. Accumulating evidence suggests that neonicotinoids are contributing to bee colony collapse.

CHEMICAL	TARGET	WHERE IT'S FOUND	WHAT'S THE PROBLEM
<b>Carbamates</b> e.g. aldicarb, carbaryl	Insects	Used in residential sprays, bait traps, and agriculture.	Toxic to the nervous system of insects by the same mechanism as organophosphates. Highly toxic to the nervous system of humans when touched, inhaled, or ingested.
<b>Neonicotinoids</b>	Sap-feeding insects Root-feeding grubs	Used in residential products and agriculture.	Toxic to the nervous system of insects. Accumulating evidence suggests that neonicotinoids are contributing to bee colony collapse.

### Additional Resources

**National Report on Human Exposure to Environmental Chemicals (CDC)** <http://www.cdc.gov/exposurereport/>

**National Pesticide Information Center** <http://npic.orst.edu/index.html>

**Northeast Organic Farming Association** <http://www.nofa.org/>

**Pesticide Use Trends in the U.S.** [https://edis.ifas.ufl.edu/topic\\_series\\_pesticide\\_use\\_trends\\_in\\_the\\_us](https://edis.ifas.ufl.edu/topic_series_pesticide_use_trends_in_the_us)

**Beyond Pesticides** [www.beyondpesticides.com](http://www.beyondpesticides.com)

**The Agricultural Health Study** <http://www.cancer.gov/about-cancer/causes-prevention/risk/ahs-fact-sheet#q3>

**ATSDR Public Health Statement on Pyrethrins and Pyrethroid** <http://www.atsdr.cdc.gov/ToxProfiles/tp155-c1-b.pdf>

**For a more extensive list of pesticide chemicals see** <http://npic.orst.edu/index.html>

Myers JP, Antoniou MN, Blumberg B, Carroll L, Colborn T, Everett LG, Hansen M, Landrigan PJ, Lanphear BP, Mesnage R, Vandenberg LN, Vom Saal FS, Welshons WV, Benbrook CM. Concerns over use of glyphosate-based herbicides and risks associated with exposures: a consensus statement.

Environ Health. 2016 Feb 17;15(1):19

Horton MK, Rundle A, Camann DE, Boyd Barr D, Rauh VA, Whyatt RM.

Impact of prenatal exposure to piperonyl butoxide and permethrin on 36-month neurodevelopment.

Pediatrics. 2011 Mar;127(3):e699-706

Liu B, Jung KH, Horton MK, Camann DE, Liu X, Reardon AM, Perzanowski MS, Zhang H, Perera FP, Whyatt RM, Miller RL.

Prenatal exposure to pesticide ingredient piperonyl butoxide and childhood cough in an urban cohort. Environ Int. 2012 Nov 1;48:156

-61