



NEWSLETTER



Letter from the Editor

Greetings,

The topic for the Summer edition of the Poison Center and Public Health Collaboration Community of Practice (PCPHCoP) newsletter is pesticides. Pesticide use and abuse is common during spring and summer months as people say goodbye to winter and begin their spring cleaning, gardening, yard projects, and yard maintenance. Pesticides are routinely used during these chores to curb or halt the occurrence of unwanted pests and weeds. Safety is vital as people use these products. Users must follow manufacturer instructions and wear personal protective equipment (PPE) to avoid poisoning when using pesticides and other chemicals. However, pesticides should not be the first step in controlling pests. They can help to control pests, but only if the root causes are also addressed. Integrated pest management (IPM) can be implemented in most pest management situations prior to using pesticides. IPM is a science-based approach for reducing populations of disease vectors and public health pests by using a variety of pest management techniques that focus on pest prevention, pest reduction, and the elimination of conditions that lead to pest infestations.¹ Health care providers, cooperative extension agents, employers, and pesticide manufacturers can help prevent harmful exposures by encouraging the use of integrated pest management (IPM) practices, encouraging the use of less toxic agents, and by increasing education on the harmful effects of pesticide misuse. Please read on to learn more about pesticides.

If you would like to hear more about a specific topic in the future, please reach out and let me know.

Sincerely,

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Contents

Letter from the Editor	1
Overview of Pesticides	2
Common Pesticide Chemicals	3
Environmental Impacts of Pesticides	4
Public Health Effects of Pesticide Poisoning in Humans	4
Pesticide Poisoning Surveillance	5
Summary	5
Additional Resources	5
References	6



Overview of Pesticides

Pesticides are chemical or biological agents that deter, incapacitate, kill, or otherwise discourage pests.^{2,3} They target an array of pests, including insects, plant pathogens, weeds, birds, and mammals. Pests can destroy property, cause nuisance, and spread disease.² Registered pesticides pose minimal risk to humans and the environment if used according to the label.² The Environmental Protection Agency (EPA) is responsible under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) for regulating pesticides with public health uses, as well as ensuring that regulated products do not pose unintended or unreasonable risks to humans, animals and the environment.⁴

Every day, people are exposed to pesticides often at levels too small to pose a risk.⁵ Exposure can take place in a variety of settings including, home, school, the workplace, or outdoors. Pesticides can be used in homes, businesses, and farms to control pests. They can enter the body through eating, drinking, breathing, or through skin or eye contact.^{2,6,7} The health risks from pesticide exposure depend on their toxicity, the amount a person is exposed to, how long the exposure lasts, and the route of exposure.^{4,7} Consequently, certain pesticide exposures present a significant public health issue to humans and the

environment.⁶ Inappropriate use of pesticides, including not using recommended personal protective equipment (PPE) can lead to adverse effects such as potential toxicity to humans and other species.^{2,6} In 2019, pesticides represented 3.6% and 3.3% of the most common sources implicated in poison exposure in children and adults, respectively.⁸ On average, 23 deaths, 1419 hospitalizations, 7385 emergency department visits, and 130,000 calls to poison control centers (PCs) are pesticide-related each year.⁶ The economic cost from human pesticide exposures is estimated at \$2 billion per year.⁶

Pesticide Poisoning

Pesticide poisoning occurs when pesticides adversely affect humans, animals or plants. Pesticide poisoning may result from acute (single, high-level) or chronic exposure. Eye irritation resulting from splashes of pesticide in the eye is an example of an acute, high-level exposure. Long-term high-level exposure may occur in pesticide formulators and manufacturers from repeated exposure, or in farmers from repeated use.^{7,9} Individuals exposed to pesticide residues in food as well as contact with pesticide residues in the air, water, soil, sediment, plants, and animals may result in long-term low-level exposure poisoning.^{7,9}



Common Pesticide Chemicals

Table 1. Characteristics of Common Pesticide Chemicals

Chemicals	Characteristics	Examples	Symptoms
Organophosphates & Carbamates	<p>Persist in the environment from only a few hours to several months⁶</p> <p>Target the brain and nervous system, interfering with nerve signal transmission^{6,9}</p> <ul style="list-style-type: none"> Organophosphates irreversibly inactivates acetylcholinesterase, which is essential for nerve function in humans, insects and many other animals^{6,9} Carbamates reversibly inactivates acteylcholinesterase^{6,9} 	<p>Organophosphates include: Dimefox, Mipafox, Methyl Parathion, Ronnel, enitrothion, Bidrin, Phorate, Fenthion, caumphos, Abate, Dichlorovas, Diptrex, Phosphomidon, Demetox, Oxydemeton-methyl, Malathion, Dimethoate, Trichlorofan^{10, 11}</p> <p>Carbamates include: Carbaryl, Carbanolate, Prupoxur, Dimethan, Dimetilan, Isolan, Carbofuran, Pyrolan, Aminocarb, Aldicarb, Vernolate, Pebulate, Diallate, Monilate, Butylate, Cycloate, Trillate, Thiourea, Methan, Thiram, Ferban, Amoban, Naban, Zineb, Maneb, Ziram Polyran, Dithane M- 4¹⁰⁻¹¹</p>	<p>Headaches</p> <p>Nausea</p> <p>Dizziness</p> <p>Vomiting</p> <p>Chest pain</p> <p>Diarrhea</p> <p>Muscle pain</p> <p>Confusion</p> <p>Convulsions</p> <p>Difficulty breathing Involuntary urination</p> <p>Coma</p> <p>Death may occur in severe poisoning incidents⁹</p>
Fumigants (application)	<p>Fumigants like methyl bromide and metam sodium can severely injure any tissue they touch⁹</p>	<p>Phosphine Gas (Aluminum Phosphide, Magnesium Phosphide)¹²</p> <p>Sulfuryl Fluoride¹²</p> <p>Carbon Dioxide (CO2)¹²</p>	<p>Minor exposures include burning and itching of the eyes and skin and respiratory tract irritation⁹</p> <p>Coughing and shortness of breath⁹</p> <p>Nose bleeds⁹</p> <p>Severe lung injury⁹</p>
Organochlorines	<p>Central nervous system (CNS) stimulant^{6,9}</p> <p>Extremely hazardous⁶</p> <p>Persistent in the environment^{6, 11}</p> <p>Bioaccumulate in tissues and food chain^{6,9}</p> <p>Many are banned in the United States, including DDT⁶</p>	<p>DDT (banned in the US), DDD, Dicofol, Eldrin, Dieldrin, Chlorobenziate, Lindane, BHC, Methoxychloro Aldrin, Chlordane, Heptaclor, Endosufan, Isodrin, Isobenzan, Toxaphene, Chloro propylate¹¹</p>	<p>Tremors, hyperexcitability and seizures^{6,9}</p>
Pyrethroids	<p>A synthetic pyrethrins (natural insecticide) produced by chrysanthemum flowers⁶</p> <p>More stable than pyrethrins (degrades in < 12 hours), and persist in the environment for weeks⁹</p> <p>Excitatory nerve toxicity and,⁹</p> <ul style="list-style-type: none"> Affects sodium channels and may lead to paralysis⁶ <p>Highly toxic to insects, fish and birds, even in very small doses⁶</p>	<p>Allethrin, Bonthrin, Dimethrin, Tetramethrin, Permethrin, Cyclethrin, Furethrin, Fenevelerate, Alphamethrin, Decamethrin, Cypermethrin¹¹</p>	<p>Tremors</p> <p>Salivation</p> <p>Headache</p> <p>Fatigue</p> <p>Vomiting</p> <p>Stinging</p> <p>Itching skin</p> <p>Involuntary twitching⁹</p>

Environmental Impacts of Pesticides

Pesticides pose widespread impact on the environment when not used according to label instructions. They can be carried away by wind, travel in water run-off, or seep into ground water. Over 95% of herbicides and over 98% of insecticides do not reach the targeted pest.¹³ As these chemicals travel to other areas, they affect a number of plant and animal species in the environment.¹³ Damages to the environment may include disruptions in the local ecosystem, long-term damage to soils and water sources, death or injury to non-targeted organisms, or superbugs/weeds which grow resistant to the pesticide.¹⁴

Impact on Wildlife

Pesticides may be linked to the decline in the bee population, a phenomenon known as colony collapse disorder (CCD).¹⁵ Bees are important plant pollinators, and plants are vital to the food chain. Therefore, a reduction in plant population impacts other organisms up the food chain. Humans and animals inadvertently consume food contaminated with pesticides. The pesticides bioaccumulate with each ascension through the food chain and can pose significant health risks.^{6,8,16}



Public Health Effects of Pesticide Poisoning in Humans

Human Exposures and Health Effects

The health effects of pesticides depend on the type of pesticide (Table 1). Organophosphates and carbamates affect the nervous system.⁵ Others may irritate the skin or eyes.⁵ Some pesticides may be carcinogens.⁵ Others may affect the hormone or endocrine system in the body.⁵

Pesticides may cause harmful acute or short-term adverse health effects, and chronic adverse health effects that may present months or years after exposure. Acute health effects include stinging eyes, rashes, blisters, blindness, nausea, dizziness, diarrhea and death, among others.⁸ Adverse chronic conditions resulting from pesticide poisonings includes cancers, birth defects, reproductive harm, immunotoxicity, neurological and developmental toxicity, and disruption of the endocrine system.⁹ Pesticides impact individuals differently. Some are more vulnerable than others. Children, especially infants, are more susceptible than adults to the toxic effects of pesticides. Children and infants are more susceptible to toxic exposure than adults because they have proportionally more intake of food contaminants, active developmental processes, multiple exposure pathways and susceptible socio-behavioral activities.¹⁷ Farm workers and pesticide applicators are also more vulnerable because of higher exposure concentration and frequency.⁸

Exposure Routes

Exposure routes vary depending on the use of the pesticide. An individual may be exposed to a particular pesticide via a single pathway or multiple pathways. Dermal, inhalation, and oral exposure routes are the three most common exposure routes.

Dermal exposure

- Occurs from absorption through skin, mucous membranes, or eyes⁷
- Happens often via a splash, spill, rub or drift, or when cleaning or repairing equipment⁷
- Makes up 95% of all exposures⁷

Inhalation exposure

- Occurs from breathing in the pesticide from powders, dusts, gases, vapors, or small spray droplets⁷
- Provides the quickest route into the circulatory system⁷

Oral exposure or ingestion

- Occurs from accidental or intentional ingestion of contaminated food and drinks or ingesting contaminated water when swimming
- Accidental ingestion happens most often when pesticides have been taken from the original container and put into an unlabeled bottle or food container and consumed⁷
- More common in children¹⁷

Pesticide Poisoning Surveillance

Surveillance is a critical public health tool for the control of pesticide poisoning. Surveillance for pesticide poisoning occurs across a number of different information systems in the United States. Federal and state environmental protection agencies maintain pesticide data, regulate use in U.S. markets, and implement policies on pesticides. Surveillance of acute pesticide-related illness and injury has been endorsed by several professional organizations and federal agencies including the American Medical Association (AMA), the Council of State and Territorial Epidemiologists (CSTE), National Institute for Occupational Safety and Health (NIOSH), and the U.S. Government Accountability Office (GAO).¹⁸

NIOSH uses data from the Sentinel Event Notification System for Occupational Risk (SENSOR)-Pesticides program and the National Poison Data System (NPDS) to monitor trends in acute pesticide-related illness and injury that occur on the job.¹⁹ The SENSOR program develops and maintains occupational illness and injury surveillance capacity within state health departments, and is most useful for identifying outbreaks and emerging pesticide

problems.¹⁹ NIOSH uses NPDS data, which is received every other year, to monitor acute work-related pesticide poisonings.^{19,20} These data serve as an early warning for any harmful effects not detected by pesticide manufacturer testing.²⁰

NPDS Captures Pesticide Data

NPDS can be used to detect harmful exposures to pesticides. PCs capture information and exposure calls from the public and medical professionals related to pesticides. People can be exposed to pesticides through multiple routes; however, dermal and inhalation are the most common. Knowing the origin of the exposure is important for assisting with treatment and other mitigation measures. When capturing data related to pesticide exposures, it may be helpful to include notes related to the exposure source, any necessary decontamination, and the amount of time a person was exposed. Having detailed PC call data for pesticide exposures can help target public health action, such as education and messaging, if poisonings of public health significance are identified through NPDS.

Summary

All pesticides have the potential to be harmful to humans, animals, other living organisms, and the environment if used incorrectly. The key to reducing health hazards when using pesticides is to always limit your exposure by wearing personal

protective equipment (PPE) and use a low-toxicity pesticide when available. Following the label and practicing safe work habits will minimize hazards from the use of pesticides.

Additional Resources

[Recognition and Management of Pesticide Poisonings | Occupational Pesticide Safety and Health | US EPA](#)

[Pesticide Exposure | Tracking | NCEH | CDC](#)

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