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A Consumer's Guide to Safer Pesticide Use

The Challenge of Pesticides

An Excerpt from *Silent Spring*

Rachel Carson, writer and naturalist, raised the public consciousness about pesticides and their dangers in her book, Silent Spring. *This year marks the 25th anniversary of the book. The editors of* EPA Journal *believe the following excerpt from* Silent Spring *eloquently states the challenge of modern pesticides and is appropriate to begin this issue of the* Journal, *which focuses on these chemicals and EPA's role in regulating them.*

For the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death. In the less than two decades of their use, the synthetic pesticides have been so thoroughly distributed throughout the animate and inanimate world that they occur virtually everywhere. They have been recovered from most of the major river systems and even from streams of ground water flowing unseen through the earth. Residues of these chemicals linger in soil to which they may have been applied a dozen years before. They have entered and lodged in the bodies of fish, birds, reptiles, and domestic and wild animals so universally that scientists carrying on animal experiments find it almost impossible to locate subjects free from such contamination. They have been found in fish in remote mountain lakes, in earthworms burrowing in soil, in the eggs of birds—and in man himself. For these chemicals are now stored in the bodies of the vast majority of human beings, regardless of age. They occur in the mother's milk, and probably in the tissues of the unborn child.

All this has come about because of the sudden rise and prodigious growth of an industry for the production of manmade or synthetic chemicals with insecticidal properties. This industry is a child of the Second World War. In the course of developing agents of chemical warfare, some of the chemicals created in the laboratory were found to be lethal to insects. The discovery did not come by chance: insects were widely used to test chemicals as agents of death for man.

The result has been a seemingly endless stream of synthetic insecticides. In being manmade—by ingenious laboratory manipulation of the molecules, substituting atoms, altering their arrangement—they differ sharply from the simpler insecticides of pre-war days. These were derived from naturally occurring minerals and plant products—compounds of arsenic, copper, lead, manganese, zinc, and other minerals, pyrethrum from the dried flowers of chrysanthemums, nicotine sulphate from some of the relatives of tobacco, and rotenone from leguminous plants of the East Indies.

What sets the new synthetic insecticides apart is their enormous biological potency. They have immense power not merely to poison but to enter into the most vital processes of the body and change them in sinister and often deadly ways. Thus, as we shall see, they destroy the very enzymes whose function is to protect the the body from harm, they block the oxidation processes from which the body receives its energy, they prevent the normal functioning of various organs, and they may initiate in certain cells the slow and irreversible change that leads to malignancy.

Yet new and more deadly chemicals are added to the list each year and new uses are devised so that contact with these materials has become practically worldwide. The production of synthetic pesticides in the United States soared from 124,259,000 pounds in 1947 to 637,666,000 pounds in 1960—more than a fivefold increase. The wholesale value of these products was well over a quarter of a billion dollars. But in the plans and hopes of the industry this enormous production is only a beginning.

A Who's Who of pesticides is therefore of concern to us all. If we are going to live so intimately with these chemicals—eating and drinking them, taking them into the very marrow of our bones—we had better know something about their nature and their power.

Pesticides: A Consumer's Guide to Safer Use

What is a "pest"? An insect, a fungus, a weed, a rodent, a mite, a mollusc, a nematode: any plant, animal, or microorganism that is bothersome, causes economic losses, or acts as a disease vector. If people want to get rid of pests, they use pesticides: insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, etc.

The similarity between these words and a word like "homicide" is no coincidence. The word element "cide" derives from the Latin verb that means "to kill." Simply put, a pesticide is a killer; that is what it is *supposed* to be. But in dealing with a killer, one must be wary, prudent. One must, to quote Shakespeare, "make assurance double sure." This Special Section of *EPA Journal* is designed to help you, the consumer, to be "double sure" that, when you deal with pesticides, you do so as safely as current technology allows.

Pests have been around for a long, long time. The dinosaur may be extinct, but a prehistoric monster of another sort, the cockroach, has been crawling the earth since the Carboniferous period

Medical Library, National Institutes of Health

"A Consumer's Guide to Safer Pesticide Use" first appeared as a special section in the May 1987 issue of the EPA Journal. *Susan Tejada of EPA's Office of Public Affairs edited the section. Thanks are owed to many EPA employees who made valuable contributions to this section: Frank Davido, Jan Auerbach, Vivian Prunier, Gary Ballard, Tom Ellwanger, Christine Gillis, and Karen Flagstad. Special thanks to Wendy Butler and Carol Panasewich of EPA's Office of Pesticide Programs and to Karen Slimak, president of Applied Science and Technology, Inc.*

Victims of bubonic plague. Flea-infested rats historically were the source of the plague, as they are today in some Third World nations. DDT is still the pesticide of choice in many countries.

some 350 million years ago. Until recently, people had to tolerate lice in their clothing, worms in their food, fleas in their bedding. But throughout history, pests have brought problems far worse than these discomforts. Diseases transmitted by insects, rodents, and bacteria led to deadly epidemics. Famines resulted when locusts, fungi, and other pests destroyed crops. During the Great Potato Famine of 1845-49, for example, Ireland lost almost a third of its population.

Attempts to use chemicals to control pests have been made since ancient times. But it wasn't until World War II, when many new chemicals were manufactured for military purposes, that many pesticide chemicals in use today were developed.

For several years following the war, pesticides were viewed as a sort of miracle. People rushed to use them, and to use more and more of them, more and more frequently. Pesticides could do the job: they could control long-standing pest problems, eradicate disease, increase crop yields, and the range of their potential ill effects was not apparent.

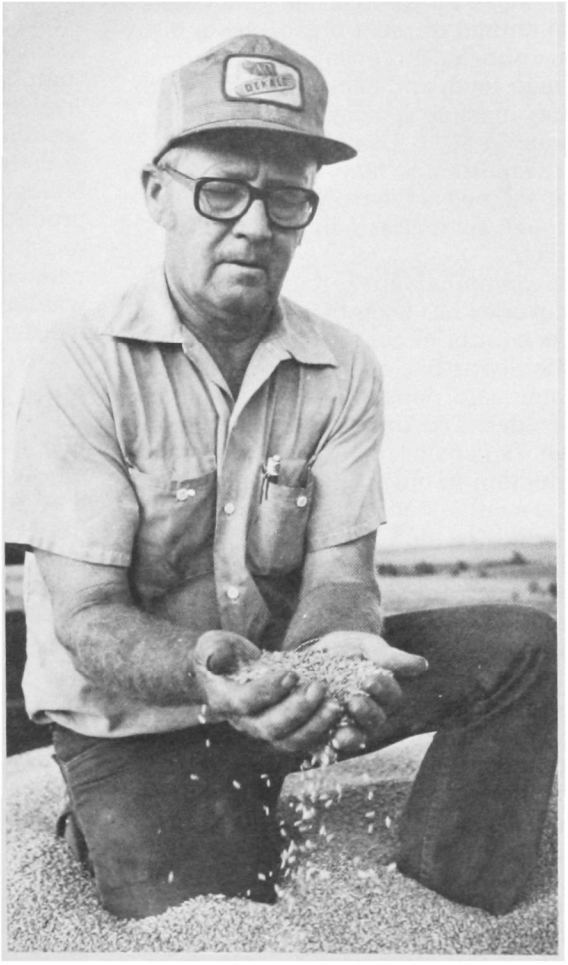
Then, 25 years ago, in 1962, Rachel Carson's book, *Silent Spring*, was published, and the way people would look at pesticides changed forever. Carson warned that the indiscriminate use of pesticides was poisoning the natural world. Since *Silent Spring*, advances in scientific knowledge and technology have shown many early fears about pesticides to be well-founded. Some cases in point:

- Until fairly recently it was believed that ground water was protected from contamination by soil and rock. Pesticides were thought to be absorbed by, and bound to, soil until they degraded. But in 1979, two pesticide chemicals were discovered in ground water in several states. Since then, at least 17 pesticides have been detected in ground water in 23 states.
- Modern technology has advanced to the point where chemicals can be detected in soil and water in minute quantities, as low as one part per billion. According to *Farm Journal*, that's like finding one copper slug in $10 million worth of pennies.
- Although health risks associated with many pesticides are still unknown, data are beginning to accumulate. Last

The Economics of Pesticides

Pesticides have taken on a crucial role in the U.S. economy. Agricultural production now depends on pesticides, as does an entire industry sector of manufacturers, formulators, and distributors. The following estimates of U.S. pesticide markets for 1985 are based on information from a variety of sources.

- Pesticide use in the U.S. more than doubled in 21 years, from 540 million pounds of active ingredients in 1964 to over 1 billion pounds in 1985. While the agricultural sector has always accounted for most of this use, its percentage share has increased, from 59 percent of total U.S. use in 1964 to 77 percent in 1985.
- Farmers spent $4.6 billion on pesticides in 1985, nearly four percent of their total farm production expenditures.
- Pesticides are used on as many as two million farms, in 75 million households, and by 40,000 commercial pest control firms (a figure that covers structural as well as agricultural custom applicators). Together, these users spent $6.6 billion on pesticides in 1985.
- Thirty major companies produce most of the basic, technical pesticide active ingredients sold and used in the United States. One hundred smaller companies also produce pesticide active ingredients.
- In addition to producers, the pesticide industry includes more than 3,000 companies that formulate pesticides—mixing active with inert ingredients to produce end use products—and 29,000 distributors of pesticide products.
- More than 11,000 people are employed by pesticide producers to do production work only—a figure that does not include those employed in research and development. Tens of thousands more are employed by pesticide formulators and distributors.
- Pesticide producers spent $410 million on research and development in 1985, of which $120 million went to R&D related to EPA registration requirements.
- About 400 million pounds of pesticide active ingredients are exported each year; 100 million pounds are imported.



Pesticides are used on approximately two million U.S. farms for a 1985 total investment of $4.6 billion. Here a farmer looks over his wheat crop to judge the results of his work.

How EPA Regulates Pesticides

September, the National Cancer Institute reported that, in a study of Kansas farmers, those who were exposed to the chemical 2,4-D—a popular herbicide in agriculture and home lawn care products—were more likely to develop a certain type of cancer than those who were not exposed.

- We now know that insects and other pests develop resistance or immunity to pesticides. In fact, according to the World Resources Institute, the number of species of insect pests resistant to one or more pesticides almost doubled between 1969 and 1980, and insect resistance cost U.S. farmers $150 million in crop losses and increased applications of chemicals in 1984.

- Some early pesticides—like DDT and other chlorinated hydrocarbon compounds—were found to persist almost indefinitely in the environment. They move up through the food chain, from animal or plant organisms to birds, fish, animals, and eventually to humans through food, and cause adverse health effects in some species. DDT was banned in 1971. Use of most of the other chlorinated hydrocarbons has also been banned or sharply restricted, although some uses still are on the market.

The cumulative result of these discoveries has been that EPA now ranks control of commercially used pesticides as one of its top priorities.

Americans depend heavily on pesticides. The United States applies about 45 percent of all pesticide production to only 7 percent of the world's cultivated land. While most pesticides in the United States are used on farms (see box, "The Economics of Pesticides"), home and garden use accounted for 14 percent of user expenditures for pesticides in 1985.

EPA's task, under the Federal Insecticide, Fungicide, and Rodenticide Act, is to ensure that the risks pesticides pose to human health and the environment do not outweigh the many benefits that pesticides provide. Your task—whether you are among the legion of home and garden pesticide users, or whether your only contact with pesticides comes when you pick out an orange in the supermarket—is to make informed decisions about pesticides. This Special Section of *EPA Journal* will give you information to help you make those decisions, and your decisions *will* make a difference. □

If the neighborhood kids mix up some lemonade, they can set up a stand on the street corner and sell their concoction by the glass. Luckily for all involved, the decision to produce, market, and use pesticides cannot be made so easily. All pesticides marketed in the U.S. must be registered by EPA.

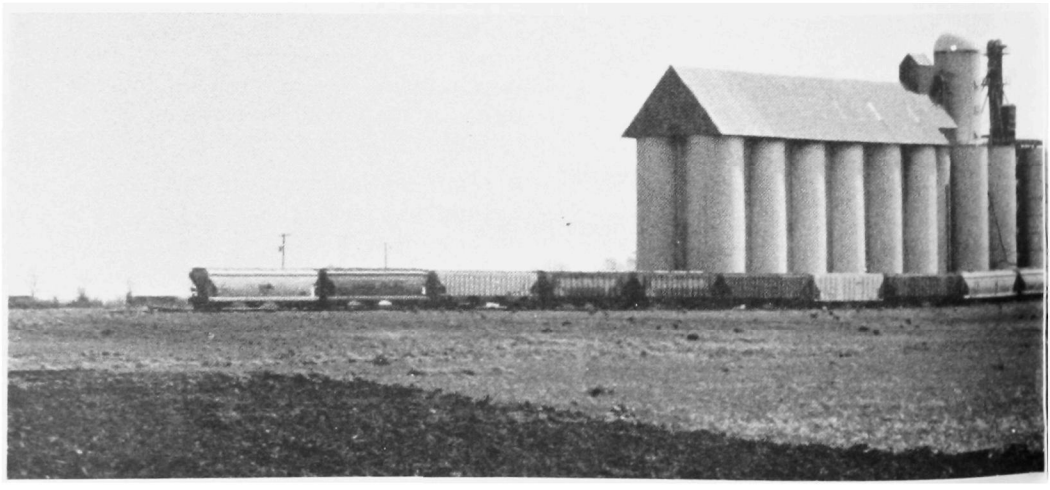
Pesticide regulation, which is governed by the Federal Fungicide, Insecticide, and Rodenticide Act, or FIFRA, and the Federal Food, Drug, and Cosmetic Act, or FFDCA, is a very complicated process. EPA has "registered" approximately 50,000 pesticide products chiefly on the basis of their active ingredients—the biologically active components in those products. How the Agency handles each registration submission depends on whether the product is entirely new or whether one or more uses already are registered.

New Pesticides

EPA is responsible under FIFRA for registering new pesticides to ensure that, when used according to label directions, they will not present unreasonable risks to human health or the environment. The law requires the Agency to take into account economic, social, and environmental cost and benefits in making decisions. In other words, pesticide registration is a pre-market review and licensing program for all pesticides marketed in the U.S., whether of domestic or foreign origin.

Pesticide registration decisions are based on Agency evaluation of test data provided by applicants. Required studies include testing to show whether a pesticide has the potential to cause adverse effects in humans, fish, wildlife, and endangered species. Potential human risks include acute reactions such as toxic poisoning and skin and eye irritation, as well as possible long-term effects like cancer, birth defects, or reproductive system disorders. Data on "environmental fate," or how a pesticide behaves in the environment, also are required so that EPA can determine, among other things, whether a pesticide poses a threat to ground or surface water.

Most registration decisions are for new formulations containing active ingredients already registered with EPA, or new uses of existing products. Other registration decisions include applications by states or federal agencies for emergency exemptions to allow special use of a pesticide for a



limited time to cover an unexpected, localized pest outbreak; registrant applications for experimental use permits to develop data supporting full registration of a new chemical or new use; conditional registrations pending full data development for products containing existing active ingredients; and for tolerances (or maximum residue levels allowed) to support registrations of pesticides on food or feed crops.

Tolerances

Under the FFDCA, EPA sets tolerances, or maximum legal limits, for pesticide residues on food commodities marketed in the U.S. The purpose of the tolerance

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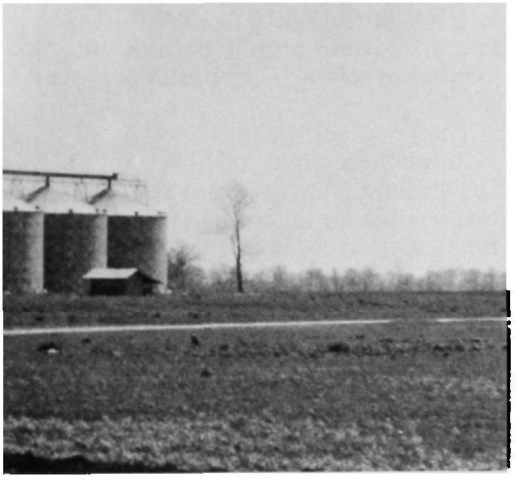
The pesticide protecting the wheat in this grain elevator in Eudona, Arkansas, has had to be registered by EPA. Many considerations enter into registering a product such as extensive data to show whether or not the pesticide has the potential for causing adverse effects in humans, domestic animals and wildlife, and whether the chemical poses a threat to ground or surface water. There are approximately 50,000 registered pesticide products in commerce.



EPA Options for Regulation

In regulating pesticides under FIFRA, EPA chooses from a variety of options:

① EPA can continue registration with no changes. (Risks and benefits are already in balance.)

② EPA can modify the terms and conditions of the registration to lower risks.

If the risk is to people who mix, load, and apply the pesticide, EPA can require:

- Protective clothing, such as gloves, hats, respirators, long-sleeve shirts, long pants, and/or chemical-resistant aprons.
- Restrictive use of the pesticide, or use only by persons who have been certified by the state as qualified to apply pesticides.
- Prohibition of certain formulation types, such as dusts or sprays.
- Protective equipment, such as enclosed vehicles or closed mixing/loading systems.

- Warning statements on the label, such as cancer or birth defect risks, to encourage greater compliance with risk reduction measures stated on the label.
- Reductions in application rates or in the frequency of applications.
- Prohibition of certain application methods, such as aerial spray or backpack sprayers.
- Integrated pest management practices, such as mechanical methods or spraying only where infestation has occurred.

If the risk is to farmworkers who reenter treated fields, EPA can require:

- Reentry intervals, which restrict farmworkers from entering a field for a certain period of time, unless they are wearing specified protective clothing.
- Changes in formulation type or application rates.
- Posting of signs to warn farmworkers that treatment has occurred.

If the risk is to consumers of crops which have been treated with pesticides, EPA can require:

- Longer preharvest intervals, so residues will have more time to dissipate.
- Changes in the manufacturing process to reduce levels of contaminants or impurities.
- Reduction in application rates or frequencies.

③ EPA can cancel use of the pesticide. In such a case, EPA can either cancel all uses; cancel certain uses where risks are particularly high; or phase in cancellation to allow the development of alternative chemicals or technologies.

④ EPA can suspend use of a pesticide, on a regular or an emergency basis, if the Agency believes the pesticide poses an imminent hazard. Suspension halts the use of a pesticide until a decision on its registration can be made through the cancellation process.

program is to ensure that U.S. consumers are not exposed to unsafe food-pesticide residue levels.

Since residue chemistry and toxicology are far more advanced now than when pesticides were first registered in this country, EPA is upgrading its traditional tolerance system. Changes include refining dietary consumption estimates, allowing more extensive use of group tolerances for related crops, and calling-in data to bring the data base up to contemporary standards. Individual tolerances for existing pesticides also are being reassessed as part of the reregistration process for old pesticides. And, finally, EPA is revoking tolerances for cancelled pesticides and setting "action levels" (for enforcement purposes) for those cancelled pesticides which take many years to completely break down in the environment.

Old Pesticides

Old pesticides registered and in use before current scientific standards were established also must be evaluated by the "no unreasonable adverse effects" guidelines applied to new pesticides. To ensure that previously registered pesticides meet current scientific and regulatory standards, FIFRA requires "reregistration" of all existing pesticides. This is being accomplished through EPA's "Registrations Standards" and "Data Call-In" programs.

To produce Registration Standards, EPA reviews its data on existing active ingredients to establish various conditions registrants must meet for reregistration of pesticide products containing old active ingredients. In order to obtain important data before the Agency completes, or even begins, a Registration Standard, EPA issues a Data Call-in to registrants which identifies data needed for reregistration of the pesticide.

These data are used to determine reregistration conditions. Such conditions may include submission of additional data; compliance with product composition, labeling, and packaging requirements; certain changes in application methods and label directions; and restricting some or all uses of the pesticides to certified applicators.

EPA is proceeding with Registration Standards on the basis of clusters of similar-use pesticides, such as termiticides, grain fumigants, and fungicides. High-volume and food-use pesticides are being assessed first.

When the Agency receives data indicating a pesticide might cause unreasonable adverse effects, EPA may begin a Special Review of that pesticide to determine whether or not regulatory action is needed.

Special Review is an intensive analysis of all the data on a pesticide: its risk and its benefits. When the analysis is complete, the Agency chooses one of the many regulatory options available—anything from keeping the current registration "as is" to an emergency suspension of the pesticide. (See box on EPA options for regulating pesticides.)

Finally, since EPA's pesticide regulation is an open process, outside experts review EPA's proposed and final pesticide regulatory actions. This includes a scientific review of all cancellations, regulations, and other major policy actions by an independent Scientific Advisory Panel composed of scientists nominated by the National Institutes of Health and the National Science Foundation; and a benefits review by the Secretary of the U.S. Department of Agriculture to make sure EPA considered the agricultural benefits of the pesticide in proposed actions.

The quality of regulatory decisions is enhanced by the active participation of those affected. Accordingly, EPA's Office of Pesticide Programs encourages public participation in regulatory decision-making by keeping industry, commodity, user, farmworker, and public interest groups informed of the progress of each decision as it wends its way through the regulatory process. Information about proposed pesticide actions also is available through organizations involved in pesticide activities, and through the *Federal Register*.

The field of pesticide regulation is very complex, merging science, public policy, and law. Since scientific knowledge constantly changes, as do the needs of society, the pesticide regulatory process is far from static. Old chemicals posing unreasonable risks are being taken off the market; new, more thoroughly tested products are replacing them. EPA will continue to update pesticide decisions as knowledge increases and improves. □

Federal Statutory Authorities

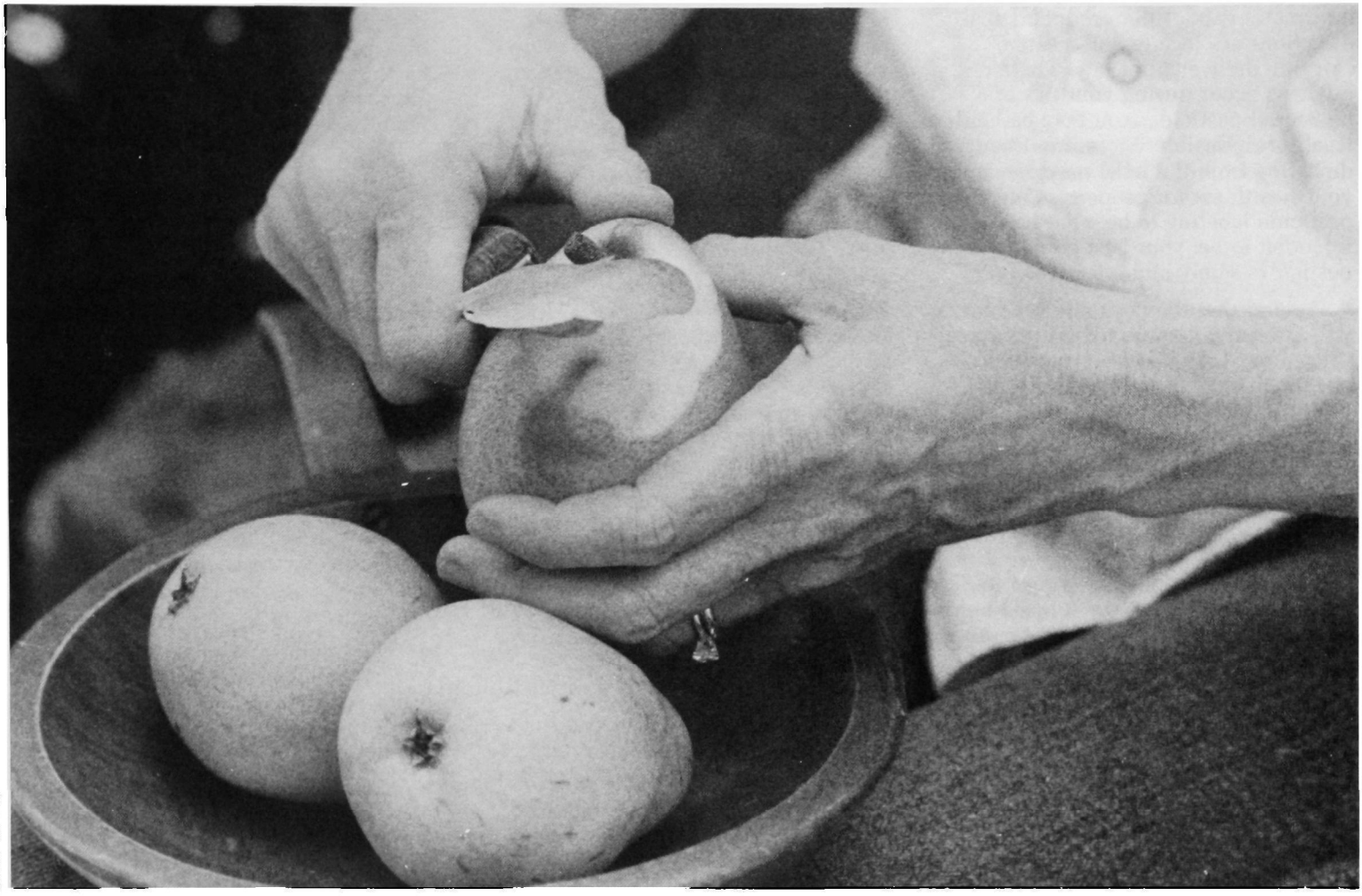
The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) governs the licensing, or registration, of pesticide products. No pesticide may be marketed in the U.S. until EPA reviews an application for registration, approves each specific use pattern, and assigns a product registration number and a pesticide producing establishment number.

Registration decisions are based upon data demonstrating that use will not result in unreasonable human health or environmental effects. In other words, FIFRA balances the risks a pesticide may pose with its benefits to society.

FIFRA was first enacted in 1947. The principal amendments were passed in 1972, establishing the "no unreasonable adverse effects" standard, the risk/benefit approach, and the task of re-evaluating all previously registered pesticides.

The Federal Food, Drug, and Cosmetic Act (FFDCA) governs, among other things, pesticide residue levels in food or feed crops marketed in the U.S. Before a pesticide can be registered under FIFRA for use on these crops, EPA sets a tolerance which specifies an upper limit of allowable pesticide residues on the crop. Exemptions may be granted when scientific data establish that the residues do not present a hazard to public health. Tolerances are intended to be enforcement tools and are set no higher than necessary to legitimize registered applications of pesticides. A tolerance is not necessarily the maximum safe level of pesticide residue.

The Food and Drug Administration and the U.S. Department of Agriculture are responsible for enforcing pesticide tolerances set by EPA, and for taking necessary regulatory action.



Steven Delaney

Human Exposure to Pesticides

Because chemical pesticides are so widely used in our society, and because of the properties of many of the chemicals, low levels of pesticide residues may actually be found throughout much of our environment, and may reach us in a variety of ways—through food, water, and air.

In regulating pesticides, EPA strives to ensure that lawful use of these products will not result in harmful exposures. Proper use of registered products should yield residue levels that are well within established safety standards. Therefore, the average American's exposure to low-level residues, though fairly constant, should not cause alarm.

Still, many people want to learn what choices they can make to further reduce any potential risk associated with the presence of low-level pesticide residues in the environment, while still enjoying the benefits that pesticides offer. Risk stems both from the toxicity of a chemical and the degree and duration of an individual's exposure to it. You cannot change the inherent toxicity of pesticide products. But by limiting your exposure to these products, you *can* keep your risks to a minimum.

Below you will find descriptions of the main pathways of human exposure to pesticides, as well as suggestions on ways to reduce overall exposure and attendant risks. If, however, you suspect that you suffer from serious chemical sensitivities, consult an expert to develop a more personally tailored approach to managing this problem.

Exposure Through Home Usage

While it is true that, over a lifetime, diet is the most significant source of pesticide exposure for the general public, on a short-term basis, the most significant exposure source is personal pesticide use.

Fruits and vegetables should be washed thoroughly with water; scrub them with a brush and peel them, if possible.

An array of pesticide products, ranging widely in toxicity and potential effects, is available "off the shelf" to the private user. Agency statistics show that about 91 percent of U.S. households use pesticides. No special training is required to purchase or use these products, and no one is looking over the user's shoulder, monitoring his vigilance in reading and following label instructions. Yet many of these products are hazardous, especially if they are stored, handled, or applied improperly.

To minimize the hazards and maximize the benefits that pesticides bring, exercise caution and respect when using any pesticide product. You will find many tips on how to handle pesticides covered elsewhere in this Special Section. Some of the tips bear repeating.

- When you must use a pesticide, read and follow all label directions and precautions. EPA regards labeling as the

primary means of conveying vital information about the product. Label directions are legally enforceable, carrying the weight of law. Therefore, if mishaps occur during your use of a registered pesticide, you may be held legally responsible. More importantly, deviating from the label may damage your health and/or property. Consider pesticide labeling to be what it is intended to be: your best guide to using pesticides safely and effectively.

- Pretend that the pesticide product you are using is more toxic than you think it is. Take special precautions to ensure an extra margin of protection for yourself, your family, and pets.
- Don't use more pesticide than the label says. You may not achieve a higher degree of pest control, and you will certainly experience a higher degree of risk.
- If you hire a pest control firm to do the job, ask the company to use the least toxic or any chemical-free pest control means available. For example, some home pest control companies offer an electro-gun technique to control termite and similar infestations by penetrating infested areas and "frying" the problem pests without using any chemicals.
- And remember: sometimes a non-pesticidal approach is as convenient and effective as its chemical alternatives. Consider using such alternative approaches whenever possible.

Exposure Through Food

Commercial Food

Throughout life—beginning even before birth—we all are exposed to pesticides. A major exposure route is through our diets. We constantly consume small amounts of pesticides. Field-grown raw agricultural commodities, as well as meat, poultry, eggs, and milk, are all likely to contain measurable pesticide residues. Ingesting pesticides along with our food is a price we pay for using these chemicals to produce an abundant, varied food supply.

EPA sets standards, called tolerances, to limit the amount of pesticide residues that legally may remain in food or feed marketed through U.S. channels of commerce. Both domestic and imported foods are monitored by the Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) to ensure compliance with these tolerances. (See the article on enforcement.) Further, since residues degrade over time and through processing, residue concentrations in or on most foods are well below established tolerance levels by the time the foods are purchased.

Although EPA does limit dietary pesticide exposure through tolerances, you may wish to take extra precautions. You can take several steps to reduce your exposure to residues in purchased food.

- Rinse fruit and vegetables thoroughly with water; scrub them with a brush and peel them, if possible. Although this surface cleaning will not remove "systemic" pesticide residues taken up into the growing plant, it will remove much of the existing surface residues, not to mention any dirt.
- Cook or bake foods to reduce the amount of some (but not all) pesticide residues.
- Trim the fat from meat and poultry. Discard the fats and oils in broths and pan drippings, since residues of some pesticides concentrate in fat.
- Take note of any available information. EPA provides fact sheets on many frequently-used agricultural pesticides to aid you in making more informed choices about the foods you buy and eat.

Home-grown Food

Growing some of your own food can be both a pleasurable activity and a way to reduce your exposure to pesticide residues in food. But, even here, there are some things you may want to do to assure that exposure is limited.

- Before converting land in an urban or suburban area to gardening, find out how the land was used previously. Choose a site that had limited (or no) chemical applications and where drift or runoff from your neighbor's activities will not result in unintended pesticide residues on your produce. Choose a garden site strategically to avoid these potential routes of entry, if possible.

If you are taking over an existing garden plot, be aware that the soil may contain pesticide residues from previous gardening activities. These residues may remain in the soil for several years, depending on the persistence of the pesticides that were used. Rather than waiting for the residues to decline naturally over time, you may speed the process.

- Plant an interim, non-food crop like annual rye grass, clover, or alfalfa. Such crops, with their dense, fibrous root systems, will take up some of the lingering pesticide residues. Then discard the crops—don't work them back into the soil—and continue to alternate food crops with cover crops in the off season.
- During sunny periods, turn over the soil as often as every two to three days for a week or two. The sunlight will break down, or photodegrade, some of the pesticide residues.

Once you do begin gardening, develop strategies that will reduce your need for pesticides while maintaining good crop yields.

- Concentrate on building your garden's soil, since healthy soil grows healthy plants. Feed the soil with compost, manure, etc., to increase its capacity to support strong crops.
- Select seeds and seedlings from hardy, disease-resistant varieties. The resulting plants are less likely to need pesticides in order to flourish.
- Avoid monoculture gardening techniques. Instead, alternate rows of different kinds of plants to prevent significant pest problems from developing.
- Rotate your crops yearly to reduce plant susceptibility to over-wintered pests.
- Become familiar with integrated pest management (IPM) techniques, so that you can manage any pest outbreaks that do occur without relying solely on pesticides. (See article on consumer usage.)
- Mulch your garden with leaves, hay, grass clippings, shredded/chipped bark, or seaweed. Avoid using newspapers to keep down weeds, and sewage sludge to fertilize plants. Newsprint may contain heavy metals; sludge may contain heavy metals and pesticides, both of which can leach into your soil.

Food from the Wild

While it might seem that hunting your own game, catching your own fish, or gathering wild plant foods would reduce your overall exposure to pesticides, this isn't necessarily so. Wild foods hunted, caught, or gathered in areas where pesticides are most frequently used outdoors may contain pesticide residues. Migratory species also may bear residual pesticides if these chemicals are used anywhere in their flyways.

Tolerances generally are not established or enforced for pesticides found in wild game, fowl, fish, or

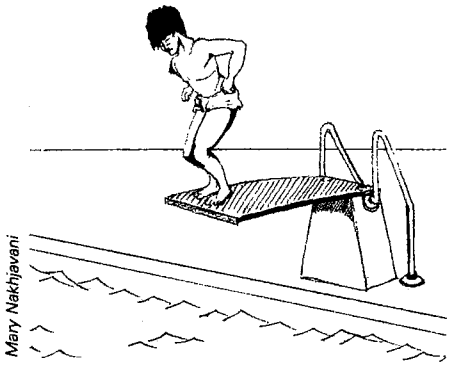
Pesticides: They're Everywhere

Angelwing. . . Moses in the Cradle. . . Adam's Needle. . . Wandering Jew. . . St. John's Wort. . . Devil's Ivy. . .Jacob's Ladder. . .Star of Bethlehem. . .

These religious allusions come not from a collection of Biblical commentary, but from "Category 31, Ornamental Herbaceous Plants," one of 99 categories in an EPA compilation of possible pesticide application sites. The EPA list illustrates two important facts about pesticides: not all are used in agriculture, and not all that are used in agriculture are used to grow fruits and vegetables.

You probably already know about some of the following places where pesticides are used. Others may surprise you. All of the categories come from the list, "EPA Site Categories for Preparing and Coding Pesticide Labeling." (Remember that "pesticides" include fungicides, herbicides, rodenticides, disinfectants, nematicides, etc., as well as insecticides.)

- Fiber crops—cotton and hemp, for example.
- Specialized field crops, such as tobacco.
- Crops grown for oil, such as castor bean and safflower.
- Forest trees and Christmas tree plantations.
- Ornamental lawns and turf, like golf fairways.
- Ornamental shrubs and vines, like mistletoe.
- General soil treatments, such as manure and mulch.
- Household and domestic dwellings
- Processed non-food products — textiles and paper, for example.
- Fur and wool-bearing animals, such as mink and fox; laboratory and zoo animals; and pets. (Pesticides are used in animal sprays, dips, collars, wound treatments, litter and bedding treatments, etc.)
- Dairy farm milk-handling equipment.
- Wood protection treatments, such as those applied to railroad ties, lumber, boats, and bridges.
- Aquatic sites, including swimming pools, diving boards, fountains, and hot tubs.
- Uncultivated, non-agricultural areas, such as airport landing fields, tennis courts, highway rights-of-way, oil tank farms, ammunition storage depots, petroleum tank farms, saw mills, and drive-in theaters.
- General indoor/outdoor treatments, in bird roosting areas, for example, or mosquito abatement districts.
- Hospitals. Pesticide application sites include syringes, surgical instruments, pacemakers, rubber gloves, bandages, and bedpans.
- Barber shops and beauty shops.
- Mortuaries and funeral homes.
- Industrial preservatives used to manufacture such items as paints, vinyl shower curtains, and disposable diapers.
- Articles used on the human body, like human hair wigs, contact lenses, dentures, and insect repellants.
- Refuse and solid waste sites. Home trash compactors and garbage disposals fall in this category.
- Specialty uses, such as mothproofing and preserving animal and plant specimens in museum collections.



Mary Nakhjavani

Pesticides are used in swimming pools to ward off bacteria and algae.

plants. Thus, if you consume food from the wild, you may want to take the following steps to reduce your exposure to pesticide residues.

- Although wild game is very lean and thus carries a relatively small body burden of pesticides, avoid hunting in areas where pesticide usage is very high.
- Avoid fishing in water bodies where water contamination is known to have occurred. Pay attention to posted signs warning of contamination.
- You may want to consult with fish and game officials where you plan to hunt or fish to determine whether there are any pesticide problems associated with that area.
- When picking wild plant foods, avoid gathering right next to a road, utility right-of-way, or hedgerow between farm fields which probably has been treated (directly or indirectly) with pesticides. Instead, seek out fallow fields, deep woods, or other areas where pesticide use is unlikely.
- When preparing wild foods, trim fat from meat, and discard skin of fish to remove as many fat-soluble pesticide residues as possible. For wild plant foods, follow the tips provided for commercial food.

Exposure Through Water

Whether it comes from surface or ground-water sources, the water flowing from your tap may contain low levels of pesticides.

When pesticides are applied to land, a certain amount may run off the land into streams and rivers. This runoff, coupled with industrial discharges, can result in low-level contamination of surface water. In certain hydrogeologic settings—sandy soil, for example, over a ground-water source that is near the surface—pesticides can leach down to the ground water.

EPA's Water Program sets standards and provides advisory levels for pesticides and other chemicals that may be found in drinking water. Public municipal water systems test their water periodically and provide treatment or alternate supply sources if residue problems arise. Private wells generally are not tested unless the well owner requests such analysis.

If you get your drinking water from a private well, you can reduce the chance

of contaminating your water supply by following these guidelines.

- Be cautious about using pesticides and other chemicals on your property, especially if the well is shallow or is not tightly constructed. Check with your EPA regional office or county cooperative extension service before using a pesticide outdoors, to determine whether it is known or suspected to leach to ground water. Never use or mix a pesticide near your wellhead.

- To avoid surface pesticide contamination problems, be sure your well extends downward to aquifers that are below, and isolated from, surface aquifers, and be sure the well shaft is tightly sealed. If you have questions about pesticide or other chemical residues in your well water, contact your state or county health department.

- If your well water is analyzed and found to contain pesticide residue levels above established or recommended health standards, you may wish to use an alternate water source such as bottled water for drinking and cooking. The best choice is distilled spring water in glass bottles. Ask your local bottler for the results of a recent pesticide analysis.

Exposure Through Air

Outdoors, air currents may carry pesticides that were applied on adjacent property or miles away. But there are steps you can take to reduce your exposure to airborne pesticide residue, or drift, outdoors. To reduce your exposure to airborne pesticides:

- Avoid applying pesticides in windy weather (when winds exceed 10 mph).

- Use coarse droplet nozzles to reduce misting.

- Apply the spray as close to the target as possible.

- Keep the wind to your side so that sprays and dusts do not blow into your face.

- If someone else is applying pesticides outdoors near your home, stay indoors with your pets and children, keeping doors and windows closed. If it is very windy during the pesticide application, stay inside for an hour or two. If pesticides are applied frequently near your home (if you live next to fields receiving regular pesticide treatment), consider planting a buffer zone of thick-branched trees and shrubs upwind to help serve as a buffer zone and windbreak.

- In many areas, local governments require that the public be notified in advance of area-wide or broad-scale pesticide spray activities and programs, through announcements in newspapers, letters to area residents, or posting of areas to be treated. Some communities have also enacted "right to know" ordinances which require public notification, usually through posting, of lawn treatments and other small-scale outdoor pesticide uses. If your local government does not require notifications, either for large- or small-scale applications, you may want to work with local officials to develop such requirements.

Indoors, the air you breathe may bear pesticide residues long after a pesticide has been applied to objects in your home or office, or to indoor surfaces and crawl spaces. Such problems are becoming increasingly apparent. Pesticides dissipate more slowly indoors than outdoors. In addition, energy efficiency features built into many homes reduce air exchange, aggravating the problem. To limit your exposure to indoor pesticide residues:

- Use pesticides indoors only when absolutely necessary, and then use only limited amounts. Provide adequate ventilation during and after application. If you hire a pest control company, oversee its activities carefully. (See box, "How to Choose a Pest Control Company".)

- If pesticides are used inside your home, air out the house often, since outdoor air generally is fresher and purer than indoor air. Open doors and windows, and run overhead or whole house fans to exchange indoor air for outside air rapidly and completely.

- If pesticides have been used extensively and an indoor air contamination problem has developed, clean—scrub—all surfaces where pesticides may have settled, including cracks and crevices. Consult a knowledgeable professional for advice on appropriate cleaning materials if soap and water are insufficient.□

Consumers and Pesticides: Toward an Informed Coexistence

THEY'RE THERE. Whether you see them or not, you know they're there—in your home, your vegetable garden, your lawn, your fruit and shade trees, your flowers, and on your pets. They are pests—insects, weeds, fungi, rodents, and others.

American households and their surrounding grounds have the dubious honor of being host not only to the most common structural pests (termites, cockroaches, fleas, rodents), but also to a huge array of pests that are more commonly associated with agriculture. Because pests are all around—sometimes creating a nuisance but sometimes causing severe financial loss—consumers increasingly have turned to pesticides to control them, and EPA registers thousands of pesticide products for use in and around homes.

An EPA survey of household pesticide use nationwide concluded that nine out of 10 American households use pesticides. Of those people participating in the survey, less than 50 percent read pesticide labels for information regarding application procedures and preventive measures, and only nine percent used pesticide products with caution; 85 percent used them without reservation. Few users sought additional information on pesticides from outside sources such as county agricultural extension agents.

Although the survey was conducted in 1976 and 1977, there is every reason to believe that household pesticide use has only increased in the last 10 years. In light of this fact, it is important that consumers make informed choices about pest control. Those choices will determine, in part, their overall levels of exposure and associated risk. The course of action taken should be based on achieving the desired result for the desired period of time, using the least toxic method, or combination of methods, to treat the problem.

Before you can control a pest, you must know what it is. Therefore, the most important first step in pest control is a rather obvious one: identify the pest. Some pests, or signs of them, are unmistakable. Others are not. For example, some plant "diseases" are really indications of insufficient soil nutrients.

Three sources are particularly helpful in identifying pests and appropriate pest control methods: reference books, such as insect field guides or gardening books; county agricultural extension agents; and pesticide dealers.

Before you actually begin pest control, decide what level of treatment you want. Is anyone in the family or neighborhood particularly sensitive to chemical pesticides? Does your lawn need to be totally weed-free? Do you need every fruit, vegetable, or flower you grow? Will you accept some blemished produce? In other words, do you need to eliminate all weeds and insects, or can you tolerate some pests? Remember that total pest *elimination* is virtually impossible, and requires more chemical follow-up than pest *control*. Remember, too, that to manage any pest effectively, you must use each method correctly and abide by all pertinent local, state, and federal regulations.

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Tips for Safe Use

Pesticides are *not* safe. They are produced specifically because they are toxic to something. By heeding all the following tips, you can reduce your risks when you use pesticides.

- All pesticides legally marketed in the U.S. must bear an EPA-approved label; check the label to make sure it bears an EPA registration number.
- Before using a pesticide, read the entire label. Even if you have used the pesticide before, read the label again—don't trust your memory. Read *all* directions, precautions, and the Statement of Practical Treatment before you begin. Use of any pesticide not in accordance with label directions and precautions is subject to civil and/or criminal penalties.
- Do not use a restricted use pesticide unless you are a certified applicator. These products are too dangerous to be used without special training.
- Follow use directions carefully. Use only the amount directed, at the time and under the conditions specified, and for the purpose listed. Don't think that twice the dosage will do twice the job. It won't. What's worse, you may harm yourself, others, or whatever you are trying to protect.
- Look for one of the following signal words on the front of the label. It will tell you how poisonous a pesticide is if swallowed, inhaled, or absorbed through skin.
  "DANGER" means highly poisonous;
  "WARNING" means moderately poisonous;
  "CAUTION" means least hazardous.
- Wear whatever degree of protective clothing the label recommends: long sleeves or pants, impervious gloves, vinyl or rubber (not canvas or leather) footwear, hat, safety goggles, and a respirator. Personal protective clothing usually is available at home building supply stores.
- If you must mix or dilute the pesticide, do so outdoors or in a well-ventilated area. Mix only the amount you need and use recommended portions. (See box, "Determining Correct Dosage.")
- Keep children and pets away from areas where you mix or apply pesticides.
- If a spill occurs, clean it up promptly. Don't wash it away. Instead, sprinkle with sawdust, vermiculite, or kitty litter; sweep into a plastic garbage bag; and dispose with the rest of your trash.
- Remove toys from the area to be treated. Remove food, dishes, pots, and pans before treating kitchen cabinets, and don't let pesticides get on these surfaces. Wait until shelves dry before refilling them.
- Allow adequate ventilation when applying pesticides indoors. Go away from treated areas for *at least* the length of time prescribed by the label. When spraying outdoors, close the windows of your home.
- Most surface sprays should be applied only to limited areas; don't treat entire floors, walls, or ceilings. Before spraying, remove birds and pets, and cover aquariums and fish bowls.

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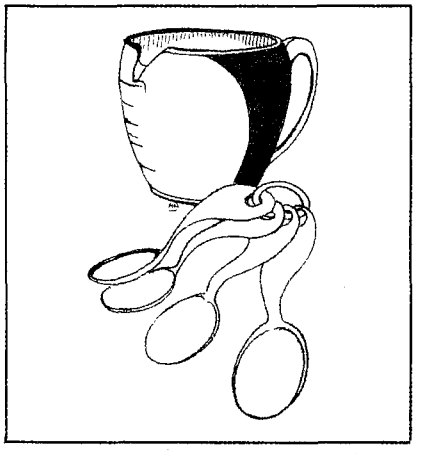
- Never place rodent or insect baits where small children or pets can reach them.
- When applying spray or dust outdoors, cover fish ponds, and avoid applying pesticides near wells. Always avoid over-application when treating lawn, shrubs, or garden. Runoff or seepage from excess pesticides may contaminate water supplies. Excess spray may leave harmful residues on home-grown produce.
- Keep herbicides away from non-target plants. Avoid applying any pesticide to blooming plants, especially if you see honeybees or other pollinating insects around them. Avoid birds' nests when spraying trees.
- Never spray or dust outdoors on a windy day.
- Never smoke while applying pesticides. You could easily carry traces of the pesticide from hand to mouth. Also, some products are flammable.
- Never transfer pesticides to containers not intended for them, such as empty soft drink bottles. Keep pesticides in containers that clearly and prominently identify the contents. Properly refasten all childproof caps.
- Shower and shampoo throughly after using a pesticide product. Wash the clothing that you wore when applying the product separately from the family laundry. To prevent tracking chemicals inside, also rinse boots and shoes.
- Before using a pesticide product, know what to do in case of accidental poisoning. (See article on pesticide emergencies.)
- In a sink or toilet, triple rinse tools or equipment, including any containers or utensils used to mix the chemicals, to remove residues.
- Evaluate the results of your pesticide use.

Determining Correct Dosage



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So much information is packed onto pesticide labels that there is usually no room to include examples of each dilution applicable to the multitude of home-use situations. As a result, label examples may inadvertently encourage preparation of more pesticide than is needed. The excess may contribute to overuse, safety problems related to storage and disposal, or simply wasted expense of unused pesticide.

Determining the correct dosage for different types of pesticides requires some simple calculations. The following information can help you to prepare the minimum quantity of pesticide needed for your immediate use situation.

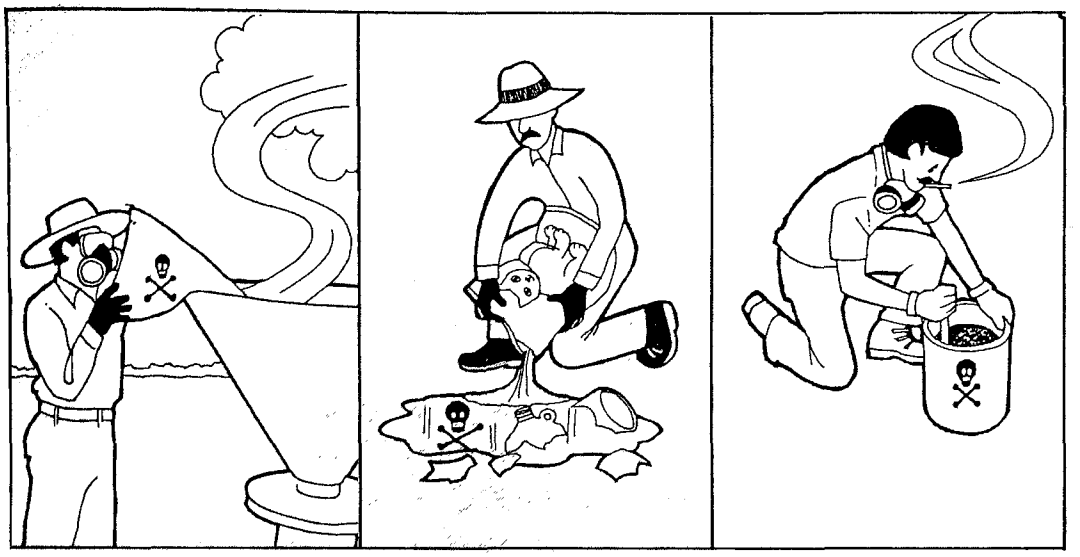
For example, the product label says "For the control of aphids on tomatoes mix 8 fluid ounces of pesticide into 1 gallon water and spray until foliage is wet." Your experience has been that your six tomato plants require only one quart of pesticide to wet all the foliage. Therefore, only 2 fluid ounces of the pesticide should be mixed into 1 quart of water. Why? Because a quart is one-fourth of a gallon, and 2 fluid ounces mixed into 1 quart makes the same strength spray recommended by the label, but in a quantity that can be used up all at once.

Consumers can solve problems similar to this one with careful arithmetic, good measurements, and intelligent use of the information provided here.

How To Measure

If you need to determine the size of a square or rectangular area, such as a lawn for a herbicide application, measure and multiply the length and width. For example, an area 10 feet long by 8 feet wide contains 80 square feet (sq. ft.). Common area measurements may involve square yards (1 square yard = 9 sq. ft.) or square feet (1 sq. ft. = 144 square inches).

If you need to determine the volume of a space such as a room, measure and multiply the room's length, width, and height. For example, a space 10 feet long, 8



Only the amount of pesticide needed should be mixed and it should be mixed in a well-ventilated area.

If pesticide is spilled, it should be covered with kitty litter, sawdust or vermiculite, and swept into a plastic bag to be disposed of along with trash.

Fumes from a pesticide should not be inhaled, and smoking while mixing makes a person twice as vulnerable to inhalation.

feet wide, and 8 feet high contains a volume of 640 cubic feet (cu ft.). You would use this procedure, for instance, for an aerosol release to control cockroaches.

Most residential-use pesticides are measured in terms of volume. Some common equivalents are:

1 gallon (gal.)	= 128 fluid ounces (fl. oz.)	
	= 4 quarts (qt.)	
	= 8 pints (pt.)	
	= 16 cups	
1 quart	= 32 fl. oz.	
	= 2 pt.	
	= 4 cups	
1 pint	= 16 fl. oz	
	= 2 cups	
1 cup	= 8 fl. oz.	
1 tablespoon (tbsp.)	= 1/2 fl. oz.	
	= 3 teaspoons (tsp.)	
1 teaspoon	= 1/6 fl. oz.	

In measuring teaspoons or tablespoons of pesticide, use only *level* spoonfuls, and *never* use the same measuring devices for food preparation.

The following tables provide examples to help you convert label information to your specific use situations. "Amount" can be any measure of pesticide quantity. However, the same unit of measure must be used on both sides of the chart. For example, 8 *fluid ounces* per gallon of water is equivalent to 2 *fluid ounces* per quart of water.

Pesticide Label Says Mix			Amount of Pesticide Per	
Amount of Pesticide	Per		1 qt. Water	1 pt. Water
8 units	1 gal. water	EQUALS	2 units	1 unit
16 units	1 gal. water	EQUALS	4 units	2 units
32 units	1 gal. water	EQUALS	8 units	4 units
128 units	1 gal. water	EQUALS	32 units	16 units

Pesticide Label Says Apply			Amount of Pesticide Per		
Amount of Pesticide	Per		20,000 sq. ft.	10,000 sq. ft.	500 sq. ft.
1 unit	1,000 sq. ft.	EQUALS	20 units	10 units	1/2 unit
2 units	1,000 sq. ft.	EQUALS	40 units	20 units	1 unit
5 units	1,000 sq. ft.	EQUALS	100 units	50 units	21/2 units
10 units	1,000 sq. ft.	EQUALS	200 units	100 units	5 units

Pesticide Label Says Release			Cans Per		
Aerosol Cans	Per		20,000 cu. ft.	10,000 cu. ft.	5,000 cu. ft.
1	10,000 cu. ft.	EQUALS	2	1	don't use
1	5,000 cu. ft.	EQUALS	4	2	1
1	2,500 cu. ft.	EQUALS	8	4	2

Not all dosage rates are included in the above examples. For rates not included, remember that, for pesticides *not* diluted with water, proportionally change both the quantity of pesticide and the area, volume, or number of items treated. For example, one-half pound per 1,000 sq. ft. is equivalent to one-quarter pound per 500 sq. ft. For a pesticide which is diluted with water, proportionally change the quantity of pesticide, the quantity of water, and the area, volume, or number of items treated. For example, one-half pound of pesticide in 1 gallon of water applied to 1,000 sq. ft. is equivalent to 1 pound of pesticide in 2 gallons of water applied to 2,000 sq. ft.

There is a point at which measurements needed for smaller quantities of pesticides are too minute to be accurately measured with typical domestic measuring devices. In such cases, the user can either mix the larger volume, realizing that there will be leftover material; obtain a more accurate measuring device, such as a graduated cylinder or a scale which measures small weights; or search for an alternative pesticide or less concentrated formulation of the same pesticide.

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Prevention

There is another important question to ask in making pest control decisions: Is there something about the site that supports the pest population that can be eliminated? The answer to this question may lead you to take some common sense steps to modify pest habitat:

- **Remove water sources.** All pests, vertebrate or invertebrate, need water for survival. Fix leaky plumbing and do not let water accumulate in your home. That means no water in trays under your houseplants overnight if you have a cockroach infestation.
- **Remove food sources** (if the pest's food is anything other than the plant or animal you are trying to protect). This could mean placing your food in sealed glass or plastic containers, not leaving your pet's food out for long periods of time, and placing your refuse in tightly covered, heavy-gauge garbage cans.
- **Remove or destroy pest shelter.** Caulk cracks and crevices to control cockroaches; remove from under or around homes piles of wood that attract termites; remove and destroy diseased plants, tree prunings, and fallen fruit that might harbor the pest.
- **Remove breeding sites.** The presence of pet manure encourages flies; litter encourages rodents; and unneeded standing water provides a perfect breeding place for mosquitoes.
- **Remove sources of preventable stress to plants** (flowers, trees, vegetable plants, and turf). Plant at the optimum time of year. Mulch to reduce competition and maintain even soil temperature and moisture. Provide adequate water.

Non-chemical Controls

If you can practice some of the above techniques, you will reduce your chances, or frequency, of pest infestation. However, if the infestation is already present, do you have any control alternatives besides chemical pesticides?

The answer is an emphatic "yes." One of several non-chemical treatment alternatives may be appropriate. Like preventive techniques, these actions depend on the site and the pest. Treatment possibilities include:

- **Biological treatments,** including predators such as purple martins, praying mantises, and lady bugs; parasites; and pathogens such as bacteria, viruses, and other microorganisms like *Bacillus thuringiensis* and milky spore disease. EPA policy is encouraging the development of biological pesticides.
- **Cultural treatments,** including land use, water use, structural and landscape design, spacing, selection of disease-resistant seed or plant varieties, trap crops, crop rotation, and diversification.
- **Mechanical treatments,** including cultivating to control weeds, hand-picking weeds from turf and pests from plants, trapping to control rodents and some insects, and screening living space to limit mosquito and fly access.

Some people find it difficult to believe that non-chemical control methods can be effective. But the fact is, these methods really work. They do have some disadvantages: results are not immediate, and more work may be needed to make a home or garden less attractive to pests. But the advantages of non-chemical methods are many. They are generally effective for longer periods of time. They do not create hardy, pesticide-resistant pest populations. And they can be used without safeguards, because they pose virtually no hazards to human health or the environment.

Chemical controls

If you decide that chemical pesticides can provide the best solution to your problem, and that you want to control the pests yourself rather than turning the problem over to a certified pest control operator, then you have an important decision to make: which product to choose. Before making that decision, learn as much as you can about a product's active ingredient, its biologically active agent. How rapidly does the active ingredient break down? Is it suspected of causing chronic health effects? Is it toxic to non-target wildlife and housepets? Is it known, or suspected, to leach into ground water?

Here again, your county agricultural extension agents, reference books, pesticide dealers, your state lead pesticide agency, or your regional EPA office may be able to provide assistance.

When you have narrowed your choices about active ingredients, you are ready to select a pesticide product. Choose the least toxic pesticide that can achieve the results you desire. Read the label. It will not only list active ingredients, but also the target pests (for example, mites, flies, Japanese beetle grubs, broad-leafed weeds, algae, etc.), and where the product may be used (for example, lawns, specific vegetable crops, roses, swimming pools, etc.). Be sure that the place where you intend to use the pesticide is included among the sites listed on the label.

This gardener has decided to avoid using pesticides and is weeding her yard by hand.

Storing and Disposing of Pesticides Safely

Unlike farmers, who often handle large quantities of pesticides, homeowners tend to use only small amounts. But small amounts can be just as dangerous as large amounts, if they are not stored or disposed of properly. The following tips on home storage and disposal can help you handle pesticides safely.

Storage

- Buy only enough product to carry you through the use season to reduce storage problems.
- Store pesticides away from children and pets as soon as you bring them into the house, and again immediately after each use. A locked cabinet in a well-ventilated utility area or garden shed is best.
- Store flammable liquids outside living quarters and away from an ignition source.
- Mix only the amount you need for the job at hand.
- Never put pesticides in cabinets with, or near, food, medical supplies, or cleaning materials. Always store pesticides in their original containers, complete with labels that list ingredients, directions for use, and antidotes in case of accidental poisoning. Apply transparent tape over the label to keep it legible. *Never* transfer pesticides to soft drink bottles or other containers that children may associate with something to eat or drink. Always properly refasten child-proof closures or lids.
- Avoid storing pesticides in places where flooding is possible, or in open places where they might spill or leak into the environment. If you have any doubt about the content of a container, throw it out.

Disposal

- Follow label directions for guidance on product (and container) disposal.
- To dispose of less than a full container of a liquid pesticide, leave it in the original container, with the cap securely in place to prevent spills or leaks. Wrap the container in several layers of newspapers and tie securely. Then place the package in a covered trash can for routine collection with municipal refuse (unless your municipality has other requirements).
- Wrap individual packages of dry pesticide formulations in several layers of newspaper, or place the package in a tight carton or bag, and tape or tie it closed. As with liquid formulations, place the package in a covered trash can for routine collection.
- Empty pesticide containers can be as hazardous as full ones, because of residues remaining inside. It is unlikely that residues can be removed from empty containers, so never reuse these containers. Handle as above. Treated this way, small quantities of pesticides are not hazardous to trash collectors or to the environment. In a properly operated sanitary landfill for municipal refuse, the pesticides will be sufficiently diluted and contained to negate any hazardous effects.
- If you do not have a regular trash collection service, crush and then bury empty pesticide containers at least 18 inches deep in a place on your property away from water sources, where you grow food, or where children may play. *Do not puncture or burn a pressurized container. It could explode.*
- Do not burn pesticide boxes or sacks either outdoors or in apartment incinerators, since this can create poisonous fumes or gases, or cause an explosion. Do not pour leftover pesticides down the sink or into the toilet. Chemicals in the pesticides could interfere with the operation of septic tanks or pollute waterways, because many municipal wastewater treatment systems cannot remove all pesticide residues.
- If you have doubts about proper pesticide disposal, contact your local health department.
- Rinsings and spent dips should be washed down your drain—never pour onto the ground.
- Puncture any non-pressurized containers to prevent re-use.
- Watch for local "amnesty days" or opportunities to bring hazardous household wastes to properly equipped collection stations.

The product you choose will fall into one of two general classifications of chemical pesticides: broad spectrum or selective. Broad spectrum pesticides are effective against a wide variety of pests. Selective pesticides are formulated to control specific pests. Chemical pesticides may also be direct poisons, attractants, repellants, growth regulators, protectants, or systemics.

Active ingredients are formulated in many ways; choose the formulation best suited to your site and the pest you are trying to control. The most common types of home use pesticide formulations include:

- **Solutions,** which contain the active ingredient and one or more additives, and readily mix with water.
- **Aerosols,** which contain one or more active ingredients and a solvent. They are ready for immediate use as is.
- **Dusts,** which contain active ingredients plus a very fine dry inert carrier such as clay, talc, or volcanic ash. Dusts are ready for immediate use and are applied dry.
- **Granulars,** which are similar to dusts, but with larger and heavier particles for broadcast applications.
- **Baits,** which are active ingredients mixed with food or other substances to attract the pest.
- **Wettable powders,** which are dry, finely ground formulations that generally are mixed with water for spray application. They also may be used as dusts.

Depending on the type of formulation you choose, you may need to dilute or pre-mix the product. Prepare only the amount that you need for each application; don't prepare larger amounts to store for possible future use. (See box, "Determining Correct Dosage.")

Once you have identified the pest, selected the right pesticide, and determined proper dosage, you are ready to use the product. Application technique and timing is every bit as important as the material used, so *read the label* for directions. That advice—to read the label—is repeated so often in this guide that it may become tiresome. But in fact, the advice cannot be

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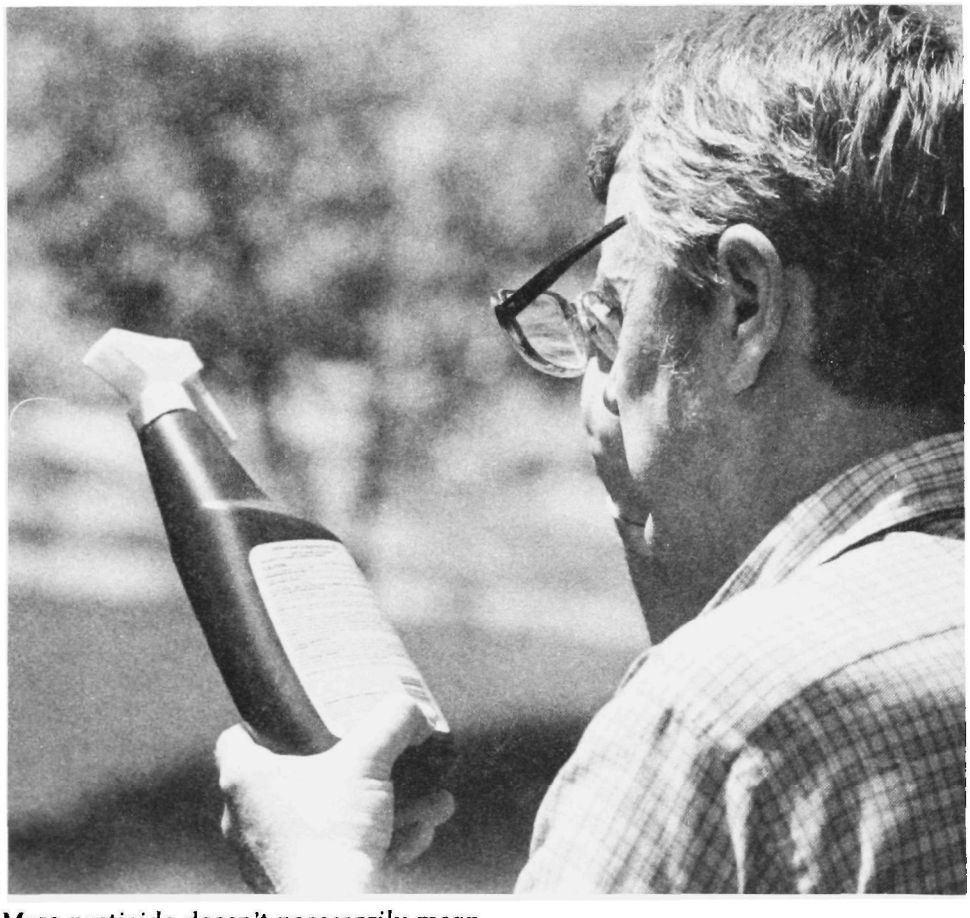
repeated often enough. Read the label before you buy a product, and again before you mix it, before you apply it, before you store it, and before you throw it away. The directions on a label are there for a very good reason: to help you achieve maximum benefits with minimum risk.

Chemical pesticides help consumers eliminate pests in and around their homes; disinfect their living quarters; and protect their homes from termites, clothing from moths, and plants from insects and disease. But these benefits depend upon safe use of the products.

Chemical pesticides also have their disadvantages. They must be used very carefully to achieve results and protect users and the environment. Effects are generally temporary, and repeated treatments may be required. And, largely because of pesticide use, hundreds of insect species, plant pathogens, and weeds have developed genetic resistance to more than one category of pesticide.

Therefore, to achieve best results when you do use chemical pesticides, use preventive and non-chemical treatments along with them. This will reduce the need for repeated applications.

The common assumption that chemical pesticide use equals pest elimination is incorrect. The assumption that readily available pesticides are safe is also incorrect. You should always evaluate your pesticide use, both before and after you treat. You should weigh the benefits of short-term chemical pesticide control against the even greater benefits of long-term control using a variety of techniques. Knowledge of a range of pest control techniques gives you the ability to pick and choose among them. Pests, unfortunately, will always be around us, and, if you know about all pest control options, you will know what to do the next time THEY'RE THERE. □



More pesticide doesn't necessarily mean more control, but it may mean more risk. Read the label carefully for desirable quantities.

How to Choose a Pest Control Company

Termites are chomping away at your house. Roaches are taking over your kitchen. Mouse droppings dot your dresser drawer. You've got a pest control problem and, you've decided, it's not one you can solve on your own. You're concerned by what you've heard about accidents caused by careless or ignorant exterminators. Nevertheless, an exterminator is what you decide you need.

If you find yourself in a situation like this, what can you do to be sure that the pest control company you hire will do a good job? Here are some questions you can ask:

1. Does the company have a good track record?

Don't rely on the company salesman to answer this question; research the answer yourself. Ask around among neighbors and friends; have any of them dealt with the company before? Were they satisfied with the service they received? Call the Better Business Bureau or local consumer office; have they received any complaints about the company?

2. Does the company have insurance? What kind of insurance? Can the salesman show some documentation to prove that the company is insured?

Contractor's *general liability insurance*, including insurance for sudden and accidental pollution, gives you as a homeowner a certain degree of protection should an accident occur while pesticides are being applied in your home.

Contractor's *workmen's compensation insurance* can also help protect you should an employee of the contractor be injured while working in your home.

In most states, pest control companies are not required to buy insurance, but you should think twice before dealing with a company that is uninsured.

3. Is the company licensed?

Regulatory agencies in some states issue state pest control licenses. It is illegal to do business in those states without such a license. Although the qualifications for a license vary from state to state, at a minimum the license requires that each company have a certified pesticide applicator (certified applicators are trained and certified to use or supervise the use of any pesticide which is classified for restricted use) present in the office on a daily basis to supervise the work of exterminators using restricted-use pesticides. If restricted-use pesticides are to be used in your home, make sure the pest control operator's license is current. Also ask if the company's employees are bonded.

You may want to contact your state lead pesticide agency (usually the state Department of Agriculture) to ask about its pesticide certification and training programs and to inquire if periodic re-certification is required for pest control operators.

In addition to the licenses required in some states, some cities also issue pest control licenses. Again, qualifications vary, but possession of a city license—where they are available—is one more assurance that the company you are dealing with should be reputable and responsible.

4. Is the company affiliated with a professional pest control association?

Professional associations—whether national, state, or local—keep members informed of new developments in pest control methods, safety, training, research, and regulation. They also have codes of ethics that members agree to abide by. The fact that a company, small or large, chooses to affiliate itself with a professional association signals its concern for the quality of its work.

5. Does the company guarantee its work in writing? What does the guarantee cover? How long does it remain in effect?

As with insurance, you should think twice about dealing with a company that is not willing to guarantee its work. Be sure to find out what you must do to keep the guarantee in force. For example, in the case of termite control treatments, a guarantee may be invalidated if structural alterations are made without prior notice to the pest control company.

6. Is the company willing, and able, to discuss the treatment proposed for your home?

Selecting a pest control service is just as important as selecting other professional services. Look for the same high degree of competence you would expect from a doctor or lawyer. The company should inspect your premises and outline a recommended control program, including what pests are to be controlled; the extent of the infestation; what pesticide formulation will be used in your home and why; what techniques will be used in application; what alternatives to the formulation and techniques could be used instead; what special instructions you should follow during treatment to reduce your exposure (such as vacating the house, emptying the cupboards, removing pets, etc.); and what you can do to minimize the pest problem in the future.

Contracts should be jointly developed. Any safety concerns should be noted and reflected in the choice of pesticides used. These concerns could include allergies, age of occupants (infants or elderly), or pets. You may want to get two to three bids from different companies—by value, not price. What appears to be a bargain may merit a second look.

Even after you have hired a company, you should continue your vigilance. Evaluate results. If you have reason to believe that something has gone wrong with the pesticide application, contact your state agency with responsibility for pesticides (usually the state Department of Agriculture). Don't let your guard down, and don't stop asking questions.

"Someone's Been Poisoned. Help!"

What To Do in a Pesticide Emergency

In recent years, control of pesticides has been one of EPA's top priorities.

While pesticides can provide substantial benefits, they can also pose significant risks. The potential for a pesticide to produce injury depends upon several factors:

- **Toxicity of the active ingredient.** Toxicity is a measure of the inherent ability of a chemical to produce injury. Some pesticides, such as pyrethrins, have low human toxicity while others, such as sodium fluoroacetate, are extremely toxic.

- **Dose.** The greater the dose of pesticide, i.e. the amount absorbed, the greater the risk of injury. Dose is dependent upon the absolute amount of the pesticide absorbed relative to the weight of the person. Therefore, small amounts of pesticide might produce illness in a small child while the same dose in an adult might be relatively harmless.

- **Route of absorption.** Swallowing a pesticide usually creates the most serious problem. In practice, however, the most common route of absorption of pesticides is through the skin, and the more toxic pesticides have caused fatalities through this route.

- **Duration of exposure.** The longer a person is exposed to pesticides, the higher the level in the body may occur. However, there is a point at which an equilibrium will develop between the intake and the output. Then, the level will no longer continue to increase. This point may be either above or below the known toxic level.

- **Physical and chemical properties.** The distribution and the rates of breakdown of pesticides in the environment significantly alter the likelihood that injury might occur.

- **Population at risk.** Those who run the greatest danger of poisoning are those whose exposure is highest such as workers who mix, load, or apply pesticides. Those who pick or consume pesticide treated foods have much lower exposures. But as other articles in this Special Section have pointed out, the general public also faces the possibility of exposure. Pesticides may be encountered in an office or home as the result of a treatment for ant, roach, or termite control. Pesticides may also be encountered outdoors from area-wide pest control application such as mosquito abatement programs. One of the points of highest exposure to some pesticides occurs right in your own backyard as you mix and apply pesticides to your garden or lawn.

Recognizing Pesticide Poisoning

As with any other chemical, pesticides may produce injury externally or internally.

External irritants may cause a contact-associated skin disease which is primarily of an irritant nature—producing redness, itching, or pimples. It may be an allergic skin reaction, producing redness, swelling, or blistering. The mucous membranes of the eyes, nose, mouth, and throat are also quite sensitive to chemicals. Stinging and swelling can occur.

Internal injuries from any chemical may occur depending upon where a chemical is transported in the body. Thus, symptoms are dependent upon the organ involved. Shortness of breath, clear sputum production, or rapid breathing occurs as the result of injury to the lung. Nausea, vomiting, abdominal cramps, or diarrhea may occur as the result of direct injury to the gastrointestinal tract. Excessive fatigue, sleepiness, headache, muscle twitching, and loss of sensation occur as the result of injury to the nervous system. In general, each class of pesticide has a set of symptoms which are unique to that particular class.

For example, organophosphate pesticides may produce symptoms of pesticide poisoning which affect several different organs, and may progress very rapidly from very mild to severe. Symptoms may progress in a matter of minutes from slight difficulty with vision to paralysis of the diaphragm muscle, causing inability to breathe.

Therefore, if someone develops symptoms after working with pesticides, seek medical help promptly to determine if the symptoms are pesticide-related. In certain cases, blood or urine can be collected for analysis or specific exposure tests can be made. It is better to be too cautious than too late.

It is always important to avoid these symptoms by minimizing your exposure (and dose) when mixing and applying pesticides by wearing gloves and other protective clothing.

The appropriate first aid treatment depends upon which pesticide was used. Here are some tips for first aid that may precede, but should not substitute for, medical treatment:

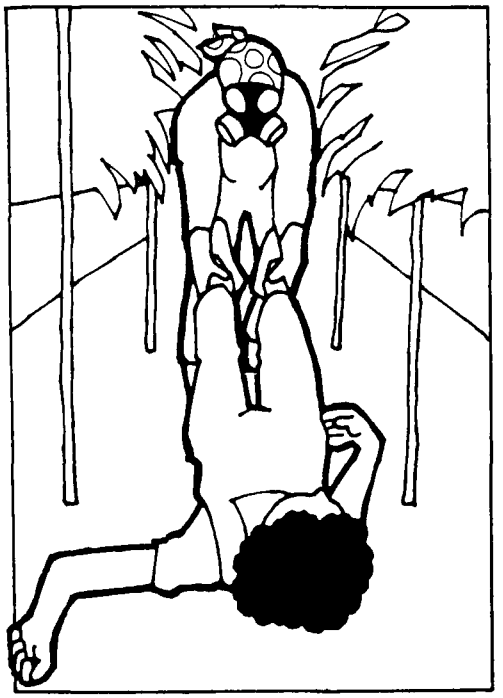
- **Poison on skin.** Drench skin with water, and remove contaminated clothing. Wash skin and hair thoroughly with soap and water. Dry victim and wrap in blanket. Later, discard contaminated clothing or thoroughly wash it separately from other laundry.

- **Chemical burn on skin.** Drench skin with water and remove contaminated clothing. Cover burned area immediately with loose, clean, soft cloth. Do not apply ointments, greases, powders, or other drugs. Later, discard or thoroughly wash contaminated clothing separately from other laundry.

- **Poison in eye.** Eye membranes absorb pesticides faster than any other external part of the body; eye damage can occur in a few minutes with some types of pesticides. Hold eyelid open and wash eye quickly and gently with clean, running water from the tap or a hose for 15 minutes or more. Do not use eye drops or chemicals or drugs in the wash water.

If poison is splashed in the eye, it can damage sight quickly. To counteract damage, the eyelid should be held open and the eye washed quickly and gently with clean running water for 15 minutes or more.

• **Inhaled poison.** Carry or drag victim to fresh air immediately. (If proper protection for yourself is unavailable, call for emergency equipment from the fire department.) Open doors and windows so no one else will be poisoned by fumes. Loosen victim's tight clothing. If the victim's skin is blue or the victim has stopped breathing, give artificial respiration, and call rescue service for help.



If poison has been inhaled, the victim should be carried or dragged into the fresh air immediately.

• **Swallowed poison.** A conscious victim should rinse his mouth with plenty of water and drink up to one quart of milk or water to dilute the pesticide. Induce vomiting *only* if instructions to do so are on the label. If there is no label available to guide you, do not induce vomiting if the victim has swallowed a corrosive poison or an emulsifiable concentrate or oil solution, or if the victim is unconscious or is having convulsions.

In dealing with any poisoning, act fast; speed is crucial.

First Aid for Pesticide Poisoning

First aid is the first step in treating a pesticide poisoning. Study the product label *before* you use a pesticide, especially the statement of treatment on the pesticide label. When you realize a pesticide poisoning is occurring, be sure the victim is not being further exposed to the poison before calling for emergency help. An unconscious victim will have to be dragged into fresh air. Caution: Do not become poisoned yourself while trying to help. You may have to put on breathing equipment or protective clothing to avoid becoming the second victim.

When initial first aid has been performed, get medical help immediately. This advice cannot be repeated too often. Bring the product container with its label to the doctor's office or emergency room where the victim will be treated; if you bring the container, keep it out of the passenger space of your vehicle. The doctor needs to know what chemical is in the pesticide before prescribing treatment (information that is also on the label). Sometimes the label even includes a telephone number to call for additional treatment information.

A good resource in a pesticide emergency is NPTN, the National Pesticide Telecommunications Network. Funded primarily by EPA and operating out of the Texas Tech University School of Medicine, NPTN is a toll-free telephone service. Operators are on call 24 hours a day, 365 days a year, to provide information on pesticides and on recognizing and responding to pesticide poisonings. If necessary, they can transfer inquiries directly to affiliated poison control centers.

National Pesticide Telecommunications Network
Call Toll-Free
1-800-858-7378

NPTN operators can answer questions about animal as well as human poisonings. To keep your pets from being poisoned, follow label directions on flea and tick products carefully, and keep pets off lawns that have been newly treated with weed killers and insecticides.

EPA is interested in receiving information on any adverse effects associated with pesticide exposure. If you have such information, contact Frank Davido, Pesticide Incident Response Officer, Hazard Evaluation Division (TS-769C), Office of Pesticide Programs, EPA, 401 M Street, S.W. Washington, D.C. 20460 (telephone 703-557-0576). You should provide as complete information as possible, including any official investigation report of the incident and medical records concerning adverse health effects. Medical records will be held in confidence. □

Pesticide Accidents in the United States

Question: How many Americans are poisoned by pesticides each year?
Answer: No one knows. There is no centralized, nationwide, annual survey to provide this information. However, statistics available from a variety of sources indicate that the number of poisoning incidents is significant.

The *American Journal of Emergency Medicine* reported that poison control centers across the country received an estimated 85,000 calls in 1985 due to pesticides. Many of the cases were treated at home; 24 percent received some kind of medical attention. The report was based on a sample of 48 percent of the nation's poison control centers. However, many of these calls reflect concern about exposure rather than the onset of an actual illness.

Also in 1985, an estimated 20,000 persons were taken to U.S. emergency rooms due to suspected or actual exposure to toxic levels of pesticides, according to the U.S. Consumer Product Safety Commission. Ten percent of those going to emergency rooms were admitted to the hospital for further treatment and observation. Pesticides were the second most frequent cause of poisoning in young children, following medicines. The Commission's report was based on a survey of 65 emergency rooms.

Based on data collected by the National Center for Health Statistics and reported in *Vital Statistics of the United States, Vol. II*, an average of 35 deaths per year due to pesticide poisoning was reported each year throughout the 1970s in the United States.

Enforcing Pesticide Laws

Two laws govern pesticide use in this country: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA). Different federal and state agencies enforce different provisions of the two laws.

EPA is responsible under FIFRA for registering pesticides and, under FFDCA, for setting national tolerances for residues resulting from use of pesticides on agricultural crops. Pesticide tolerances actually serve a dual regulatory purpose: first, as a dietary level of pesticide residue that is considered acceptable; second, as an indicator of proper pesticide use, reinforcing FIFRA enforcement programs.

EPA sets tolerance levels, but two other federal agencies enforce them. The Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) are responsible for enforcing tolerances for pesticide residues in food and animal feed commodities that move in interstate commerce, or are imported into the U.S. Individual states also monitor food commodities to ensure their compliance with tolerances.

To carry out their enforcement efforts, both FDA and USDA conduct monitoring and surveillance programs. Any commodity bearing residues in excess of a tolerance, or in the absence of a tolerance, is considered adulterated, and may be subject to regulatory action such as seizure for domestic products, or barred entry into the U.S. for imports. FDA enforces tolerances for all food and feed items except meat, poultry, and egg products, which are USDA's responsibility.

If a pesticide is properly applied on a crop for which it is registered, it is safe to say that resulting residues will be within tolerance limits. In fact, federal and state authorities find that the vast majority of foods sampled in tolerance enforcement programs do not contain illegal pesticide residues. FDA samples about 12,000 food shipments each year for pesticide residues, and reports an overall "pass" rate of 96-98 percent for both domestic and imported shipments. Most of the problems found by FDA indicate that a farmer has used a pesticide registered for use on one crop on a different crop, rendering the residues illegal. This is true for both domestic and imported commodities. USDA reports only sporadic violations of pesticide tolerances, with a "pass" rate of over 99 percent for both domestic and imported meat and poultry products sampled and analyzed by the USDA Food Safety and Inspection Service.

Pesticide tolerances apply to agricultural commodities "at the farm gate." In general, residues tend to dissipate, or break down, as time passes after harvest. If pesticide residues are, in fact, present at maximum tolerance levels when produce leaves the farm, they most likely will be below tolerance level by the time the produce reaches the consumer. In many cases, pesticide residues may be further reduced by washing, peeling, cooking, and processing food. However, legal tolerances are intended to protect consumers from unsafe pesticide residue levels, even if the residues are not reduced below tolerance before the food is consumed.

Through state/federal cooperative enforcement agreements, all states except Nebraska and Wyoming have assumed, with EPA oversight, primary enforcement responsibilities for pesticide use violations. EPA sets FIFRA enforcement policy and conducts compliance monitoring and enforcement in these two states.

Enforcement includes monitoring the distribution and use of pesticides, and issuing civil as well as criminal penalties for violations. For example, it is unlawful under FIFRA to use a registered pesticide product in a manner inconsistent with its label, to alter an approved label, or to distribute in commerce any adulterated or misbranded product.

In addition to the various federal and state agencies involved, you have a role to play in enforcing pesticide laws.

Anyone who misuses a pesticide, either deliberately or carelessly, or who otherwise violates its labeling, may be subject to civil or criminal penalties under FIFRA. If you become aware of pesticide misuse, or an accident involving pesticide exposure, you should report this information to your state pesticide enforcement agency (in most states, that agency is the state Department of Agriculture) or to your EPA regional office.

With your cooperation, the multitude of federal and state agencies that enforce pesticide laws can do an even better job of making sure that the pesticides used around your home and on your food are safely used. □

Today's Change, Tomorrow's Improvement: Trends in Regulation

While there are many steps you can take right now to use pesticides more safely, what developments are underway to improve the pesticides to which you may be exposed during your lifetime? What changes can you expect to see in the pesticides of the future?

New pesticides come on the market at the rate of about 15 per year. They are thoroughly tested before being approved, and cannot be sold or used if there are major data gaps or if the data show that a chemical poses an unreasonable risk to man or the environment.

Many of the new pesticides are target-specific; that is, they kill what they are supposed to kill and don't kill what they are not supposed to kill. They dissipate quickly and, therefore, are less likely to bioaccumulate up the food chain. New pesticides tend to be less acutely hazardous than many older pesticides; accidental exposure is less likely to cause injury or immediate illness. Potential for chronic toxicity remains a problem. However, some of the new pesticides and many older pesticides may cause delayed effects such as chronic disease or cancer.

U.S. Department of Agriculture

Some insecticides are being partially replaced by biochemical sex attractants used to lure male insects into a trap. Entomologist Jeffrey Aldrich fills a yellow jacket trap with attractants, helping keep the woodland safe for strollers.

Insecticide trends

For a variety of reasons, many of the insecticides introduced in the 1940s and 1950s have gone off the market in the past few years. Some were found to pose unacceptable health risks to people. Many are environmentally persistent: residues of insecticides banned years ago are still turning up today in soil, in water, and in our bodies. Some old insecticides no longer were efficacious as insects developed resistance to them. Patents expired on many old insecticides, leading to increased competition and shrinking profit margins. A final factor leading to the demise of old insecticides is EPA's demand for a complete data base for continued registration of each chemical. To prepare such a data base would, in many cases, require extensive testing. If the product does not generate enough sales to justify such an investment, it will probably go off the market.

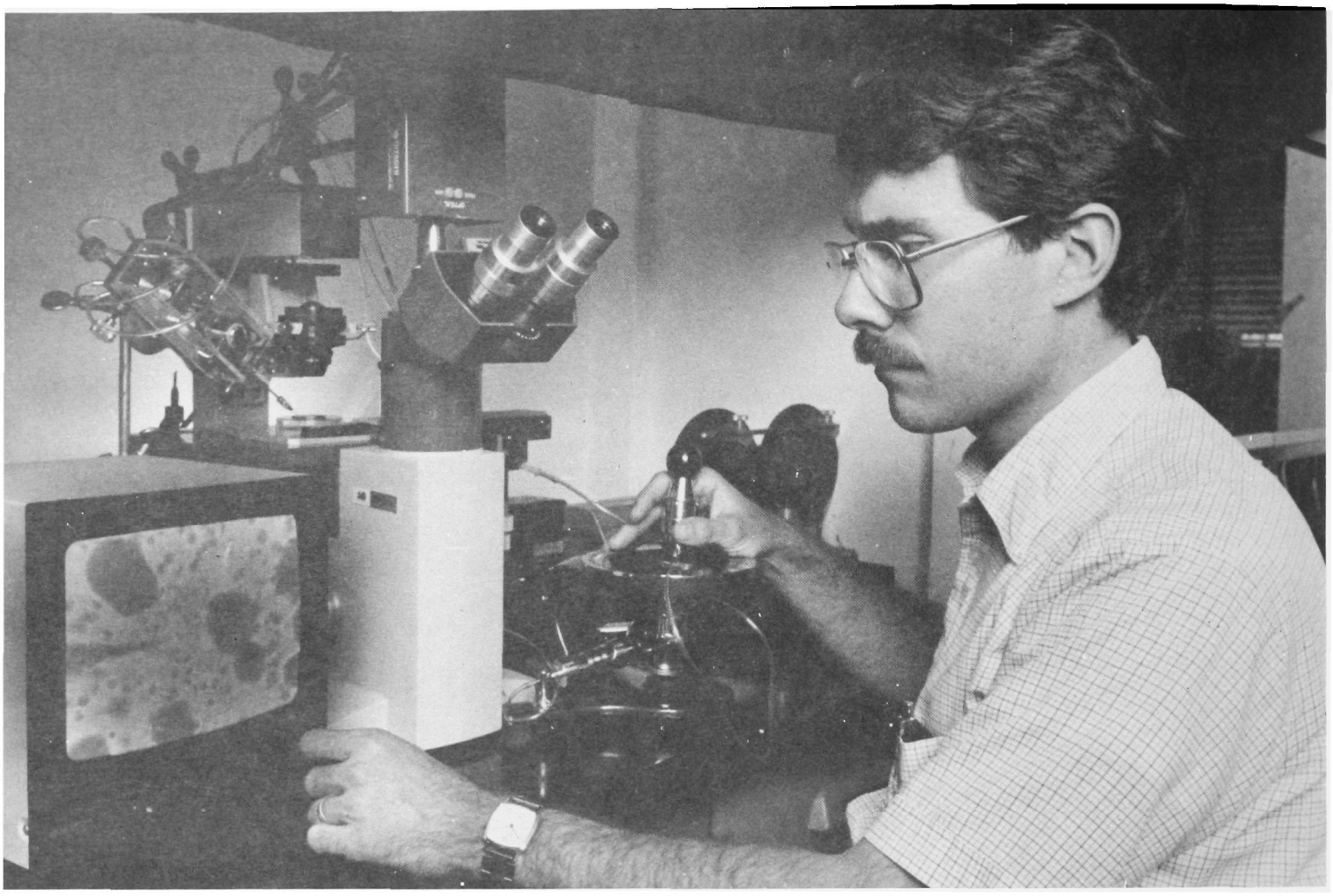
What will take the place of the disappearing insecticides?

Synthetic pyrethroids are replacing some old, broad-spectrum insect poisons. They are chemically related to the safe but expensive pyrethrins obtained from crushed chrysanthemums.

Another trend is toward use of **biochemicals**, such as synthetic sex attractants that lure male insects to traps. These insecticides pose very low hazards to people and non-target animals. However, they work only with a relatively small number of insects.

Microbiological pesticides are isolates of insect pathogens found in nature that are being used to infect and kill susceptible insects. These also pose very low hazards to people and non-target animals. But their effectiveness is limited because each insect pathogen is usually capable of infecting only a limited number of insect species.

The latest trend is the development of **novel microbiological pesticides.** These



may be exotic microbial species that do not occur in the habitat of intended use, or they may be genetically engineered microbes. The latter typically are made by inserting genes that carry a desired trait—such as pathogenicity against a particular insect—into a harmless indigenous microbe. While novel microbiological pesticides hold great promise for achieving highly targeted pest control with little risk of conventional adverse effects, they do raise the specter of unknown risks. To date, EPA has not approved any novel microbiological pesticides for sale. EPA has approved field testing of a microbe that is supposed to prevent frost damage in strawberries, but has not yet registered any novel microbiological pesticides.

Herbicide trends

Old herbicides decline for many of the same reasons as old insecticides. The chief difference is that plant species rarely develop resistance to herbicides. (However, the presence of herbicides favors the development of pesticide-degrading soil microbes which decrease herbicide effectiveness.)

The most noteworthy trend in this area is the development of herbicides that are effective at very low dosage rates. A related trend is the development of new application technologies that permit very precise dosing of target weeds. Together, these two methods can minimize both applicators' and sensitive species' exposure to herbicides.

Genetic engineering technology holds promise here too. For example, genes for pesticide resistance could be inserted in desired crops, which could then flourish even in the presence of herbicides. Or genes to fix nitrogen could be inserted into ordinary soil bacteria typically associated with nitrogen-depleting crops. This would decrease the need for synthetic fertilizers and simplify crop-rotation schedules.

Disinfectant trends

Conventional pesticides pose hazards because they can work too well, poisoning people and animals. Disinfectants, on the other hand, pose hazards because they may not work well enough, exposing people to the potentially dangerous bacteria and viruses that they are supposed to kill. To minimize disinfectant hazards, EPA is targeting five areas for improvement: ensuring consistency in efficacy tests; predicting how well efficacy tests that work in the research lab will work in the home or hospital; ensuring quality control in manufacturing; preventing toxic effects; and accurate labeling and advertising. EPA is also requiring exposure and/or toxicity data on certain kinds of disinfectants products.

Trends in risk assessment

Risk is assessed by relating toxicity to exposure; the better the data on toxicity and exposure, the better the risk assessments. In using data to characterize risk, EPA has developed a "weight-of-evidence" rule to help ensure consistency in assessing the cancer-causing potential of a chemical. Weight-of-evidence means that, when EPA determines the potential of a chemical for causing cancer, it considers not only the results of the study in question, but also its quality, as well as

Genes for pest resistance may in the future be inserted into crops, making the use of herbicides unnecessary. Using a microscope attached to a closed-circuit television, geneticist Robert Griesbach prepares to inject a chromosome into a petunia cell, magnified 15,000 times. Genetic engineering for plants is still in its infancy, but significant possibilities are forecast.

the results of other studies on the same kinds of test animals, and the results of other kinds of predictive tests. EPA is also beginning to use weight-of-evidence to assess a chemical's potential to cause non-cancer risks, such as reproductive toxicity.

To improve its ability to predict exposure pathways, EPA requires registrants to submit data on environmental fate, residues, and worker exposure. The Agency has developed a model for predicting a pesticide's potential to contaminate ground water, and a system for estimating dietary exposure to pesticides for various segments of the U.S. population.

The trends are toward pesticides that are more specific, less toxic, and more thoroughly tested than the products they are replacing. As "broad spectrum" products disappear, users will need to become better informed about chemical and non-chemical methods that can be used to manage pest problems.

In the future, use of pesticides will pose fewer hazards to man and the environment, possibly resulting in improved health of farmworkers and others who are occupationally exposed to pesticides and improved vigor among a myriad of wildlife species. Decreasing dietary intake of highly toxic chemicals will result in subtle but real improvements in the health of the general public.

The comprehensive testing of all pesticide products will allow regulatory officials to better evaluate health and environmental risks before a pesticide is introduced into the environment, or in the case of existing products being tested under the Agency's reregistration program, to determine whether an old product may remain on the market.

It remains to be seen whether our society's commitment to these goals will withstand the economic challenge posed by them. □

Sources of Information on Pesticides

Information from EPA

The following EPA documents are available upon request from EPA, Office of Pesticide Programs, (TS-766C), 401 M Street, S.W., Washington, D.C. 20460:

Pesticides Fact Book. Brief summary of EPA pesticide regulatory programs.

Labeling Fact Sheet. Brief description of Agency requirements for the contents of a pesticide label.

Pesticide Safety Tips. Suggested practices for consumers.

Suspended, Cancelled, and Restricted Pesticides. List of pesticides which, because of their hazards, are no longer available for use by the public.

Recognition and Management of Pesticide Poisoning. Reference manual designed for health care professionals to help diagnose and treat pesticide poisonings. Categorizes pesticides according to toxicity; describes symptoms or signs of poisoning; and gives information for confirming diagnosis and antidotes.

EPA Journal, May 1987, and reprints of this *Special Section.*

List of Pesticide Fact Sheets. Lists the various fact sheets EPA has printed. Each fact sheet, which may be obtained separately, describes a particular pesticide: what it is used for, who makes it, when it was registered, how toxic it is, and regulatory action(s) the Agency has taken on the pesticide.

The following EPA documents are available upon request from EPA, Public Information Center, (PM-211 B), 401 M Street, S.W., Washington, D.C. 20460:

Pesticide Safety for Non-Certified Mixers, Loaders, and Applicators. Bilingual (Spanish/English), illustrated handbook on safety procedures. Contains guidance on how to read labels, signs of poisoning, first aid information, protective clothing, and safe and unsafe work practices.

Pesticide Safety for Farmworkers Bilingual (Spanish/English), illustrated handbook for farmworkers on pesticide safety on the farm and around the home. Included are safe and unsafe practices, signs of poisoning, first aid information, guidance on how to read a label, and information on reentry times.

Information from Other Sources

National Pesticide Telecommunication Network. Call 1-800-858-PEST (7378) toll-free to pesticide experts who can provide information on: recognizing and treating pesticide poisoning; pesticide products; pesticide cleanup and disposal; contacts for animal poison centers; enforcement contacts; pesticides certification and training programs; and pesticide laws.

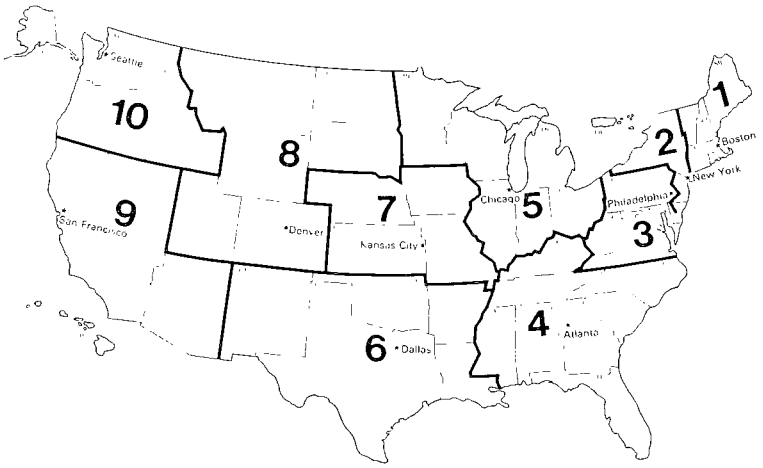
National Pesticide Information Retrieval System (NPIRS). A computer network of pesticide data, including most non-confidential federal pesticide registration data; data from participating states; product names; names and percentages of active ingredients in products; names and addresses of manufacturers and registrants; use sites, crops, and pests on which a product may be used; and EPA registration numbers.

NPIRS may be accessed through county agricultural extension agents, land-grant universities, state and federal regulatory offices, crop consultants, pesticide dealers, various user groups and organizations, and others working on pesticide-related activities.

County Agricultural Extension Agents and pesticide dealers can provide information on pesticide use in your locality. *Libraries and book stores* contain reference books and magazines with information on indoor and outdoor use of both chemical and non-chemical means of pest control.

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGIONAL ORGANIZATION



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Edison, NJ 08837
(212) 264-2525

Region 3
Chief, TSCA/FIFRA Enforcement Section
841 Chestnut Street (3HW13)
Philadelphia, PA 19107
(215) 597-8598

Region 4
Chief, Pesticides and Toxic Substances Branch
345 Courtland Street NE
Atlanta, GA 30365
(404) 881-4727

Region 5
Chief, Pesticides and Toxic Substances Branch
536 South Clark Street
Chicago, IL 60605
(312) 353-2291

Region 6
Director, Air and Waste Management Division
1201 Elm Street
Dallas, TX 75270
(214) 767-2600

Region 7
Chief, Case Preparation and Technical Assistance Section
727 Minnesota Avenue
Kansas City, KS 66101
(913) 236-2800

Region 8
One Denver Place
999 18th Street
Suite 1300
Denver, CO 80202
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Region 9
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215 Fremont Street
San Francisco, CA 94105
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Region 10
Chief, Pesticides and Toxic Substances Branch
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1200 6th Street
Seattle, WA 98101
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State Agencies

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Hazardous Materials Management Unit
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165 Capitol Avenue
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State Office Building-Station 28
Augusta, ME 04333
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(603) 271-3550

Rhode Island
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Dept. of Environmental Management
22 Hayes Street
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(401) 277-2782

Vermont
Director, Plant Industry Division
Dept. of Agriculture
116 State Street, State Office Building
Montpelier, VT 05602
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Region 2

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Chief, Bureau of Pesticide Control
New Jersey Dept. of Environmental Protection
380 Scotch Road
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New York
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Puerto Rico
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Puerto Rico Dept. of Agriculture
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Santurce, PR 00908
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Virgin Islands
Director, Pesticide Programs
Division of Natural Resources Management
Dept. of Conservation and Cultural Affairs
111 Watergut Homes
Christiansted, St. Croix
U.S. Virgin Islands 00820
(809) 773-0565

Region 3

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Delaware Dept. of Agriculture
POB Drawer D
Dover, DE 19901
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District of Columbia
Division of Pesticides and Hazardous Materials
Dept. of Environmental Services
District of Columbia
5010 Overlook Avenue SW
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Maryland
Chief, Pesticide Applicator's Law Section
Maryland Dept. of Agriculture
50 Harry S. Truman Parkway
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Pennsylvania
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Pennsylvania Dept. of Agriculture
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Director, Plant Pest Control Division
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Alabama Dept. of Agriculture and Commerce
POB 3336
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Mississippi State, MS 39762
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Dept. of Agriculture
State Agriculture Building
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South Carolina
Pesticide Supervisor, Plant Pest Regulatory Service
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Tennessee
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Nashville, TN 37204
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Region 5

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Dept. of Agriculture
Emmerson Building
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Office of Health Protection
Dept. of Public Health
535 West Jefferson
Springfield, IL 62761
(217) 782-4674

Indiana
Pesticide Administrator, Office of the State Chemist
Dept. of Biochemistry
Purdue University
West Lafayette, IN 47907
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Michigan
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Region 6

Arkansas
Director, Division of Feed, Fertilizer, and Pesticides
Arkansas State Plant Board
1 Natural Resources Rd.
Little Rock, AR 72205
(501) 225-1598

Louisiana
Office of Agricultural and Environmental Sciences
Louisiana Dept. of Agriculture
POB 11453
Baton Rouge, LA 70804
(504) 925-3763

New Mexico
Chief, Division of Agricultural and Environmental Services
New Mexico State Dept. of Agriculture
POB 3150
New Mexico State University
Las Cruces, NM 88003
(505) 646-2133

Oklahoma
Supervisor, Pest Management Section
Plant Industry Division
Oklahoma State Dept. of Agriculture
310 NE 28th Street
Oklahoma City, OK 73105
(405) 521-3863 or 3871

Texas
Director, Division of Agricultural and Environmental Sciences
Texas Dept. of Agriculture
POB 12847
Austin, TX 78711
(512) 463-7524

Region 7

Iowa
Supervisor, Pesticide Control Section
Iowa Dept. of Agriculture
Henry A. Wallace Building
East 7th Street and Court Avenue
Des Moines, IA 50319
(515) 281-8590

Kansas
Director, Plant Health Division
Kansas State Board of Agriculture
109 SW Ninth Street
Topeka, KS 66612
(913) 296-2263

Missouri
Supervisor, Bureau of Pesticide Control
Dept. of Agriculture
POB 630
Jefferson City, MO 65102
(314) 751-2462

Nebraska
Director, Bureau of Plant Industry
Nebraska Dept. of Agriculture
301 Centennial Mall
Lincoln, NE 68509
(402) 471-2341

Region 8

Colorado
Supervisor, Pesticide Section
Division of Plant Industry
Colorado Dept. of Agriculture
4th Floor, 1525 Sherman Street
Denver, CO 80203
(303) 866-2838

Montana
Administrator, Environmental Management Division
Agriculture-Livestock Building
Room 317, Capitol Station
Sixth and Roberts
Helena, MT 59601
(406) 444-2944

North Dakota
Director, Plant Industries Division
Dept. of Agriculture
State Capitol
Bismarck, ND 58505
(701) 224-2231

South Dakota
Director, Division of Regulatory Services
South Dakota Dept. of Agriculture
Anderson Building, 445 East Capitol
Pierre, SD 57501
(605) 773-3375

Utah
Director, Division of Plant Industries
Dept. of Agriculture
350 North Redwood Road
Salt Lake City, UT 84103
(801) 533-4107

Wyoming
Manager, Plant Industry
Wyoming Dept. of Agriculture
2219 Carey Avenue
Cheyenne, WY 82002
(307) 777-9321

Region 9

Arizona
Administrator, Board of Pesticide Control
1624 West Adams, Suite 103
Phoenix, AZ 85007
(602) 271-3578

State Chemist, Agriculture Experiment Station
POB 1586
Mesa, AZ 85201
(602) 833-5442

Executive Secretary, Structural Pest Control Board
2207 South 48th, Suite M
Tempe, AZ 85282
(602) 271-3664

California
Assistant Director, Division of Pest Management, Environmental Protection, and Worker Safety
California Dept. of Food and Agriculture
Sacramento, CA 95814
(916) 322-6315

Hawaii
Head, Division of Plant Industry
Hawaii Dept. of Agriculture
POB 22159
Honolulu, HI 96822
(808) 548-7124

Nevada
Administrator, Division of Plant Industry
Nevada Dept. of Agriculture
POB 11100
Reno, NV 89510
(702) 789-0180

Guam
Director, Air and Land Programs Division Guam Environmental Protection Agency
POB 2999
Agana, GU 96910

American Samoa
Director, Dept. of Agriculture
POB 366
Pago Pago, American Samoa 96799

Trust Territory of the Pacific Islands
Executive Officer, Trust Territory Environmental Protection Board
Office of the High Commissioner
Trust Territory of the Pacific Islands
Saipan, Mariana Islands 96950

Commonwealth of the Northern Mariana Islands
Environmental Engineer, Division of Environmental Quality
Commonwealth of the Northern Mariana Islands
Dr. Torres Hospital
Saipan, Mariana Island 96950

Region 10

Idaho
Supervisor, Pesticide Specialist and Registrar
Idaho Dept. of Agriculture
POB 790
Boise, ID 83702
(208) 334-3240

Oregon
Assistant Chief, Plant Division
Oregon Dept. of Agriculture
635 Capitol Street NE
Salem, OR 97301
(503) 378-3777

Washington
Pesticide Specialist
Washington Dept. of Agriculture
406 General Administration Building
Olympia, WA 98504
(206) 735-5064

Alaska
Alaska Dept. of Environmental Conservation
POB 1088
Palmer, AK 99645
(907) 745-3236

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