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# EPA JOURNAL

## Pesticides and the Consumer

# Pesticides and the Consumer

An EPA work group recently concluded that pesticides pose some of the greatest risks among the environmental problems with which the Agency deals. This issue of *EPA Journal* focuses on pesticides, how they affect us in our daily lives, and how their risks can be reduced.

Leading off the issue, EPA Administrator Lee M. Thomas outlines the challenge of successfully communicating to the public how the Agency's pesticide program works and explaining the risks and benefits of these products. In an interview, John H. Moore answers questions about EPA's pesticides program and pesticides problems generally. Dr. Moore is the Agency's Assistant Administrator for Pesticides and Toxic Substances.

Next is an *EPA Journal* Special Section featuring information for consumers about pesticides. Articles in the Special Section describe growing concerns over pesticides and spell out EPA's procedures for keeping unsafe pesticides off the market and evaluating the risks that these chemicals may cause. Other articles in the section contain practical information that consumers can use in their homes and gardens: how to limit exposure to pesticides in food, air, and water; how to use pesticides properly; how to use pesticide alternatives; and how to handle a pesticide poisoning. The Special Section concludes with a discussion of what the federal government is doing to enforce pesticide laws, and a look at what the future may hold for pesticide products.

Following the Special Section are five articles to complete the picture of pesticides in America today and EPA's role in regulating these pest control agents. First, Douglas Campt, Director of EPA's Office of Pesticide Programs, discusses the pesticide daminozide, or Alar, as a case study of Agency decision-making in the midst of intense public controversy. Next is a piece on the outlook for this Congress to pass a new law regarding pesticide regulation. Then, an environmentalist describes challenges to EPA and Congress presented by pesticide use, and a pesticide manufacturer discusses what it is like to be a regulated industry. Another piece explains the problem of ground-water contamination by pesticides and reports on an EPA survey of pesticides in drinking water.

In a separate feature, three observers outside of EPA discuss the implications of the report by the Agency work group which compared environmental problems according to the risks they pose. This is another of the Forums in which *EPA Journal* invites observers outside the Agency to comment on current issues.

This issue concludes with a regular feature, Appointments. □

*Farmers generally rely on pesticides to provide control against pests that could damage crops such as the corn and alfalfa shown in the picture below.*

U.S. Department of Agriculture

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*Front Cover: A woman shopper at produce stand. Says John A. Moore, EPA's Assistant Administrator for Pesticides and Toxic Substances, while "the American food supply is wholesome and safe, at the same time, it can be improved." See interview beginning on page 4 for further comment by Dr. Moore.*

*Design Credits: Donna Wasylkiwskyj; Ron Farrah; James R. Ingram.*

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# 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.

# Making and Communicating Pesticide Decisions

by Lee M. Thomas

*(The following is excerpted directly from remarks by Thomas in a recent interview. He is Administrator of EPA.)*

Of the various environmental authorities EPA has, its pesticide authorities give the clearest direction for balancing risks and benefits, for balancing human health and environmental protection with agricultural and other pest control needs. But the way in which the statute and the program give us that direction makes pesticide regulation one of the most difficult jobs we've got.

Beyond the scientific and economic complexities, the statute itself sets up, in some cases, a fairly cumbersome process for decision-making. To ensure that the balancing goes on all the way through the process, Congress and the Agency have written into the statute and regulations various mechanical ways to weigh environmental interests against agricultural interests and other benefits.

We have a several-stage process for decision-making, including scientific and economic analysis, open meetings with our scientific advisory panel, and public comment. If we propose, after all this, to cancel a pesticide, the public says, "This chemical must be bad. EPA's taking action against it." But then somebody else says, "Now wait a minute. I don't agree with you." Then we must start the process over again through a trial-like, administrative law judge hearing. The public, of course, is confused and says, "Hey, what's going on? I don't understand."

This process makes the pesticide program a difficult one to manage and to communicate to the public. It promotes confusion about timeliness and finality of decisions.

But successfully communicating to the public is critical. I believe strongly that we need to open up our processes and communicate what we know about pesticides and how we make decisions about them. The program is one of the Agency's most important responsibilities, with significant implications for the protection of ground water, soil, air, for food safety, and for the conservation of beneficial plants and animals. From an exposure point of view, it is the one program we manage, other than the air program, that has the greatest potential to affect public health and ecological well-being.

There are a number of things we need to do to improve pesticide regulation and our communications to the public. First, we need to try to modify some of the decision-making procedures we use. Some of this could be done through regulatory revisions which we're working on; other procedures would require statutory change.

But the bigger issue, or the more immediate one, is to carry out a more aggressive effort to communicate to the public how the pesticide program works, what the risks are, and what the benefits are.

Effective communication can be difficult. When the Agency goes out with a decision as it did with EDB, for example, the public can get alarmed. In response, I've heard from industry that perhaps the Agency is being too open too early in the process. Industry believes that we ought to wait until we have certainty in our risk and benefits assessments and then make a decision.

Well, this Agency has very good and very strong scientific expertise and we consult with other agencies too. But there is never going to be a point where this Agency is going to have the answer so certain that we can't be challenged.

***I believe strongly that we need to open up our processes and communicate what we know about pesticides and how we make decisions about them.***

There needs to be an opportunity for people outside this Agency to discuss and review and challenge decisions we're making. To say that we shouldn't engage in this public discussion is like saying, "We don't want to talk to the public about the risk this Superfund site is posing until we've decided exactly how to clean it up and have the bulldozers ready to roll." I don't feel comfortable with that process. I want to put out the best scientific information that tells me what the risks and the benefits are, and then I want an opportunity for people to challenge that information. That is the process we use in this country, and it's a healthy one. I also want the public to understand why the Agency is going forward with a decision, and that there's a consensus in the scientific community behind that decision in many cases.

Now, from industry's point of view, if the public quits buying a certain food before the Agency has taken final action, the public is overreacting. But I think the only way you can deal with that situation is to open up communications, not close them down.

Part of the message that EPA has got to talk about in all of its programs, but especially relating to pesticides, is that evaluation and regulation are a continuing process. We are updating our decisions on pesticides as our knowledge increases and improves. Decisions made 10 or 20 years ago may need to be changed today because we know more now. And today's decisions will need to be re-evaluated in the future as our knowledge expands. It's easy to manage and communicate a static situation. It's far harder to handle a dynamic one well. The challenge for EPA is to make and communicate pesticide decisions which respond to changing knowledge and needs and which create public confidence in them because the public knows how the decision-making process works and has the opportunity to participate. □

# Answering Questions about Pesticides

## An Interview with John A. Moore

*What are the challenges involved in regulating the use of pesticides in the United States? EPA Journal asked John A. Moore, who is the Agency's Assistant Administrator for Pesticides and Toxic Substances. The text of the interview follows.*

Steve Delaney

*John A. Moore*

U.S. Department of Agriculture

*A herbicide is applied to this cropland in Plymouth County, Iowa, where corn was planted.*

**Q What do you think is EPA's biggest challenge in regulating pesticides today?**

A One of our most important efforts efforts has been to rebuild our credibility with the public, get them to trust our pesticide registration process again. I think we've made great strides in that area, but it must always remain a major goal.

A somewhat mechanical goal and our greatest effort is to complete the

reregistration of the "old" pesticides, some 600 active ingredients which were registered for use before the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was amended in 1972. Those amendments radically changed the pesticide law in this country into a health-oriented statute, and required all the previously registered pesticides to be re-evaluated under a new set of rules.

The challenges to the Agency and the pesticide program have been to define those new, more stringent rules and to implement them as a standard to judge a pesticide backlog that includes hundreds of active ingredients involving tens of thousands of products. At the same time, we're registering new pesticides, too.

We've finally got a reregistration process in place to carry out these important reviews, and I think it's really working. I'm not hearing complaints about the product that comes out of it. If there is any frustration that I hear from our critics, it isn't about the quality of the product delivered or the decisions we make, but it is that the pace needs to be accelerated.

**Q What can you do about speeding up the pace of reregistration?**

A Well, reviewing old pesticides includes two steps: developing new test data and then assessing those data as they are generated. I think everyone agrees that the process is very labor-intensive, very people-intensive, and machines just aren't going to replace people in most of the process. I believe it will be 10, 15, or even 20 years before we can say the last product has been evaluated under this process.

Therefore, we are focusing first on the review of high-volume production and food-use chemicals that have the greatest potential for exposure or adverse effects. These are being looked at first—even though their numbers might seem small in comparison with the total—because they have the greatest impact. For example, the first 90 chemicals we reviewed in this effort reflected close to 50 percent of the total pesticide usage in this country.

We've also taken other steps in the pesticide program which will ultimately speed up reregistration. For example, the "data call-in" program requires companies to submit missing data on chronic health effects. We've accelerated those submissions so that we can use them as soon as possible in reviewing old pesticides.

Finally, we're involving industry in this effort as much as possible. We're trying to determine which producers are committed to their products, and which are willing to make the major economic investments required to develop the data we need to sustain old pesticide registrations. We're asking them about that commitment now, not 10 years from now, so that if they have no intention of developing the data, they're not getting a free ride at the public's expense.

We're also telling companies—reminding them—that if they find any adverse effects as a result of new testing, FIFRA requires them to inform us of those effects. We can use those new data while we're reviewing our priority, high-use chemicals.

*Continued to next page*

**Q You've said that reregistration is going to take a long time. What assurances does the public have that it's being protected from unduly hazardous pesticides?**

A First of all, I'm not sure the process of evaluating pesticides is ever complete. What we think is adequate today may not be adequate five years from now. As we learn more about pesticides, more about science, we also learn to ask new questions.

But the public shouldn't feel that we have no data on old pesticides. We have data that are inadequate only under the most rigorous standards in the world for pesticide reviews. The data we do have serve us well. It's just that, as a society, we want to take the extra steps to ensure there are no hidden surprises.

**Q What about new pesticides? How can we be sure that they won't pose the same health and environmental problems that many old pesticides presented?**

A To begin with, we're asking more of the right questions today before a product is registered. We're trying to anticipate problems before they occur. In order to get a new product registered for use on crops destined for human consumption, for example, we ask for extensive data on whether a chemical might cause cancer, birth defects, or other types of toxicity ranging from eye and skin irritation to kidney and liver damage. We also check environmental persistence and exposure. How much of a residue will remain on the crop as a consequence of use? Is it likely to leach through the soil and possibly find its way into ground water?

Take the problem of ground-water contamination. If we have indications that a chemical might leach into ground water, we might impose extensive field studies for the first few years of commercial use as a condition of registration. That way we can monitor real-world applications to find out if use restrictions can minimize or prevent contamination. These are questions that nobody dreamed of asking even 10 or 15 years ago.

**Q You depend a lot on data submitted by registrants. Has it been adequate? Do you trust it?**

A Well, it's not trust *per se*, but there are at least two factors that help ensure valid data. First of all, developing a new pesticide product today means the commitment of tens of millions of dollars. Those producers are betting they will have a successful product. It would be very shortsighted to jeopardize a multimillion dollar investment for want of a modest data set of one sort or another.

Aside from the producers' self-motivation, however, EPA also depends on quality assurance standards for laboratories producing pesticide registration data. Participating laboratories are monitored and inspected by EPA personnel to ensure compliance with the standards.

**Q EPA increasingly is facing new pesticide issues—the safety of inert ingredients, regulation of bioengineered microbials, and the effects of pesticides on wildlife and presence of pesticides in ground water. What are you doing to take control of these issues before they become major problems?**

A Well, of course, these are all very different concerns, but as I said before, we're making a real effort to anticipate problems as much as we can. And in fact, we are looking already at the problems you asked about.

In the case of inert ingredients, for example, we started to review them a year and a half ago. More than a thousand inert ingredients are used in pesticide products, but they are not toxicologically or chemically inert; they are just not pesticidally active. We've found a category of about 50 materials that seem to pose special health or environmental concerns, and we're encouraging manufacturers to substitute other materials in their formulations for the same purpose. If they do not or cannot replace them voluntarily, we're going to start to move them off the market by holding hearings to cancel the registration of products which contain those toxic inert ingredients.

**Q But biotechnology is developing a whole new class of pesticides. Doesn't this pose an extraordinary regulatory challenge?**

A No, we're on top of it. I'm comfortable that we have a process in place that can handle the task of reviewing and ultimately approving genetically engineered microorganisms that are used as pesticides. Don't forget that EPA has already registered over 100 microbial products of one sort or another, and these have been very effective and relatively safe in the environment as an alternative to chemical pesticides.

All we're talking about now is the use of a new technology to develop some of these products faster, more easily, and more precisely. I think our experience with more traditional microbial pesticides will serve us well in reviewing products developed through genetic engineering.

**Q Some reports, including one by EPA, have pointed to weaknesses and shortcomings in the Agency's protection of endangered species. What are you doing to protect these species in areas where pesticides are used?**

A We've instituted a process that provides more frequent and more formal contact between EPA and the Interior Department's Office of Endangered Species. We've also committed ourselves to addressing any concerns that office may identify about the use of particular pesticides in areas inhabited by threatened or endangered species. Further, we've embarked on a strong outreach program to get information to pesticide users—to sensitize them to the dangers pesticides pose to threatened animal or plant species—so that they can make informed decisions about use in the areas of concern.

Finally, in those few instances where better awareness and management simply won't suffice, we will curtail pesticide usage in geographic areas where these concerns exist.

**Q Earlier you mentioned some of the steps EPA takes to minimize ground-water contamination by pesticides. Do you think these procedures are enough, or is new legislation needed to deal more effectively with this or other problems?**

A In many respects, the FIFRA statute is already sufficiently broad to address the major ground-water problems we see. On the other hand, while the law is broad enough to encompass the problems, I think the mechanisms for dealing with them are very inefficient or cumbersome at best. And that means your results are not going to be timely, either because the usual process is so time-consuming, or because, if you try an innovative approach, you're likely to be challenged legally.

These problems with FIFRA aren't limited to ground water; they're part of the circuitous way the law is written. It's as if, for me to get from my office here in Washington to Baltimore, I would have to go by way of Tulsa, OK. Given the size of the job we have to do and the finite resources that are available to do it, it bothers me and many of my colleagues to have to take such a circuitous route, especially when there are so many other things people are demanding be done on a priority basis.

In my view, that could be the true benefit from a reauthorized FIFRA—not so much radical changes in the scope of coverage, but a streamlining of the process.

**Q Do you think we'll get a new FIFRA this Congress?**

A I'm pessimistic. We came close last year when there was a very concerted effort on the part of polarized groups to get along with each other and identify those areas they could agree on to enhance our ability to regulate pesticides.

But the fact is that, despite that effort, despite that camaraderie, the bill finally failed on issues that were not directly relevant to EPA's ability to effectively administer a pesticide statute. It failed on questions like liability, data compensation, and uniform tolerances. All of these are legitimate issues of great import and concern, but they're not central to improving or accelerating pesticide registration and reregistration, which everyone agrees should be our number one priority.

*"Don't use that thing, I'll get the spray."*

**Q How about the problem of pesticide residues in imported foods? Although they are more likely to contain illegal amounts or types of pesticide residues, imported foods are largely unmonitored by the Food and Drug Administration (FDA). What are EPA's responsibilities in this?**

A EPA sets maximum legal limits, called tolerances, for pesticide residues on all foods—domestic or foreign—marketed in the U.S. EPA sets these limits and FDA enforces them. And let me say right off that I think the FDA does an admirable job of monitoring foods for these residues. We work very closely with FDA so that its attention is directed to the worst problems.

From the consumer's point of view, our efforts to reregister old pesticides has been very helpful in that some of them are now being cancelled or their use prohibited. That means that their food tolerances are also being revoked or eliminated. When that happens, foreign countries can no longer export food treated with these pesticides to the United States. In the last one and a half to two years, for example, we have eliminated almost 500 tolerances on cancelled pesticides.

**Q In a related issue, what about the safety of those who grow our food? Farmworkers routinely are exposed to much higher levels of pesticide residues than the average consumer.**

A Several things are going on in this area. We are trying to develop a decision process or a management process that identifies chemicals that may present particular risks to the people who mix, load, or apply them. Those materials can be put into the restricted use category.

Restricted use takes a pesticide out of the hands of the average user and, depending on the conditions imposed, restricts access to trained users who can demonstrate they know when and how to use it.

We're also in the process of expanding our regulations to protect farmworkers. These regulations, promulgated in 1974, protect farmworkers by prohibiting direct spraying while they are in the field, and by requiring protective clothing, waiting periods after fields are treated, and warnings about toxic effects of pesticides. These requirements are good as far as they go, but they need more work.

**Q Restricted pesticides can be used only by or under the direction of certified applicators. What is EPA doing about training and certification for this group of users?**

A Proper handling and application are critical to the safe use of pesticides. Under FIFRA, the states certify private and commercial applicators to use restricted pesticides, with the Cooperative Extension Service of the Department of Agriculture providing most of the training. Some states have moved ahead of the basic FIFRA requirements in areas such as examinations and recertification, but one of our priorities is to improve the certification process for all the states by sharing EPA expertise, materials, and other resources with the states and the Extension Service.

This spring, for example, USDA and EPA—for the first time in eight years—organized a workshop for certification-training leaders from each state. These trainers had a chance to discuss emerging pesticide issues such as ground-water contamination, and to review new training materials and techniques for applicators. We've also gotten the National Institute for Occupational Safety and Health to provide trainers with the latest information on applicator protection equipment.

It's essential to have a strong certification and training program in place if we want to preserve the use of some very important but hazardous pesticides.

**Q With all the scares we've had in the past few years—EDB, Alar, etc.—American consumers might be feeling that pesticides are just bad. Why do we have to use them?**

A Let's leave out farmers for a minute here, and instead of asking why does Farmer Brown use product X or product Y, let's hit a little closer to home, literally.

Most homes in this country are susceptible to termite attacks. I think there are very few people who would presume to suggest that we eliminate the use of pesticides to control termites. People's homes could be destroyed if we did that.

Continued to next page

On the other hand—and by the way, everything under FIFRA is "on the other hand"; it is a risk balancing statute—we've also got to work harder to develop and choose products and application methods that minimize the risks that termite pesticides can pose. That might mean that, in some circumstances, old ways of doing things that served us well 20 or 30 years ago may need to be improved. Our immediate task is to identify a better way and then force ourselves to use it.

I think it's appropriate for the public to expect EPA to continually review registered pesticides in view of new knowledge and new product availability. Products that were tolerated despite their associated risks because they were needed, may no longer need to be tolerated. There are new products that may achieve the same goals without the risks.

**Q Okay, let's take termites. Agency inaction on chlordane and some other chemicals used to treat termites has resulted in a great deal of negative publicity—and public concern—about these pesticides. Are they being reviewed?**

A It's too bad the public often sees the time needed for regulatory action as delay or as inaction. Actually, EPA has been developing risk information for several years now on chlordane and the related pesticides heptachlor and aldrin, focusing particularly on the problems of misuse or misapplication that could lead to excessive resident exposure, and on whether even proper use can pose risks to residents.

Our review of the three termiticides was completed last December and, based on that, we've restricted all three to use only by certified applicators. That should minimize misapplication problems in the future. However, we're still studying the results of indoor air monitoring to determine whether even proper use can be harmful; that study should be finished this summer and, if necessary, we'll take further regulatory action.

**Q What is EPA doing to encourage the development of safer pesticides over the long run?**

A Well, one thing is that we've clearly signaled the industry that we will give priority consideration to reviewing and registering *new* products.

We do this for two reasons. One is that any new product submitted for consideration must have a full, robust data base, which develops far more information than we ever had before. Secondly, there's no question that new products are designed to be far less persistent in the environment and far more precise in attacking their targets. I think these improvements go a long way toward getting better products on the market.

**Q After you've reregistered the pesticide backlog and gotten new, improved products on the market, what's next? Where do you see the next regulatory challenge?**

A When we've gotten reregistration behind us, I think the challenge is going to be in enhancing management processes and techniques to minimize even further any potential untoward effects. An example would be to refine application techniques to the point where we can reduce pesticide amounts by 90 percent and still achieve the desired effects.

Couple that with a better understanding and a better commitment on the part of society in general to integrated pest management, and I think we'll increasingly be able to fine tune, if you will, some pesticide uses. We'll be much more skillful in knowing how and when to apply them. When we can minimize the number of applications we now make for "insurance," I think we'll find that we're also minimizing excess residues in the environment.

**Q Do you think techniques such as integrated pest managment and low-input farming can significantly reduce the use of traditional pesticides?**

A No doubt about it. There are enough success stories across this country that prove those techniques can work. But I'm not suggesting at all, nor do I ever want to suggest, that we're going to be out of the business of using pesticides in agriculture or many of our other pursuits. What I'm talking about is that we're going to know our targets and our materials much better than we do now.

**Q Looking back over the pesticide control efforts of the last 15 years, can we say that the American public is really safer today?**

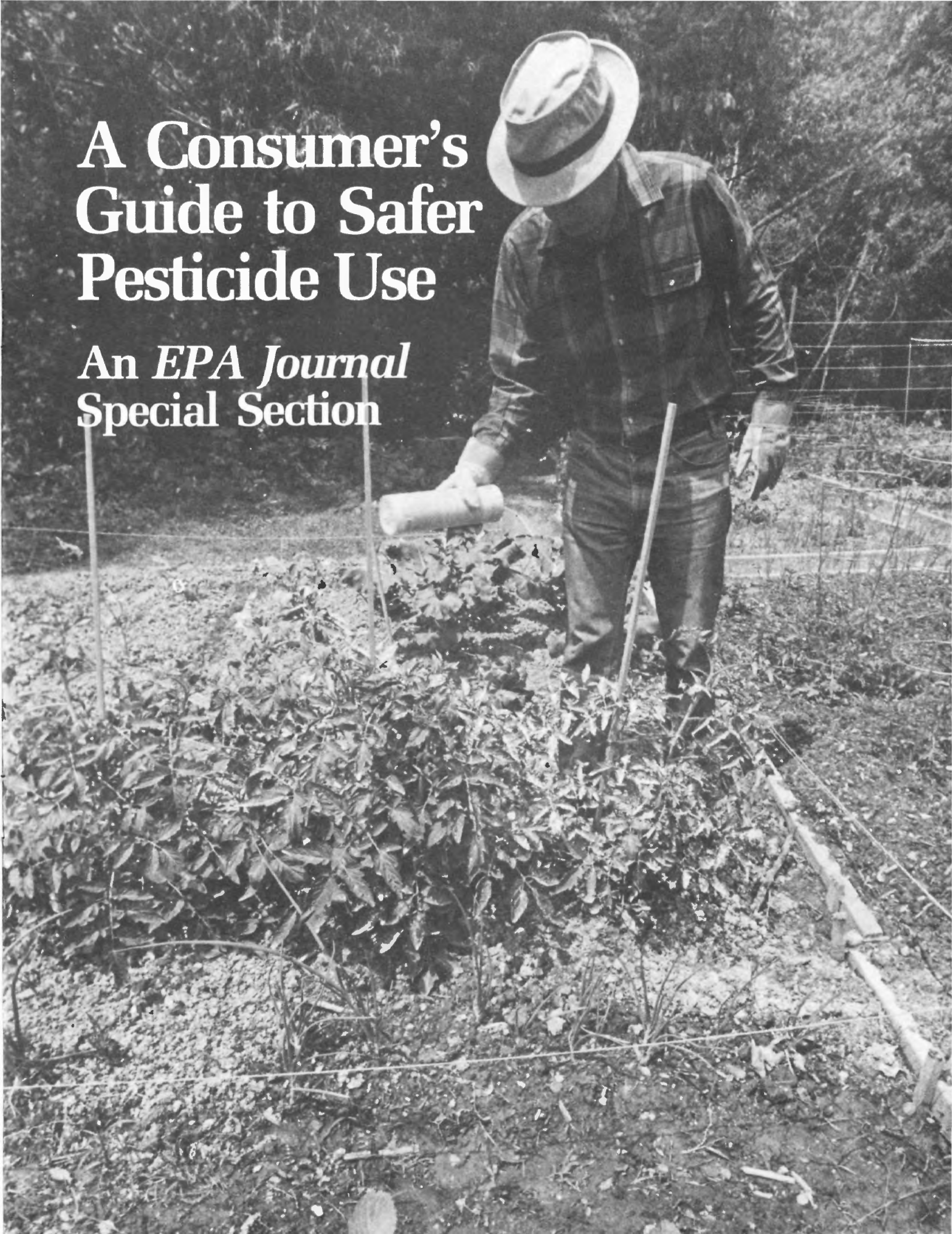
A I think so. There's no doubt in my mind, whether we're talking about the applicator who can now do a much more careful and informed job of applying the material, or the eagles that have returned because DDT was banned, or the fact that EPA finally knows the right questions to ask about pesticide uses and risks. There is no similarity between the data available to us today and what we had 15 years ago. It's night and day.

**Q The National Academy of Sciences (NAS) recently published a report which identified potentially cancer-causing pesticides used in food commodities. The report lists 28 pesticides and cites 15 staple foods (including tomatoes, beef, potatoes, lettuce, oranges, and chicken) "with the greatest estimated oncogenic (tumor-causing) risk." In light of these findings, is our food supply safe?**

A The answer is definitely yes. In fact, the authors of this study—commissioned by EPA two years ago—repeatedly emphasized that certain calculations should not be interpreted to represent actual consumer risk from use of specific pesticides on food crops.

I think the appropriate question for EPA, in the context of this report, is: can the quality of our food supply be improved? Again, the answer is yes. The NAS report will help us regulate all agricultural pesticides in a manner that can best serve the overall safety of the food supply.

The NAS study findings will be particularly useful because they provide EPA with an index of priorities by ranking pesticides for regulatory attention. This was the purpose of the report's risk estimates which are based on a set of working assumptions tending to greatly overstate the dietary risks of pesticides. One assumption is that 100 percent of crops that legally may be treated with a pesticide are treated. This is not the case. A second assumption is that pesticides residues on foods always are present at tolerance levels (maximum legal residue limits) at the time of consumption. For instance, since 92 pesticides are registered for use on tomatoes, the estimates assumed that all tomatoes contain tolerance level residues of all 92 pesticides. This is never the case. Pesticide residues rarely are present at tolerance levels in ready-to-eat food commodities and in many cases may be undetectable by the time the food products reach the consumer. □



# A Consumer's Guide to Safer Pesticide Use

## An *EPA Journal* Special Section

# 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*

*Bodies were collected on carts during the 17th Century epidemic of bubonic plague in England. Flea-infested rats were the source then of the plague, as they are today in some Third World countries. DDT is still the pesticide of choice in many countries.*

*Cover photo: Home gardener dusting tomato bushes with a common pesticide. Although the label does not specifically require special protective clothing and equipment, to reduce exposure, the user is wearing a long sleeve shirt, hat, and gloves.*

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.

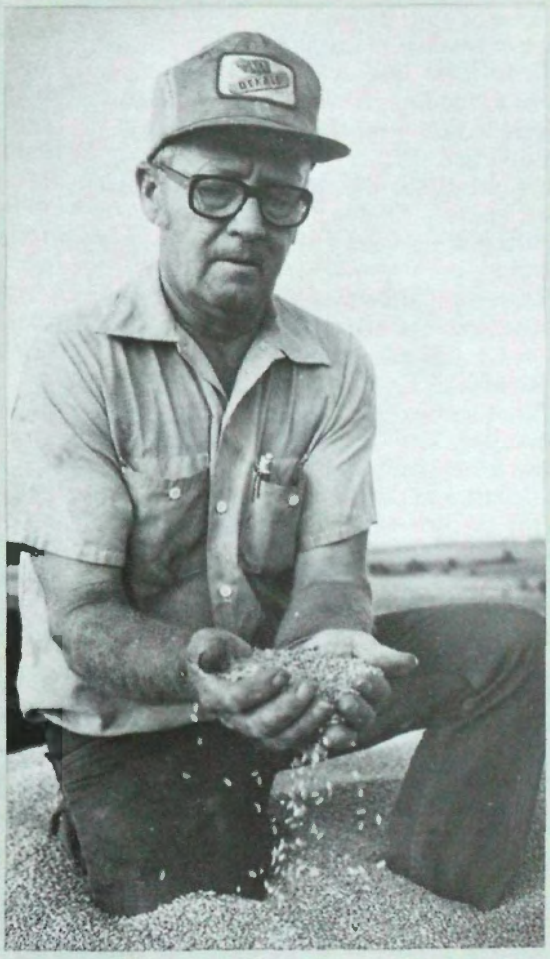
- Thirty major companies produce most of the basic, technical pesticide active ingredients sold and used in the United States. One hundred smaller companies also produce pesticide active ingredients.

- 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.



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. □

# How EPA Regulates Pesticides

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.

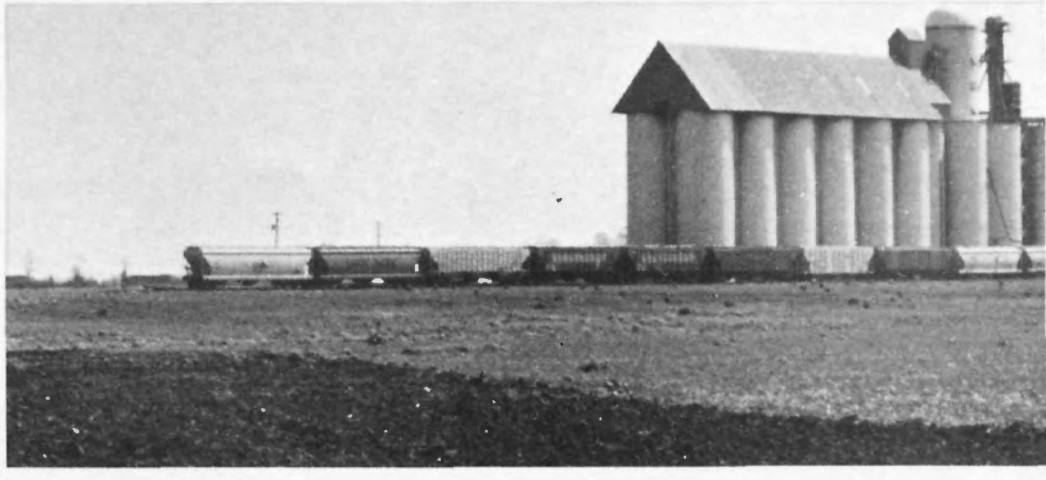
Pesticide regulation, which is governed by the Federal Fungicide, Insecticide, and Rodenticide Act, or FIFRA, and the Federal Food, Drug, and Cosmetic Act, or FFDCA, is a very complicated process. EPA has "registered" approximately 50,000 pesticide products chiefly on the basis of their active ingredients—the 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



Cargill

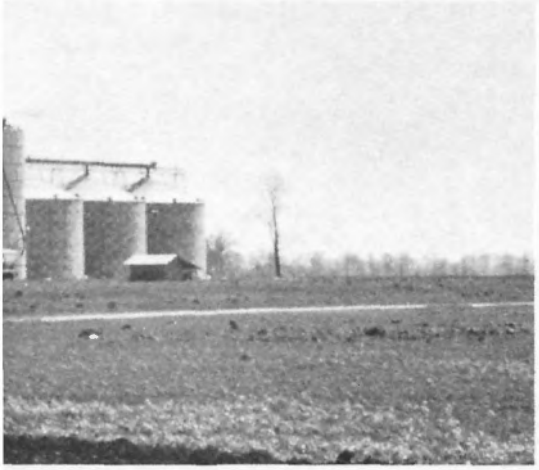
limited time to cover an unexpected, localized pest outbreak; registrant applications for experimental use permits to develop data supporting full registration of a new chemical or new use; conditional registrations pending full data development for products containing existing active ingredients; and 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

Continued on p. 14

The pesticide protecting the wheat in this grain elevator in Eudora, 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.

To lower risk, EPA registration can require protective clothing and respirators, as well as closed mixing 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

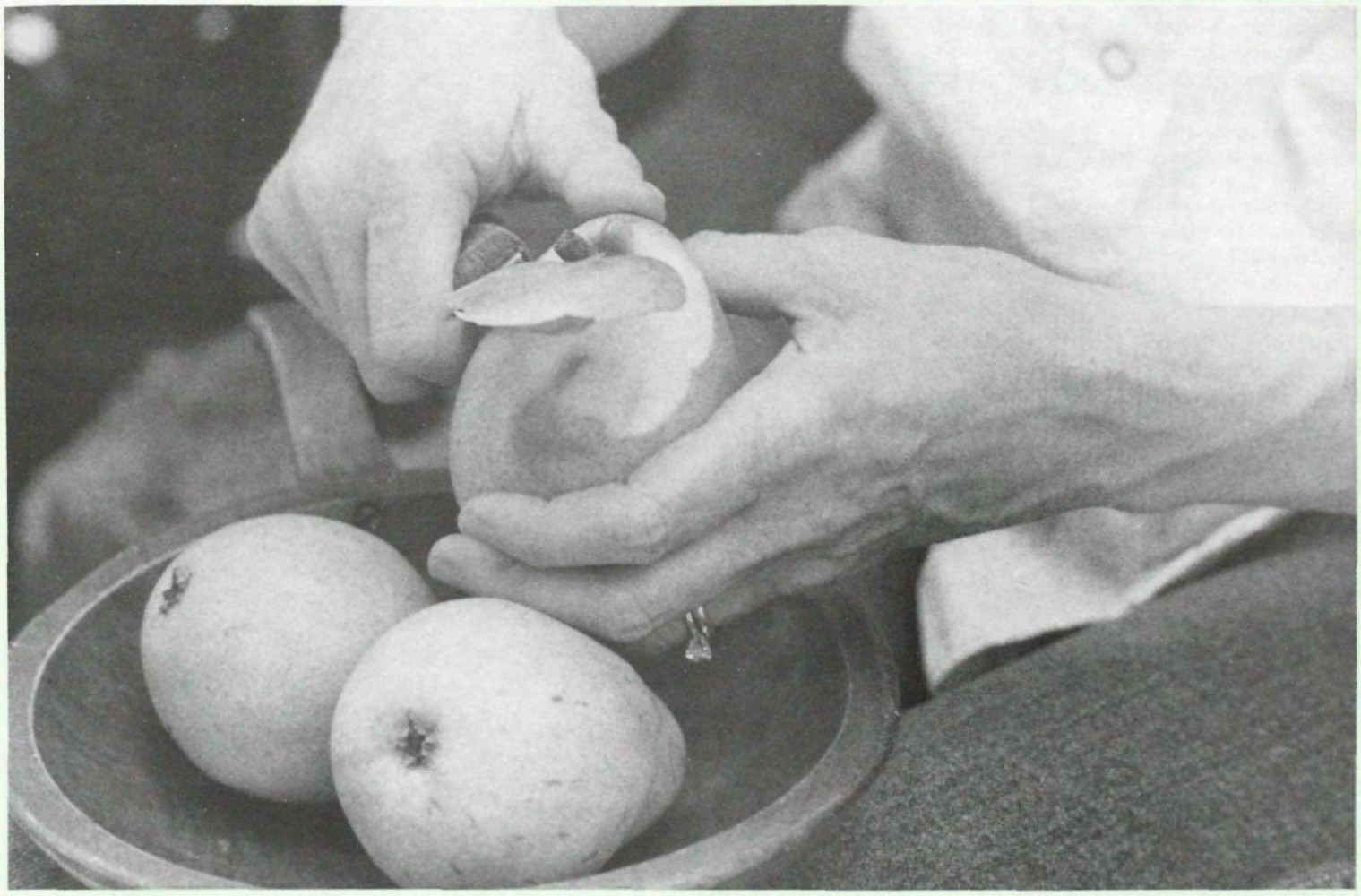
**The Federal Insecticide, Fungicide, and Rodenticide Act** (FIFRA) governs the licensing, or registration, of pesticide products. No pesticide may be marketed in the U.S. until EPA reviews an application for registration, approves each specific use pattern, and assigns a product registration number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

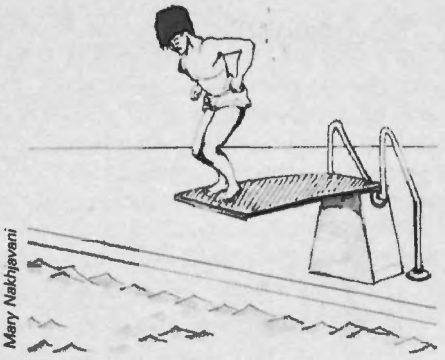
# Pesticides: They're Everywhere

*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 Nakhjevani

*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

Mary Nakhjavani

*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.

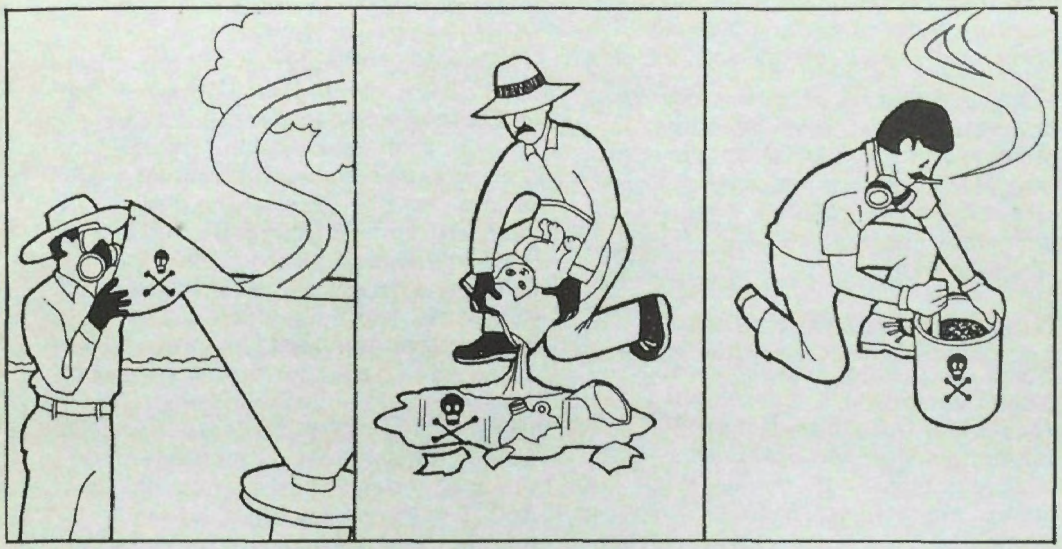
For example, the product label says "For the control of aphids on tomatoes mix 8 fluid ounces of pesticide into 1 gallon water and spray until foliage is wet." Your experience has been that your six tomato plants require only one quart of pesticide to wet all the foliage. Therefore, only 2 fluid ounces 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.

## 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.

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Steven Delaney

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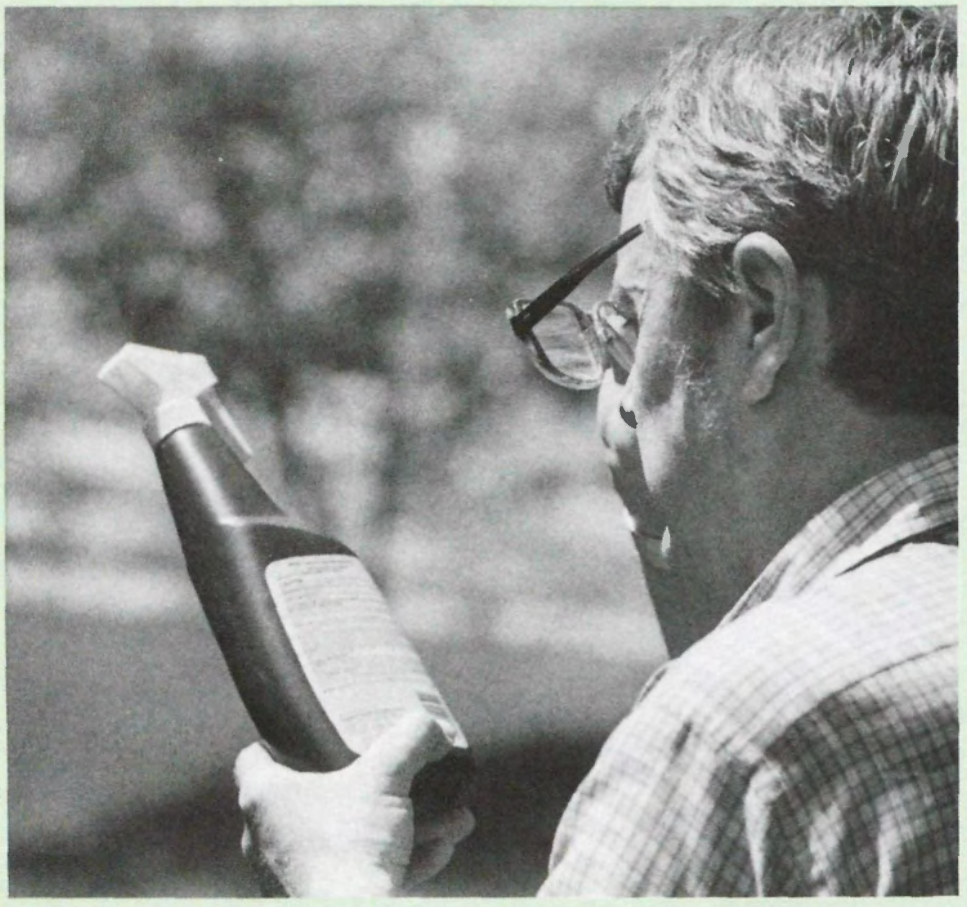
repeated often enough. Read the label before you buy a product, and again before you mix it, before you apply it, before you store it, and before you throw it away. The directions on a label are there for a very good reason: to help you achieve maximum benefits with minimum risk.

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. □



Steven Delaney

*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.

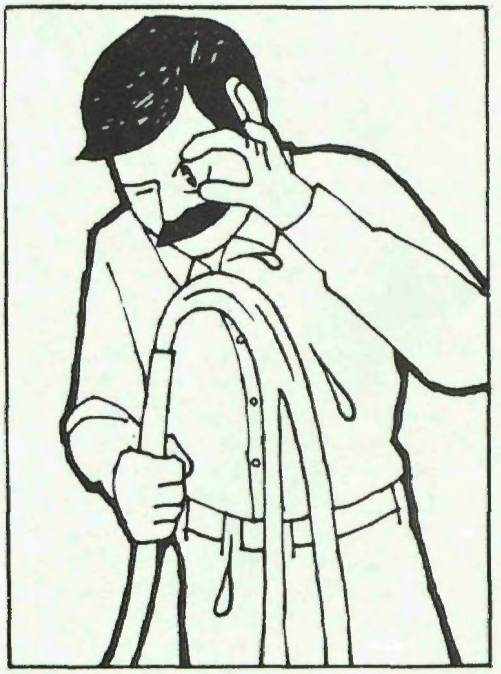
It is always important to avoid these symptoms by minimizing your exposure (and dose) when mixing and applying pesticides by wearing gloves and other protective clothing.

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.

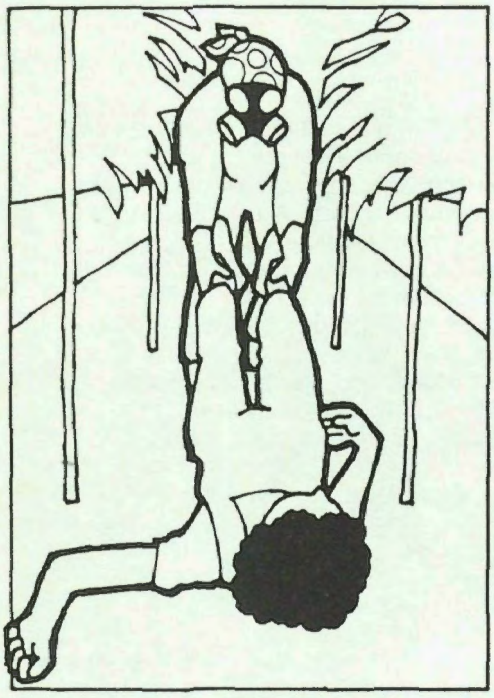
- **Chemical burn on skin.** Drench skin with water and remove contaminated clothing. Cover burned area immediately with loose, clean, soft cloth. Do not apply ointments, greases, powders, or other drugs. Later, discard or thoroughly wash contaminated clothing separately from other laundry.

- **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

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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 pesticide 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-212), 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.

# Daminozide: A Case Study of a Pesticide Controversy

by Douglas Campt

Like EDB, the pesticide daminozide, or Alar, has captured the American public's attention. When the evening television news shows sky rockets interspliced with baby foods on the assembly line, this conveys an alarming message to the viewer: "UDMH is a component of daminozide. UDMH is used in rocket fuel. UDMH is in your baby's food." This TV report was very effective in delivering a message to the public, but not very effective in expressing the complexities of known, and unknown, effects of pesticide residues in food.

A plant growth regulator used primarily on apples, daminozide offers important food production benefits. However, new data now indicate that it also may pose a potential cancer risk.

Like EDB also, the daminozide issue is plagued with scientific uncertainties. These unresolved questions have limited the Environmental Protection Agency's ability to act as quickly and definitively as would be necessary to lessen public confusion and calm public anxieties.

Unlike EDB, however, daminozide is giving EPA the opportunity to apply the lessons from recent past experience in communicating risk findings to the public. EDB taught EPA important lessons about what types of information the public wants and needs to know when confronted with new findings of pesticide risks. However, though EPA's experience with EDB demonstrated the need to communicate pesticide risks to the public, our experience with daminozide proves our need to do still more. EPA must improve its capacity to assure the public that the decision-making process does manage pesticide risks.

EDB, daminozide, and numerous other pesticides recently in the news point to what has become for EPA an all-too-familiar regulatory dilemma—should the Agency base its actions primarily on timeliness or on certainty? Often, when compelling new health and safety questions about a pesticide arise, studies that would help elucidate the pesticide's risks are missing or inadequate. That leaves us with a difficult decision. Do we move forward briskly with an aggressive regulatory proposal that may later prove to have been unreasonably stringent? Or, do we wait for data on the pesticide

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Our decision is influenced to an extent by the provisions of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) which requires a weighing of the risks and benefits to determine whether or not a pesticide poses "unreasonable adverse effects" or an "imminent hazard" prior to cancelling a pesticide registration or suspending its registration. It is the responsibility of the license holder or registrant to provide data and to prove that the benefits of a pesticide outweigh the risk of that pesticide. Before we take action, however, we must have data showing the risks and benefits of the pesticide so that we may make the balancing test of whether or not the benefits in fact do outweigh the risks. The absence of such data is not a supportable basis for cancelling or suspending a pesticide product's registration. This means that EPA must have its ducks in a row and its data in hand if the Agency hopes to prevail in a cancellation or suspension proceeding.

*Interim measures have been set up to minimize the potential risks in the use of daminozide on apples, awaiting the results of new studies and regulations. Final decisions should be reached within 18 months.*

In the case of daminozide, EPA received several toxicity studies in the early 1980s which indicated that unsymmetrical dimethylhydrazine, or UDMH, a metabolite and degradate of daminozide, causes tumors in mice. These oncogenicity studies and some mutagenicity data showing toxicity, along with studies indicating that daminozide and UDMH occurred in raw and processed foods and thus had a potential for human exposure, prompted EPA to initiate a Special Review of daminozide in 1984 to determine if its registration should be cancelled or otherwise restricted. In August 1985, EPA proposed an expedited cancellation of all food crop uses of daminozide, based on a finding that the potential cancer risks from dietary exposure to daminozide and UDM/outweighed the known benefits.

By law, EPA refers such regulatory proposals to the FIFRA Scientific Advisory Panel (SAP) for review. This independent panel of scientists convenes to review the scientific analyses leading to EPA's pesticide regulatory decisions. After a public meeting in late September 1985, the panel concluded that the daminozide cancer studies, while giving rise to concern about potential health effects, were flawed and not sufficient to predict cancer risks from exposure to daminozide and UDMH in food products. The SAP believed the existing studies were scientifically inadequate and could not support the Agency's daminozide risk assessment.

At the same time, the Department of Agriculture (USDA) argued that EPA underestimated the benefits of continued daminozide use, and submitted additional benefits information. USDA urged the Agency to reconsider its decision to cancel daminozide.

After several months of careful reconsideration, the Agency postponed a final regulatory decision on daminozide until new data could be developed by its producer. Meanwhile, however, we needed to balance our quest for scientific certainty with some action. Because scientists will virtually never reach a state of absolute certainty about a pesticide's hazards, some actions may be taken at a point short of knowing all the answers.

Fortunately, under FIFRA we have the option of taking interim risk reduction measures while we wait for data that we need to answer some of the larger questions about long-term risks. With daminozide, the Agency took a number of actions to ensure that exposure would be as low as possible until EPA has the data necessary to make a final determination on the chemical. We reduced the legal application rates; temporarily lowered the tolerance for apples; and limited application to grapes not intended to be processed into raisins. Meanwhile, the manufacturer, Uniroyal, has limited the amount of daminozide produced for use on grapes, and has agreed to include in every bag of daminozide a user advisory recommending that treated apples not be sold for processing into applesauce. These measures, taken together, will limit public exposure to daminozide during the next 18 months. By then, new studies better elucidating daminozide's cancer potential will be available, and a final regulatory decision can be reached.

All of this deliberation on daminozide has, of course, taken place in the light of public scrutiny. Different groups have distinctly different expectations and beliefs about chemical risks. The public generally perceives Agency concern about risk as positive evidence of risk. Ambiguity is not understood or accepted. Similarly, pesticide users also reject any ambiguity on our part, instead tending to see scientific doubt as evidence that concern is not really warranted, that the government is simply overreacting. In short, perceptions about risk tend to be both absolute and polarized. Unresolved scientific questions do not satisfy anyone—they tend to be ignored or replaced by absolutes reflecting the bias of the listener.

The timeliness of Agency decisions is important to all affected parties, but so is the openness of EPA's decision making. Because EPA operates in an open forum, we sometimes publicly raise the issue of health risks before we have the information to resolve these concerns. Waiting for resolution of public health and policy issues can be difficult and painful for all parties directly involved, including the public. When a problem is identified, it is natural to want a solution. Delaying decisions satisfies no one. However, openness and access to information are major Agency and societal principles not worth compromising.

*Continued to next page.*

Health risk issues, especially those involving food safety, tend to be over-simplified; outside opinions become polarized; and these situations create pressure for quick and simplistic answers. Such cases are unfortunate because they often create confusion, fear, and economic disruption.

We believe EPA's role is to communicate Agency concerns and regulatory decisions as clearly and forthrightly as possible. Risk communication will not guarantee that all levels of society will behave rationally or consistently, but it can go a long way toward avoiding confusion and minimizing disruption.

Our philosophy is that the public needs to be both *informed* of immediate pesticide risk problems, and *educated* about risk assessment over time. This is a massive and complex task, since literally everyone in this country is affected by pesticides.

We are practiced at conveying a good deal of information on timely pesticide risk issues, including press releases, fact sheets, meetings, hearings, and correspondence, orchestrated to announce specific pesticide decisions. But, clearly, we need to do more.

Public education about pesticide risks, and EPA's assessment of those risks, is one of the long-term goals of the Office of Pesticide Programs. Certain audiences are targeted for special outreach efforts—the general public, farmers and other users, pesticide dealers, and the states. If we successfully reach them with our messages, we reach the audiences with the greatest need to know about pesticides. We must provide enough basic information on pesticide risks and benefits so those hearing or reading media reports on pesticides are able to fill in the whole picture. In addition, people must understand that Agency *concern* about a pesticide is not the same as established *risk*. And, finally, the public should know that EPA manages pesticide risks throughout the decision making process.

As part of this effort, we meet frequently with a wide range of outside parties to explain basic regulatory processes, policies, and procedures. With a good foundation of knowledge and understanding, these representatives can more easily become involved and can influence EPA pesticide decision-making.

The overall intent of this educational effort is to provide the climate needed to conduct a pesticide program that steadily progresses along a planned course of action over time, rather than one that is constantly reacting to crises and misunderstandings.

In developing both our focused informational and longer-term educational efforts, of course, we realize that the content of outreach messages also is important. Our experience in communicating the risks of EDB taught us that our messages are geared to the nation as a whole, while the public wants more personal information. Until continuing educational efforts raise the average person's level of understanding about chemical risks, a message from EPA that a pesticide poses a risk of $1 \times 10^{-6}$ will not mean much. What the listener really wants to know is, "Can I safely eat this vegetable or fruit?"

At present, then, we are keeping in mind both the need to raise the level of public understanding about chemical risks over the long term, and the need to address people's immediate, personal questions and fears about particular pesticides in the short term. Our fact sheets and press releases on daminozide, for example, try to answer anticipated questions about potential personal risks from consuming apples, apple juice, and other treated foods.

Although a high degree of scientific uncertainty may be involved, as is the case with daminozide, we can allay at least some public fears by telling people what we know in a direct, understandable way. We can explain what we are doing until more data come in, and how we and the public can manage the pesticide's potential risks.

In summary, what we want the public and the media to understand about daminozide and other pesticides is that:

- Ambiguity about pesticide risks is common and certainty is hard to come by.
- Pesticide risk issues are not simple and do not have easy solutions.
- Adequate time is needed to successfully resolve uncertainties in an open manner; no one is well-served when premature decisions are made.

***EPA must have its ducks in a row and its data in hand if we hope to prevail in a cancellation or suspension proceeding.***

- This doesn't mean that EPA waits for absolute certainty before acting; we recognize that timeliness is important and we strive for it.
- In the interim, EPA does all it can to reduce exposure to potential carcinogens and other bad actors in the food supply.

The situation surrounding daminozide is still deeply controversial, illustrating the frustrations and polarized feelings that can result when EPA strives to achieve a balance between timeliness and scientific certainty. As Assistant Administrator John Moore has noted, the really unfortunate aspect of a case like daminozide is that nobody wins, now or in the end. EPA is blamed by all sides for not acting more quickly; the public loses faith in government as its protector; environmentalists become frustrated and sue EPA; apple growers, especially small growers, face an impossible marketing problem (they need daminozide and legally may use it, but their treated fruit may be rejected in some markets); food processors are caught in the middle since the market is so disrupted; retail food stores cannot sell daminozide-treated produce or products without appearing socially irresponsible; the states feel that they must step in and set their own reduced tolerances, further disrupting the market since standards then vary from state to state; and the producer of daminozide suffers because no matter what the data ultimately show, the product's reputation has been damaged and may never completely recover.

However, the daminozide case also shows that regulating pesticides is not an all-or-nothing proposition. While EPA waits for new studies to come in, we are doing a variety of things to limit exposure to daminozide and mitigate potential risks. As a result, the pesticide can continue to be used pending a final decision because, in the interim, risks are being managed.

Daminozide illustrates EPA's commitment to an open and balanced pesticide decision making process, as rocky and painful as that process can be for everyone involved. The benefits of openness are well worth the costs, and we believe better communication will help us to realize such benefits more fully in the future.□

*(Campt is the Director of EPA's Office of Pesticide Programs.)*

# The Outlook for a New Pesticides Law

by Rep. George Brown

*Congressman George E. Brown, Jr.*

The start of the 100th Congress brings with it a list of unfinished legislative business, including attempts to rewrite the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This statute, which authorizes the pesticide regulatory program at the Environmental Protection Agency, has not had major amendments made to it since 1978, although Congress has made numerous attempts to revise it since then. The latest attempt was made last year but failed as a major reform package died in the final hours of the 99th Congress. Given the work which went into this last effort, it is almost certain that another attempt will be made during this Congress, although the chances of success this time are up in the air.

As Chairman of the House Agriculture subcommittee on Department Operations, Research, and Foreign Agriculture, the subcommittee with responsibility for the pesticide program at EPA, I have been involved in many of the past efforts to amend FIFRA. Over time I have seen this statute become the subject of increasing attention and public concern, leading to an increasingly complex and intractable legislative situation.

When, as subcommittee chairman in 1981, I was first involved in the effort to amend FIFRA, we took on the task of negotiating between the various interest groups ourselves. This task lasted well into 1982, when the negotiated bill passed the House but died in the Senate. We initiated negotiations again in 1983, in the 98th Congress, but quickly ran up against a wide range of interest groups, still angered by the disappointing failure to enact amendments in 1982, who were unwilling to negotiate further. At that point, I made the decision that the subcommittee would not consider further amendments until the interested parties were willing to work out compromises on their own.

In 1985, the environmental groups successfully held up consideration of legislation important to the agricultural chemical industry. At that point it became apparent that each side could stop legislation important to the other, but neither side could make any progress unless a negotiated agreement was reached on the major unresolved FIFRA issues. As a result, the environmental community and the major agricultural chemical producers began protracted negotiations, outside of Congress, which eventually produced a compromise which became the core of the bill considered in the 99th Congress.

After thousands of hours of work, a tenuous agreement was reached on legislation which, in various forms, passed the House three times and the Senate once, but was finally killed on issues tangential to the central environmental focus within FIFRA. Now, in 1987, we are faced with the task of rebuilding that fragile agreement.

The major issues before us remain the same. There is great public concern about the adequacy of the health and safety data being used to support the registrations of many pesticides. There is growing concern about the contamination of ground water by pesticides and other agricultural chemicals. There is a growing realization of the inadequacy of the resources at EPA's disposal to complete the work before it in a timely manner. In addition, there are concerns about just compensation of one company for the use of another's data, concerns about states' powers to regulate pesticides and pesticide residues, concerns about pesticide applicator training, and a host of other issues.

With the issues remaining the same and with a major agreement having passed both Houses of Congress only a few months ago, it would seem likely that an early legislative solution could build upon last year's near success. Early plans are for the House Agriculture Committee to start where it left off last year and work to pass a bill that embraces most of the core agreements from the 99th Congress. It is uncertain whether a bill like this will move or, if it does, how far it will move, since some of the interest groups involved last time have shifted their agendas. One change from the last Congress which might improve chances for legislation this year, however, is the Senate Agriculture Committee's desire to act early on FIFRA legislation. But, unless the interest groups are willing to stay with the agreement of last year, or work to fashion a new one this year, the chances of early legislative action on FIFRA in 1987 are dim. The subcommittee has spent an inordinate amount of time on this issue over the last six years and is acutely aware of the futility of negotiations between uninterested parties. We will await an agreement by the interest groups or the

passage of a Senate bill, but we will not force negotiations on anyone. If an effort toward agreement does not emerge early in the 100th Congress, the subcommittee will examine pesticides issues, such as ground-water quality, pesticide resistance, and integrated pest management, but outside of the framework of legislative changes.

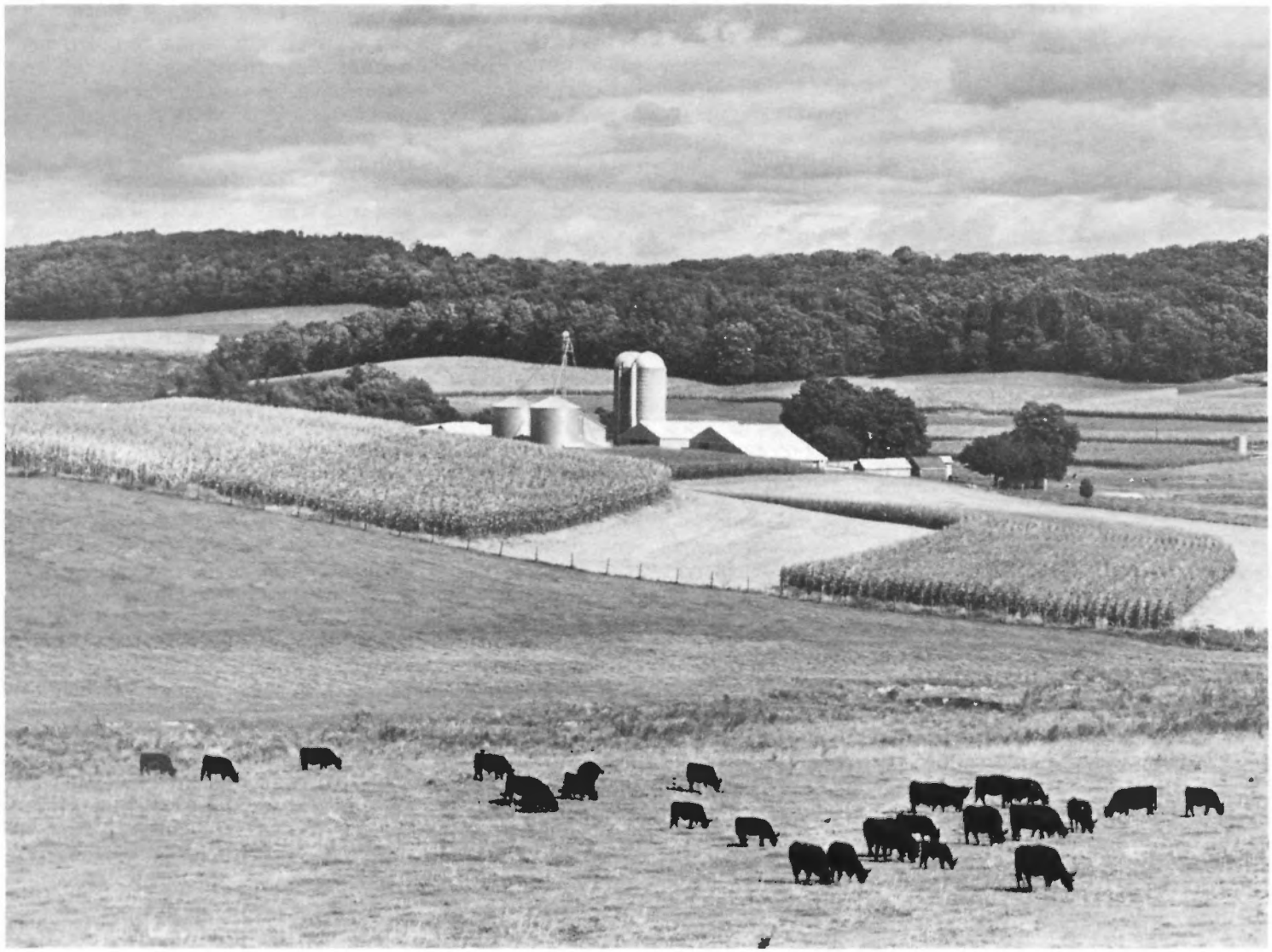
What happens if we are unable to amend FIFRA and deal with the public concern? Without legislation at the federal level, we will see an increase in the role of the states in this area. Following the EDB emergency, the states were forced onto the front lines of pesticide regulatory activity. With inadequate EPA resources, and growing public concern, the states have grown resigned to their increased responsibility and many states have started expanding their regulatory programs. Some states have even gone further and have begun to regulate some pesticides and some pesticide uses more stringently than the federal EPA. This, however, is a piecemeal approach which is less satisfactory than improvements at the federal level.

Our inability to amend FIFRA also places EPA in a shrinking box, as it is forced to deal with growing public concern without clear, updated mandates and improved resources. While EPA can accomplish many of the tasks facing it under current authority, clarifying its authorities and procedures will save time and resources, both of which are essential commodities in the effort to restore public confidence.

The resource limitations are especially important to the restoration of public trust, since resources, or the lack of them, can affect the Agency's ability to act on a problem. While resource considerations should be made in any Agency decision, delaying or adjusting EPA pesticide program decisions for resource reasons during this period of heightened public concern can have damaging results.

It is my hope, and the hope of the other House Agriculture Committee members, that we will see early action on a set of FIFRA amendments in 1987. Without this action, public confidence will continue to erode, pesticide regulation will be increasingly Balkanized, and EPA will be under increasing pressure to do more with less, affecting the quality of its operations. It is in everyone's interest to work cooperatively on a legislative agenda this year. □

*(Congressman Brown, D-CA, is Chairman of the Subcommittee on Department Operations, Research, and Foreign Agriculture of the U.S. House Agriculture Committee.)*



*A Wisconsin dairy farm demonstrates the manifold uses of pesticides in agriculture for such things as oats, alfalfa, and grazing land.*

U S Department of Agriculture

# Managing Pesticides: An Environmentalist View

by Lawrie Mott

EPA Administrator Lee Thomas has ranked pesticides as one of the most urgent problems facing the Agency. Recently, EPA completed an Agency-wide analysis of its across-the-board efforts to protect public health and the environment. The report concluded that preventing pesticide residues in food and other pesticide risks such as contamination of drinking water ranked relatively high among the Agency efforts, while pesticide contamination of water and air are areas of relatively high risk but low EPA effort.

By definition, pesticides are toxic chemicals—designed to kill insects, weeds, fungi, and other pests. Some have also been found to cause cancer, birth defects, and other health hazards. But the overwhelming majority of these chemicals have never been completely tested for their health effects. As Steven Schatzow, the former director of EPA's pesticide program, explained, "Pesticides dwarf the other environmental risks the Agency deals with. The risks from pesticides are so much greater because of the exposures involved. Toxic waste dumps affect a few thousand people who live around them. But virtually everyone is exposed to pesticides."

Since the 1940s, pesticide use has increased tenfold. Last year alone, 2.6 billion pounds of pesticides were sold in the United States. As a result of this extensive use, our food, drinking water, and environment now contain pesticide residues. In fact, nearly all Americans have residues of the pesticides DDT, chlordane, heptachlor, aldrin, and dieldrin in their bodies—though all have been banned.

Ground water is the source of drinking water for 97 percent of rural Americans and 50 percent of all Americans; yet according to a 1986 EPA report, 17 pesticides, some of which cause cancer and other harmful effects, have been found in ground water in at least 23 states. In California alone, 57 different pesticides have been detected in more than 200 wells across the state. Further, as EPA and individual states initiate routine ground-water monitoring, the number of pesticides detected is expected to increase. Last fall, a poll in Iowa found that about half of the adult population identified farm chemicals as the biggest threat to their drinking water, and three out of four Iowa adults favor limits on the use of farm chemicals.

The extent of contamination of our food is unknown. Between 1982 and 1985, the federal Food and Drug Administration (FDA) detected pesticide residues in 48 percent of the types of fresh fruits and vegetables consumed most frequently. (Under federal law, EPA sets allowable residue levels for certain pesticides.) This figure understates the actual presence of pesticides in these foods because about half of the pesticides applied to food cannot be readily detected by FDA's laboratories. (EPA has identified 47 carcinogenic pesticides that are registered for use on food.) Indeed, the GAO also revealed that EPA has generally taken two to six years to complete special review of chemicals that may pose significant health or environmental risks—even though these reviews are supposed to be conducted rapidly.

In 1983 and 1984, for example, dangerous levels of the cancer-causing pesticide EDB detected in grain supplies, citrus, and other foods received public attention. In the summer of 1985, nearly 1,000 people in several western states were poisoned by residues of the pesticide Temik in watermelons. During 1986, there was increasing public concern over the use of the cancer-causing plant growth regulator Alar, used primarily to make the apple harvest easier and to make the fruit redder, but resulting in residues in both apple juice and applesauce; the outcry led many food manufacturers to announce they would no longer accept Alar-treated apples. Also in 1968, milk from approximately 40 dairy farms in Arkansas was quarantined because of contamination by the banned pesticide heptachlor. Some milk contained heptachlor in amounts as much as seven times the acceptable level. Given these incidents, it is no surprise that three out of four consumers consider pesticides in food a serious hazard, according to a survey by the Food Marketing Institute.

In spite of the continued and routine use of pesticides, we have only a very limited understanding of the cumulative effect of this widespread chronic exposure. Some of the only examples of health effects in humans now available involve farmers and fieldworkers. In California, farmworkers have the highest rate of occupational illness, yet only one to two percent of pesticide poisonings in farmworkers are estimated to be reported. A National Cancer Institute study last year found that farmers exposed to herbicides had a risk six times greater than nonfarmers of contracting one form of cancer. Other studies have shown similar results, with farmers in Nebraska and Iowa exposed to pesticides having an increased risk of developing cancer.

Another serious consequence of the long term and increasing use of pesticides is that the targeted species are becoming resistant to these chemicals. The typical solution to this problem is to apply more pesticides which in turn can increase the pest's resistance. Between 1970 and 1980, for example, the number of insects resistant to insecticides nearly doubled.

Why are pesticides becoming a greater health hazard as the above examples indicate? The primary cause is an inadequate federal regulatory program that stems from insufficient resources and a fundamentally flawed federal

***The weaknesses in the federal pesticide regulatory programs arise primarily from fundamental flaws in the pesticide law itself.***

pesticide law. Since the mid-1970s, an unbroken litany of congressional, GAO, and other reports have detailed the failures of EPA and FDA efforts to protect the public and the environment from pesticides. The most recent GAO reports contain the same criticisms repeatedly raised in the past. For example, in 1972 Congress directed EPA to reevaluate the safety of the approximately 600 older chemicals licensed for use before the current requirements for health effects testing were enacted.

This process of reregistration theoretically would have consisted of identifying the gaps in the necessary health and safety data and requiring pesticide manufacturers to submit the studies. According to GAO, by the spring of 1986, EPA still had not completed a final safety reassessment for a single chemical. At this pace, reregistration will extend past the year 2000. In the meantime, these chemicals continue to be used, resulting in residues in our food, water, work places, and homes. GAO also criticized the Agency's failure to regulate inert ingredients in pesticide products. Although these chemicals may be inert against pests, some are toxic in their own right and the majority are completely untested for their hazards.

FDA's pesticide program is also plagued by problems. GAO's investigation expanded on earlier criticisms. The routine laboratory methods used by FDA to identify pesticides can detect only about half the chemicals registered for use on food. Furthermore, FDA has acknowledged that 40 percent of the pesticides classified as moderate-to-high health hazards cannot be detected by any of the routine methods. Perhaps even more astonishing is GAO's disclosure that FDA laboratories, on average, took 28 calendar days to complete sample analysis and processing. In other words, in the time FDA took to check for illegal pesticide residues, most food would have been sold and consumed.

The weaknesses in the federal pesticide regulatory programs arise primarily from fundamental flaws in the pesticide law itself. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) allows EPA to leave inadequately tested pesticides on the market, permits EPA to license new chemicals without full health and safety data, and allows EPA unlimited time to remove dangerous chemicals from the market. Reform of FIFRA is long overdue and essential in order to strengthen EPA's pesticide program.

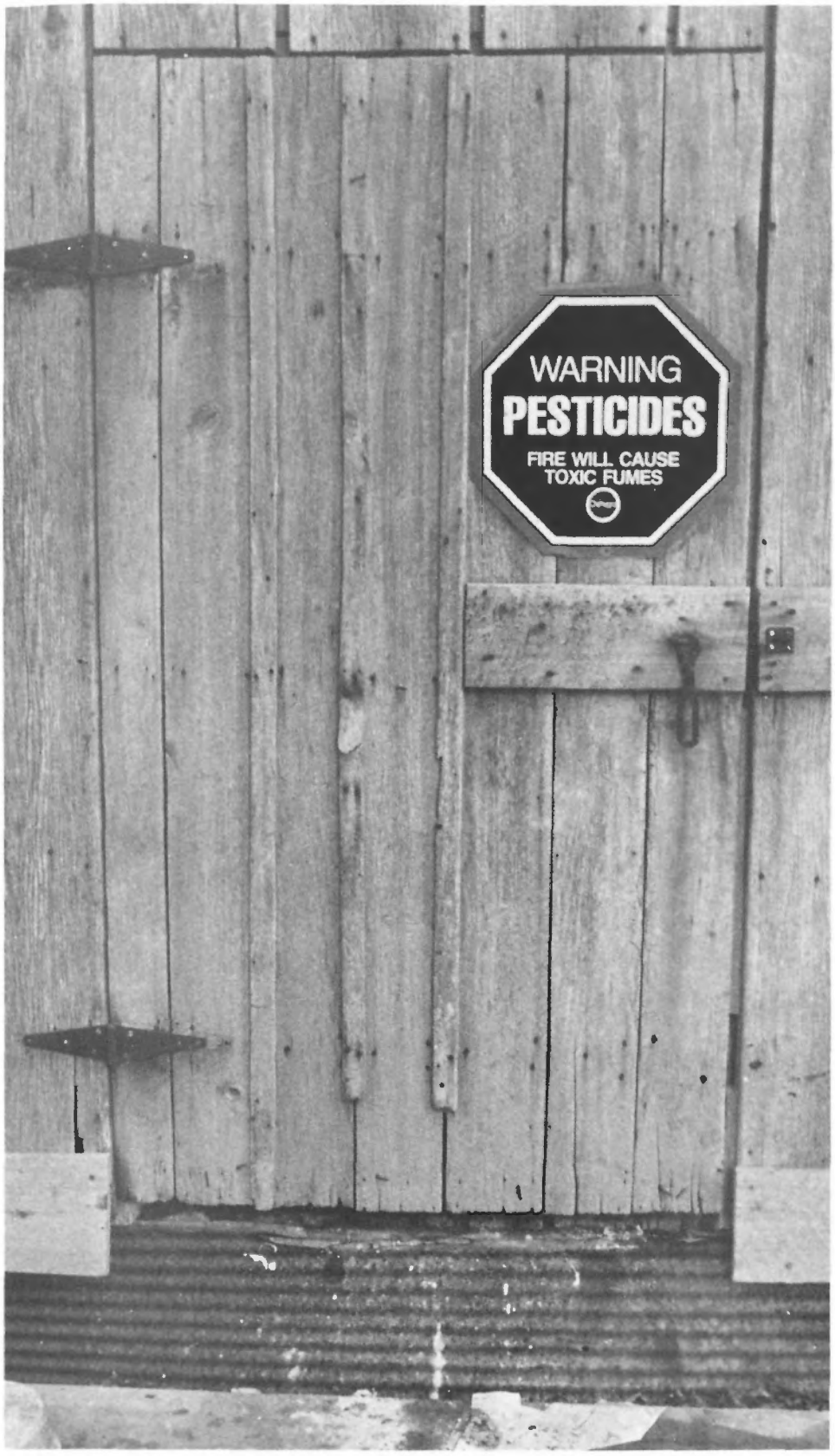
Last year's Congress came close to passing a FIFRA reform bill after a 10-year impasse. Some key elements of that legislation were to require full health and safety testing of all older pesticides on a rapid mandatory schedule, to fund EPA's reregistration program through fees from pesticide manufacturers, to expedite EPA's process for removing dangerous chemicals from use, to create a program to protect ground water from pesticide contamination, and to improve protection of workers from pesticides. These amendments were not enacted—despite support from the environmental, labor, and consumer communities and the pesticide manufacturers—largely because of efforts by the nation's food companies and agricultural interests to preempt state regulation of pesticides in food and alter the liability of pesticide users and manufacturers for damages caused by these chemicals.

With the new 100th Congress, the chance to finish the job and enact comprehensive FIFRA reform legislation has improved significantly. While not a panacea, last year's proposed legislation is a good starting point. Building on last year's efforts, this Congress has the opportunity to pass even stronger legislation than last year's bill. But if such reform is to occur, it is critical that the narrow-minded efforts of the food industry and farm block to use FIFRA to preempt the states or escape liability under other laws be decisively turned aside. Only then, finally, will protection of the public from these highly dangerous chemicals become a reality.

If Congress again fails to eliminate the loopholes that cripple FIFRA, individual states will act. Laws such as California's Proposition 65, or Safe Drinking Water Initiative, that would prohibit the discharge of carcinogens or reproductive toxins into drinking water, California's Birth Defects Prevention Act that requires health and safety testing for pesticides on a rapid schedule, or Arizona's and Wisconsin's comprehensive ground-water legislation to prevent pesticide contamination may become more common. And even if state legislatures do not pass new laws, state agencies may be forced to restrict, or possibly ban, individual chemicals due to EPA's inadequate controls.

The burden for protecting the public from pesticides is not entirely determined by FIFRA, nor does it rest exclusively on government agencies. Growers should always attempt to use the minimum amount of pesticides necessary. Food companies should take independent steps to reassure consumers about the safety of their products. One excellent example is the Heinz Company's announcement that food treated with any pesticide in EPA's special review process will not be used to manufacture baby food.

Pesticide manufacturers should be submitting to EPA all required health and safety data as rapidly as possible. The companies need not wait for notification from EPA to begin the process of filling data gaps. It is simply unacceptable to continue use of




Steve Delaney

*No part of our world is immune from the effects of pesticides. Here a building could threaten the health of a whole community if its contents were to go up in smoke.*

pesticides without full knowledge of the health effects of these substances. Manufacturers should also provide EPA and FDA with *practical* analytical methods for detecting their products, e.g., methods that can be conducted with existing FDA equipment, completed within eight hours, and at costs no greater than those typically incurred now. Pesticides should not be used on food if the government agencies do not have the analytical capability to enforce the tolerance and protect the public.

The next decade will be an era of major transition for pesticides. As the older chemicals are tested, it is inevitable that many will be removed from use, either through EPA actions or voluntary withdrawals by the manufacturers. This change will create three major challenges for society. First, agriculture must be restructured to reduce reliance on chemical pesticides drastically. Methods to control pests without chemicals are now available, but they must be expanded and disseminated to growers more effectively. Second, because we cannot entirely eliminate pesticides, manufacturers must develop new products that are toxicologically safe, effective in much smaller amounts, and do not migrate in the environment. Finally, society as a whole, and EPA in particular, must view pesticides with a new perspective. For the sake of our public health and environment, we cannot continue to use vast quantities of pesticides.

The most rigorous testing systems now available for predicting the health hazards of pesticides do not address threats such as immunotoxicity or synergism. In the future, scientists will discover new hazards posed by pesticides applied to increase the yields of surplus commodities or improve the cosmetic appearance of fruits or vegetables. Perhaps consumers would even be willing to pay marginally higher food prices in return for lower pesticide residues. □

*(Mott is a senior staff scientist with the Natural Resources Defense Council, working on pesticide issues, with a master of science degree from Yale University in molecular biochemistry.)*

# Managing Pesticides: An Industry View

by Robert L. Harness

For many reasons, and not all of them valid, the public continues to be concerned about the risks of pesticides. That concern increases the pressure upon industry, and indeed, has an enormous impact on industrial research and development. That concern has also increased the pressure upon EPA, which faces heightened demands for ever tighter and more restrictive regulation, even if it may not be necessary or effective.

This public concern is one reason why pesticide regulation is often portrayed as an adversarial battle—sometimes between industrial and environmental organizations, and sometimes between EPA and the environmentalists. Lost in the accusatory rhetoric is one simple fact: it is in the best interests of the public, and the pesticide industry, to have a strong, credible federal agency that registers pesticide products for use.

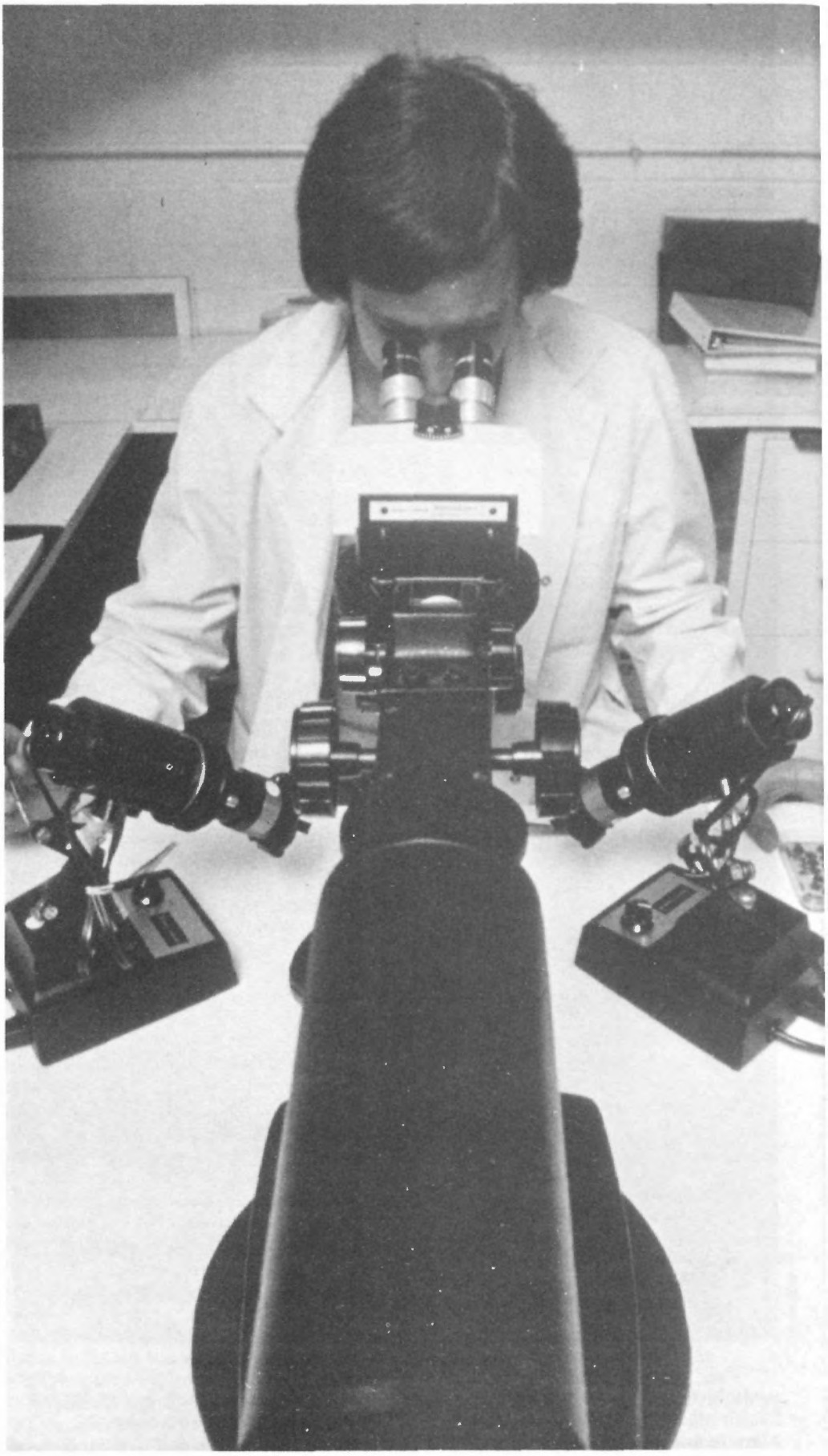
Put another way, the pesticide industry needs a strong, credible EPA. If we are to be allowed the freedom to operate and conduct business and to be able to compete in a highly regulated environment, we in industry must have an effective EPA.

The questions for all of us in industry are, therefore, what are the factors that result in a strong EPA, and what are industry's role and responsibilities?

## Independent Assessments

One factor is so obvious that it's often overlooked; we need an EPA that makes independent judgments. With its responsibility for pesticide regulation, EPA must not, and cannot, represent any single interest.

As EPA Administrator Lee Thomas has pointed out, "EPA is not so much a coherent national program to manage pollution as it is a reflection of the success that many independent interests have had in getting their positions established in the law. Carried to the



Monsanto Agricultural Company

extreme, the success of these interests could burden EPA with a set of mandates so vast that no resource base within the realm of economic reason could possibly carry them all out."

This is almost stereotypically true for pesticide regulation. The very heart of the EPA role is the language of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which states that a pesticide can be registered for use if "it will not cause unreasonable adverse effects on the environment." What constitutes an "unreasonable adverse effect," of course, can differ widely in interpretation. EPA must remain independent of all "special interests," to make a reasoned, scientific judgment of adverse effects, risks, and benefits. That does not mean the Agency regulates pesticides in isolation from companies, environmental groups, the news media or any other interest; but it does mean that no one interest can be allowed to dominate EPA's deliberations.

## Scientific Assessments

Of equal importance is that these assessments must make use of the best available science, scientific experience, and scientific expertise.

To regulate pesticides effectively, EPA must consistently follow clear guidelines. This is especially crucial for industry, which needs clear guidelines to conduct the battery of tests required by EPA for a particular registration. The problem is that scientific and technological advances can make the criteria used to formulate guidelines quickly obsolete.

Thus, a balance must be maintained between evolutionary guidelines and clear, consistent standards. This balance can only be achieved by relying upon the judgment of experienced scientists. The EPA often achieves this balance by using scientific advisory panels and peer review boards. In fact, the use of outside scientists can also enhance EPA's need for independence.

The need for science is critical to the assessment of risks and benefits for a particular product. No pesticide product, and no aspect of life itself, is totally without risk. Any regulatory decision must be based on a fair assessment of the science and risk involved, including important assumptions and uncertainties. Risk assessment is not an exact discipline, and subjective judgment plays a major role. If the assessment of risk and subsequent EPA regulatory decision are to be fair and reasoned, it is vital for the Agency to seek and rely upon the expert opinions of independent scientists.

*Reviewing results at Monsanto's environmental health laboratory in St. Louis, MO, of tests for effects of Monsanto pesticide products. Work supports safety and toxicological studies that the company does to satisfy EPA registration requirements.*

## Communicating to the Public

A third factor that helps maintain a strong, credible EPA is communications with the public. This is the area that is, perhaps, the most difficult to achieve, particularly on an ongoing, regular basis.

As already noted, the public is concerned about pesticides. This is nothing new, and this concern has been with us so long as to form part of the environment in which both industry and EPA operate. Often, new analytical technology makes the job of communication even more difficult.

For example, our ability to detect materials in the environment at increasingly smaller traces—parts per billion, parts per trillion, and smaller—has vastly exceeded our ability to understand and manage what those traces mean. And communicating the scientific concepts through a lay press to a lay public is a challenge for both industry and government. In any area of controversy or disagreement, it is natural to judge an issue in terms of absolutes such as good or bad, beneficial or harmful. And it is certainly easier for the news media to report in terms of such absolutes as safe or unsafe, contaminant or non-contaminant, carcinogen or noncarcinogen. Nevertheless, industry, EPA, academic scientists, and even environmental groups understand that it is extremely rare for any pesticide issue to be considered solely in these absolute, simplistic terms.

The nature of the news media creates serious pressures on EPA. Will the public gain confidence in a regulatory agency because it takes a firm stand, or lose confidence because the regulator chooses a less conclusive option, such as calling for more or better information? How does a regulator go about communicating the risks and benefits behind a particular decision without either frightening the public or minimizing the issue? The answers EPA provides to these kinds of questions can create or destroy the Agency's credibility.

## The Challenge for Industry

I believe that the pesticide industry and EPA have essentially the same "agenda": providing pesticide products that are environmentally sound and of economic value to society.

Industry must understand that it is EPA's job to determine a product's risks and benefits, and to determine the balance between risks and benefits. EPA must do this independently. The Agency can, and usually does, call upon a company for particular kinds of information, reports of experiences in field trials, clarifications of information submitted to the Agency, and the like. A company can offer its opinion, backed up by scientific judgment. But only EPA can make the decision.

And it is not enough for a company to conduct the required tests and submit data; the data provided must be of the highest possible quality. We should consider EPA guidelines to be the minimum expected, and help the Agency in its deliberations by providing information that goes beyond the basic regulatory requirements.

In this regard, some companies have been pushing at the very frontiers of regulatory science. When significant questions arise, scientific exploration can provide important and useful insights.

## The Challenge to EPA

In this complex, science-based process of pesticide regulation, EPA must overcome the conflicting demands of various interest groups. An independent EPA, drawing upon the judgment of expert scientists, is the best assurance we can all have of safe, beneficial products.

Reliance upon quality science is the best way for EPA to resolve legitimate disputes, particularly in the "gray areas" between clearly safe and clearly unsafe products. The burden falls on the regulators to weigh opposing arguments and decide on the best course of action.

Public understanding of, and confidence in, EPA's role has increased over the last several years. It will continue to increase as long as the Agency continues to make responsible, science-based decisions. □

*(Harness is Vice President for Environmental and Public Affairs at the Monsanto Agricultural Company, a manufacturer of pesticide products.)*

# Pesticides and the Nation's Ground Water

by Bob Barles
and Jerry Kotas

Contamination of ground water and drinking water by agricultural chemicals has become an issue of increasing concern across the country. In an Iowa poll last October, over half the adults surveyed identified farm chemicals as the biggest threat to the water they drink. In Florida, more than a thousand wells have been shut down as drinking water sources because of contamination with ethylene dibromide (EDB), a potential carcinogen. And in 1986, EPA estimated that at least 17 pesticides have been found in the wells of 23 states.

The factors that contribute to ground-water contamination by pesticides and fertilizers are complex and not yet well understood, but clearly there is concern. Our dependence on ground water for all uses is significant. It currently provides 40 percent of the irrigation water used in the United States, and drinking water for about 50 percent of the U.S. population. In rural areas, it accounts for as much as 95 percent of water used for domestic purposes. It is important to identify and prevent sources of ground-water contamination because of our reliance on it and because cleaning up ground water is enormously expensive and, in some cases, even impossible.

Until recently, ground water was generally thought to be protected from contamination by impervious layers of subsoil, rock, and clay, and also by the soil's own degradation processes. Challenging this long-held belief was the discovery of the pesticide dibromochloropropane (DBCP) in about 2,500 California wells and in the ground water of four other states as well. In 1979, the pesticide Aldicarb was found in wells on Long Island and subsequently in Wisconsin and 11 other states. The discovery of EDB-contaminated wells in California, Georgia, and other states in 1982 and 1983 raised concerns to new levels.

A particularly disturbing realization is that one of the major sources of such contamination may be the normal, approved use of agricultural chemicals. Applied to the land, pesticides can get into ground water through rain, runoff, infiltration, and snowmelt. Other sources include accidental spills or leaks, improper disposal, and misuse or overuse.

The combined effects on the environment from these multiple sources of contamination can be serious. In the San Joaquin Valley in California, for example, it has been estimated that DBCP is present in approximately one quarter of the usable ground water, some 30 million acre feet. From a health perspective, the pervasiveness, toxicity, and persistence of many pesticides in the environment are of concern. A number of pesticides, if present in sufficiently high concentrations, are known or suspected to cause a variety of adverse health effects, ranging from eye and skin irritation to cancer.

In response to growing public concern about the health and environmental implications of chemicals contaminating ground water, EPA issued a Ground-Water Protection Strategy in 1984; more recently, the Agency began developing a more focused effort on pesticides and fertilizers, referred to as the Agricultural Chemicals in Ground Water Strategy. The aim of this strategy is to compile available information on the extent and nature of the problem; to spur additional, coordinated research on areas of highest priority; to examine options available to EPA, in coordination with other governmental and private organizations, to solve the problems; and finally, to specify goals and an implementation plan to address the issues.

EPA expects to circulate a draft strategy soon for public comment and review by the states and in workshops around the country. The cornerstone of the strategy is prevention. Because cleanup of contaminated ground water is extremely costly, especially for large areas, prevention of contamination is critical.

The chief difficulty in designing a prevention strategy is the enormous variety of conditions across the country. The vulnerability of ground water to contamination may vary widely even within a single county; moreover, individual wells drawing on the same ground water can have varying degrees of vulnerability to contamination depending on their depth and construction. Furthermore, in some areas ground water is an irreplaceable source of drinking water, while in others it is unusable due to such factors as high salinity or low yields. Given these large variations, a uniform national approach is unlikely to be successful. Instead, EPA is considering ways to approach the problem more locally and is looking at various options for appropriate federal/state roles in protecting ground-water quality.

The concern for ground-water protection has led a number of states, including California, Florida, Maryland, Minnesota, Iowa, New York, Washington, and Wisconsin, to mount major efforts to address the problem. In some cases, these states are passing laws to better manage the use of farm chemicals. An increasing number of states are also monitoring ground water to determine the extent of contamination. These state monitoring efforts have been very useful to EPA as well as the states in helping to identify pesticides that need to be better

***Applied to the land, pesticides can get into ground water through rain, runoff, infiltration, and snowmelt.***

managed so as to prevent ground-water contamination.

EPA is also taking steps to deal with immediate problems and to provide adequate, nationwide data on the extent of ground-water contamination. For the short term, EPA is using the pesticide registration/reregistration process to address ground-water issues. During the past few years, for example, EPA has rejected several proposed new pesticides and new outdoor uses due to concerns about the potential for ground-water contamination. Pesticides such as EDB and DBCP have been banned outright. EPA has also recently required companies to conduct additional studies to determine the leaching potential of certain conditionally registered products or uses.

Looking further ahead, EPA is conducting a nationwide survey of pesticides in drinking water wells in order to provide the first national picture of the extent of agricultural chemicals in drinking water wells. This three-year survey will analyze samples from approximately 1,500 drinking water wells across the country, including about 750 domestic wells in largely rural areas and about 500 community wells.

The pilot study for this survey began this March in three states—California, Minnesota, and Mississippi—and is intended to test major components of the full survey. Shortly after completion of the pilot study in September 1987, the full national survey will begin. This will be a representative sample of the more than 13 million domestic wells in the United States, as well as some 55,000 community water systems.

Results from the National Pesticide Survey will provide the first accurate, statistical estimates of the extent of pesticide contamination of drinking water wells. The results are also expected to improve our understanding of the relationships between pesticide contamination, pesticide usage patterns, and the vulnerability of ground water to pollution in different areas of the country.

*The first ground water sample is collected in Terry, MI, for the National Pesticide Survey. Mississippi is one of three states in the pilot test that includes Minnesota and California. By the end of 1987, every state is expected to have been surveyed for ground water contamination from pesticides.*

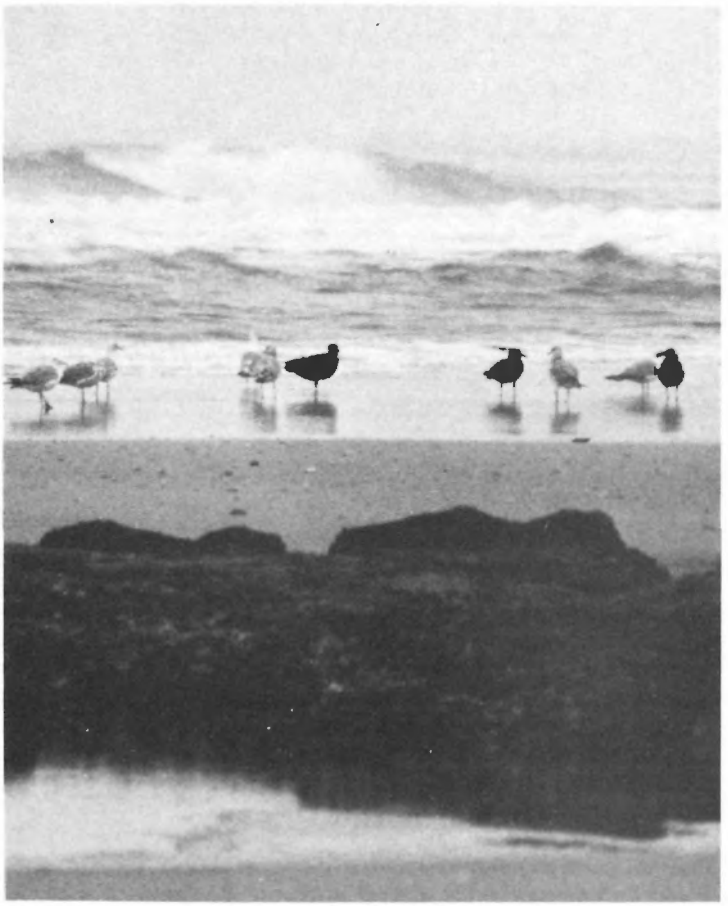
In the meantime, preparations for the survey have already begun to yield valuable information and practical tools. In preparation for the survey, EPA has:

- Identified 70 pesticides with the greatest potential for leaching into ground water.
- Developed five multi-residue analytic methods to detect these 70 pesticides as well as 50 others.
- Proceeded with the development of health advisories for the 70 priority pesticides. These health advisories will help well owners, operators, and the general public evaluate the results of well sampling, and determine whether detected contamination levels require further action.

Through its survey and protection strategy, EPA is moving ahead in a coherent and consistent manner to meet its fundamental federal responsibility for protecting ground water. The site-specific nature of the ground-water problem dictates that the states play a major role in managing this problem, too. Together, EPA and the states can begin to give ground water the same strong protection that has been provided to other vital natural resources. □

*(Barles is a special assistant to EPA's Assistant Administrator for Pesticides and Toxic Substances and Kotas is the Director of the National Pesticides Survey being conducted jointly by the Agency's Office of Drinking Water and Office of Pesticide Programs. This article was written with the assistance of Gilah Langner, a private consultant on pesticide issues.)*

# Unfinished Business in Protecting the Environment



*This is an EPA Journal forum with observers outside of EPA commenting on a recent Agency report that compared the risks posed by the various environmental problems EPA is charged with addressing. The title of the report is: "Unfinished Business: A Comparative Assessment of Environmental Problems." The purpose of the report was to give the Agency an additional tool in setting its priorities. The article by Richard Morgenstern, Director of the EPA Office of Policy Analysis, explains the report and its findings and then the commentaries follow.*

*Those commenting include persons from Capitol Hill, the environmental community, and industry. First is Philip T. Cummings, Counsel for the U.S. Senate Environment and Public Committee, which handles much of the legislation affecting EPA's responsibilities. Second is William A. Butler, until recently Director and General Counsel for the National Audubon Society's Washington, D.C., office and now in private law practice. Third is Khris L. Hall, Program Manager for Government Programs for the IBM Corporation.*

## Richard D. Morgenstern

The fundamental mission of the Environmental Protection Agency is to reduce risks—to health, ecosystems, and welfare. When EPA was established in 1970, Congress gave the Agency some specific responsibilities based on the most visible polluters and pollutants: soot and smoke from motor vehicles and smokestacks, and raw sewage and chemicals from municipal and industrial wastewater.

Substantial progress has been made on controlling these more visible problems, but much unfinished business remains. Newer issues, such as hazardous waste, toxic air emissions, indoor radon, global climatic change, and acid rain, now beg for attention alongside the old ones. It is not immediately clear which pose the greatest risks and which should be given the greatest priority by an agency that now administers nine major statutes and has programs addressing dozens of environmental problems.

Last spring, Lee Thomas commissioned a task force of career EPA officials and technical experts to carry out what became known as the "Comparative Risk Project." The objective was to develop a ranking of the relative risks associated with major environmental problems that could help EPA set priorities. "In a world of limited resources," Thomas notes, "it may be wise to give priority attention to those pollutants and problems that pose the greatest risks to our society." Until this project was launched, there had been no systematic comparison of the different risks the Agency might address.

The project team—75 senior Agency managers, staff persons and experts representing all EPA programs—worked together over a period of about nine months. Environmental problems were divided into 31 different areas, corresponding generally with existing EPA programs or statutes, and including problems such as criteria air pollutants, indoor air pollution, contaminants in drinking water, abandoned hazardous waste sites, pesticide residues on food, and worker exposures to toxic chemicals. The group evaluated each problem area according to four types of risk: cancer risks, non-cancer health risks, ecological effects, and welfare effects (such as visibility impairment and negative impacts on recreation). Since the intent of the project was to identify areas of unfinished business, the team focused on risks that remain today, and did not consider those that have been controlled under current programs.

From the outset, the project team recognized that it would be very difficult to compare risks from different environmental problems. While great amounts of information exist, data gaps, uncertainties, inconsistencies, and the lack of adequate risk assessment methodologies in some areas prevent scientifically exact analysis. The participants ultimately had to use their collective judgment to fill substantial gaps in available data, and the final report thus represents expert opinion rather than a precise quantitative analysis.

While no problems ranked high or low in every type of risk, four problems did rank high in three out of the four categories or at least medium in all four. These include: criteria air pollutants (particulates, sulfur and nitrogen oxides, carbon monoxide, ozone, and lead); depletion of the stratospheric

ozone layer; pesticide residues on foods; and "other" risks from pesticides resulting from leaching, runoff, and air deposition.

Some problems are primarily threats to human health—ranking relatively high in cancer and non-cancer health risks but low in ecological and welfare risks. These include hazardous air pollutants such as metals and organic chemicals released from industrial plants, motor vehicles, and other sources; indoor radon, a naturally occurring gas that accumulates in homes and can cause lung cancer; other indoor air pollution from sources such as tobacco smoke, unvented space heaters and gas ranges, fireplaces, and cleaning products; risks to workers from application of pesticides; exposure to consumer products such as asbestos in building materials, formaldehyde emissions from pressed wood products, and chemicals in paint and solvents; and exposure to toxic chemicals in the workplace.

Other problems are primarily threats to the environment—ranking relatively high in ecological and welfare risks, but low in both types of health risks. These include global warming caused by the buildup of heat-absorbing carbon dioxide in the atmosphere; point and non-point sources of surface water pollution from industrial and municipal wastewater discharge, and runoff from urban areas and farms; physical alteration of aquatic habitats, including estuaries and wetlands; and mining wastes such as sediment and acid mine drainage.

In some respects, these rankings by risk do not correspond closely with EPA's current program priorities. Areas of relatively high risk, but low EPA effort include indoor radon; indoor air pollution; stratospheric ozone depletion; global warming; discharges to estuaries, coastal waters, and oceans; other pesticide risks; accidental releases of toxics; consumer products; and worker exposures. Areas of high EPA effort but relatively low or medium risks include RCRA sites, Superfund, and underground storage tanks.

This divergence between what we found in terms of relative risk and EPA's priorities can be explained by several factors. In some high-risk areas, such as indoor air pollution, indoor radon, and global warming, EPA has no clear statutory authority to address the problem. In others, such as consumer products and worker exposures, EPA shares jurisdiction with other federal agencies. And some problems, such as drinking water contamination and surface water pollution from point sources, appear to pose lower risks precisely because high levels of program effort have been devoted to controlling them. These high levels of attention may remain necessary in order to hold risks to current levels.

Overall, EPA's priorities appear more closely aligned with public opinion than with estimated risks, which is not surprising in light of the fact that the public, through Congress, dictates EPA's agenda. Recent national polling data show that the public is most concerned about chemical waste disposal, water pollution, chemical plant accidents, and air pollution. They are relatively less concerned about indoor air pollution, consumer products, and global warming.

While many other factors besides risk must be considered in setting priorities, and the results of this project cannot alone set EPA's agenda, this project has stimulated discussion among policy makers and the public on what EPA's priorities should be. It is to further this dialogue that the *EPA Journal* asked these outside observers for their thoughts on the report.

*(Morgenstern was the coordinator of the Comparative Risk Project at EPA. Other project leaders included Don R. Clay, Deputy Assistant Administrator for Air and Radiation; Marcia E. Williams, Director, Office of Solid Waste; Rebecca W. Hanmer, Deputy Assistant Administrator for Water; and Gerald A. Emison, Director, Office of Air Quality Planning and Standards.)*

## Philip T. Cummings

The Agency's recent report on its Comparative Risk Project, describes a provocative exercise. For the first time, EPA is taking a look across the various media with which it deals, and evaluating how its programs are matching up to the need.

Steve Delaney

While it is valuable for the Agency to review the relative importance of its many objectives, however, we must keep in mind the limitations of this particular evaluation. Some have drawn the conclusion that this report shows that the Agency (and, by inference, the Congress) is investing its resources in the wrong problems. This inference apparently comes from the report's statements that EPA's largest programs (e.g. Superfund) are aimed at problems this analysis does not include in the top rank of "risk."

I want to make several observations about the way political systems (including Congress and EPA) make decisions on the allocation of resources for environmental problems. In addition, these comments will underscore several of the caveats noted in the report itself.

First, the EPA report is aptly named "Unfinished Business." The issues that the EPA report ranks highly for "risk" are exactly the concerns that occupy the legislative agenda for the 100th Congress. The number one environmental priority in the Senate, for example, is to amend the Clean Air Act so as to hasten attainment of the health-projective standards for criteria pollutants. Much time has already been spent this year on legislation to reduce the threat to health and the environment from depletion of stratospheric ozone. Reform of the pesticide laws to improve protection against dangerous residues on food and contamination of ground water is another major objective. And legislation helping EPA and the states respond to the threat posed by radon is likely to be passed early in the session.

Even if the methodology used in the EPA project were an accurate way of assessing "risk," however, other factors besides risk may come into play in deciding what environmental legislation to pass, what problems to address, and what funds to authorize or appropriate. The consideration of legislation, particularly of reauthorization bills, necessarily runs in cycles. The capacity of specific committees, or of the Congress as a whole, to deal with environmental

legislation is limited. When the authorization for a major program such as Superfund expires, and legislation must be enacted for the program to continue, there is little Congressional attention to spare for other issues.

Moreover, program size cannot be equated with relative "risk" or even the level of importance Congress attaches to the problem addressed. Often, size and resources devoted are a function of the strategy chosen. A site-by-site cleanup or treatment construction effort, like the Superfund or sewage treatment programs, will always involve more expense to the government than a regulatory program.

Sometimes the greatest determinant of legislative attention and funding is a legislative corollary to Newton's Third Law—bills in motion keep on moving, while issues that are stalemated stay at rest. Consensus on what should or can be done to address an environmental concern dramatically lifts its legislative priority. Hard issues stay down the agenda, even if the perceived "risk" is great.

The method of analysis used by the EPA project makes the comparative risk assessments somewhat unreliable as well. One point often overlooked by those outside the Agency is that the project examined only the risks from problems to which the Agency is *already* devoting attention. That is, it only compared problems considered serious enough to have programs already undertaken by EPA. There is no measure of absolute or objective risk here, only a comparison among serious concerns.

Neither are all the areas evaluated of the same size or breadth. The further a problem is subdivided, the lower its elements rank in comparative risk. And obviously, health "risks" and environmental "risks" and welfare "risks" cannot be measured by the same currency, making their combination on a total comparative scale impossible. As the Agency itself notes, data gaps and uncertainties make the assessment process one of informed opinion, not quantitative analysis.

An example is the flawed process of evaluating "risk" to health. The project's overemphasis on exposure systematically understates the environmental danger of ground-water contamination, which shows up in several categories (Superfund, hazardous waste regulation, storage tanks, and municipal dumps). Such a methodology flies in the face of the average citizen's perception of environmental risk. I have been a persistent critic of EPA's use of risk assessment, in part because the process suggests a degree of scientific exactness, when in fact the outcome is determined by the manipulation of pre-disposing assumptions. This forum is not the place for extending that criticism, however, and I prefer to appreciate the Comparative Risk Project for the preliminary contribution that it has made.

Just as the Project report is labeled "Unfinished Business," I believe the analytical work is also unfinished. This project would be most useful as a baseline for a re-survey of comparative risk in five years, with care taken in the meantime to address the data gaps and methodological problems that limit this analysis. For today, it is most helpful as a first look across the Agency's wide responsibilities, and as a reminder that every part of the environment is indeed connected.

## William A. Butler

What should be the public reaction to a study by 75 of EPA's top managers which concludes that, based on an assessment of comparative risks posed by environmental problems, the Agency's current priorities are wrong? Perhaps surprisingly, the general response to EPA's self-analysis has been complimentary.

Steve Delaney

Some have asked how EPA could have gotten so far off course if these same managers were at the helm. The answer is that EPA's priorities are only partially self-generated. Few agencies have ever initiated such a searching analysis of their agenda and come forth with such a useful result, for this report is likely to lead directly to both substantive and procedural reforms in the way EPA does business, as well as guidance for those both within and without the Agency who influence its priorities.

The "Comparative Risk" report has important acknowledged qualifications It focuses solely on comparative risk analysis, and does not consider economic factors, technical possibilities, relative benefits, statutory and/or public mandates to deal with risks, or the ability of EPA as an agency to make a difference (particularly internationally). It also omits many traditional qualitative aspects of comparative risk analysis (such as voluntary assumption of risk, equity, etc.). Nonetheless, by acknowledging that the Agency's current priorities may not correlate well with actual environmental risks, EPA has signaled that changes are in order. What next?

One answer, suggested both by current EPA Administrator Lee Thomas and by former Administrator William Ruckelshaus, is to implement uniform risk assessment techniques at least throughout EPA, if not throughout all environmental regulatory agencies.

Another suggestion is to conduct a vigorous campaign to educate the public on comparative risk. Many observers have commented on the American public's tendency to fear unknown risks more than familiar ones, regardless of the actual threats. A public education campaign would discuss risk assessment with candor, admitting uncertainty where it exists, but also discussing it in terms of familiar, accessible analogies and examples. The goal would be to generate support for national, and cost-effective, risk avoidance. A cardinal tenet would be always to make a logical distinction between risk assessment and risk management, with value judgments in the latter being clearly stated.

A more controversial proposal has been for EPA to state frankly that a "zero risk," or even an "ample margin of safety," approach to chemical regulation is impossible where threshold doses cannot be found scientifically and should be implemented only under extreme circumstances. Other examples of the "tell it like it is" approach to public education include expressing risk calculations on the basis of ranges and estimates rather than absolute numbers, acknowledging the role of economics in risk reduction, and explaining frankly the

uncertainties of quantifying risk. This report itself, by initiating debate about comparative risk and its uncertainties, also promotes a climate for more rational discussion of environmental priorities by Congress, the media, and the public generally. In such a climate, EPA decisions will enjoy greater public support and credibility.

EPA's effort to compare environmental risks is a good start at just such a strategy. It should continue. At the same time EPA should also turn to other elements important in setting its priorities, including as many of the factors omitted in the last report as possible. This and subsequent reports on risk priorities should be widely promoted and disseminated, most particularly to Congress and the White House. Where there loom potential highly significant risks about which too little is now known, such as global warming, stratospheric ozone depletion, and indoor air pollution, the Agency should begin to develop data now.

One critically important result of EPA's self-examination of comparative risks and priorities will be the spillover effect to other elements of society. For example, Congress, supported by public opinion, will be encouraged to respond by addressing EPA priorities as it reauthorizes existing statutes and creates new ones. To accomplish its legislative role effectively, Congress must know what EPA considers its risk reduction priorities should be, and why. Otherwise Congress will set its own, reflecting public concerns of the day whose actual risks may not merit priority attention. For example, if EPA sees the potential risk of acid rain and indoor air pollutants as being high, and says so backed by facts, Congress is more likely to address those priorities in reauthorizing the Clean Air Act. Oversight committees can then hold EPA to consistent implementation of its own analysis of priorities for risk reduction.

The media, industry, and environmental groups are three important elements in molding public opinion about comparative environmental risks. Yet none is so well adapted as EPA for making a dispassionate analysis. Sensationalism, denial, and hyperbole are reflex actions difficult to unlearn, particularly when their short-term economic payback is demonstrably great. If EPA speaks clearly and frankly, it will be able to set its own regulatory agenda on the basis of informed public analysis of comparative risk rather than on the basis of mistaken public perceptions. One of the most troublesome of the study's findings is that apparently EPA's current priorities most closely approximate mistaken public perceptions of comparative environmental risk, rather than those of EPA's own and presumably better informed management and scientific experts. This report is a good start towards remedying that situation.

## Khris L. Hall

The report of EPA's Comparative Risk Project asks several fundamental questions concerning EPA's efforts to protect the environment: Is the United States—both public and private sectors—committing billions of dollars to remedy environmental problems that may be less serious than others receiving little attention? In chasing the chimera of cancer, is EPA taking insufficient action to protect against serious threats to ecosystems? Does the public perception of environmental problems match the actual risks?

Steve Delaney

These questions have been raised before. Unfortunately, little attention has been paid to them by the people who actually make and implement environmental policy. EPA's risk project can play a useful role in serving as the basis for a new discussion of these issues.

The comparative risk report attempts to rank the environmental issues presenting the highest risks to health and the environment. To do so, EPA asked 75 of the Agency's most experienced managers to evaluate 31 cross-media, cross-program environmental issues, ranking them for cancer risks, non-cancer health risks, ecological risks, and welfare risks.

But comparing within and among these four types of risk is not just comparing apples and oranges; it's comparing apples, onions, and fried chicken. There is simply no common reference point or unit of measurement. In addition, there is the problem of uncertainty. EPA is continually called upon to make policy decisions in the absence of information or precise data. Yet, for three of the four types of risks addressed—non-cancer health, ecological, and welfare risks—very little information exists to define the severity of the problem or provide ways of measuring it. Because of this, much of EPA's analysis is based on judgment, rather than quantifiable measurements. Given the considerable degree of uncertainty in quantifying risks that have been better studied, risk quantification can instill a false sense of precision. Relying on the judgment of experts may well be an appropriate way to approach such issues. If nothing else, the uncertainties highlighted in the report point up the need for a fresh and broader look at EPA's research program. But even with these limitations, the comparative risk report is the best effort, to date, to look at environmental risks broadly, and to attempt to put them in perspective.

The report does raise more questions than it answers. The report ranks ground-water problems relatively low, yet the United States is pouring vast amounts of private and public money into correcting them. Is this the result of faulty methodology, or does ground-water contamination really pose less of a risk than other environmental problems? If public perceptions about environmental risk differ substantially from the actual degree of risk, what is the appropriate response? What use should EPA make of the report? Should EPA reorder its existing priorities? Should EPA expand its current agenda to accommodate the issues such as greenhouse effect and indoor air pollution that rank as high relative risks but as low EPA priorities? What use should Congress make of the report?

All of these questions deserve attention and public debate. It may be that our compartmentalized way of implementing environmental policy tends to lose the big picture. In our rush to protect, we may neglect to think broadly enough. While one can argue with individual findings of the report, the fact that this broad evaluation was undertaken at all is beneficial to the evolution of EPA's programs and environmental protection. □

# Appointments

**James Scherer** has been appointed by Lee M. Thomas to be the new Regional Administrator for EPA's Region 8.

Scherer, who is currently an investment advisor in the Denver area, has served as a Colorado State Representative from 1982 to 1986, and as President of Compacts Only Rent-A-Car System and First City Lease Corporation.

Scherer is a graduate of Notre Dame University with a bachelor's degree in Communications Arts. While serving as state representative he was named the second most effective representative out of a body of 100.

**David G. Davis** has been named the first director of EPA's new Office of Wetlands Protection.

Davis has extensive expertise and experience in wetlands protection. He joined EPA in 1974 as an economic analyst and from 1982-83 he served as director of the Sludge Task Force. He has also served as Office of Federal Activities (OFA) division director for wetlands and National Environmental Policy Act (NEPA) compliance, section chief for wetlands in the water program, deputy director of OFA, and acting director of the Office of Wetlands Protection.

Davis received his bachelor's and master's degrees in microbiology from the University of Illinois and a master's in business administration from the Harvard Business School. He has served four years in the U.S Air Force as a commissioned officer and has received a number of Agency awards, including the 1986 Award for Excellence in Leadership and Management.

**Gary M. Katz** has been appointed to the position of Deputy Director of the Office of Administration (OA) at EPA.

Katz brings strong experience in management and program analysis with him. He began his career in the government in 1966 at the municipal level, where he served on the staff of the Mayor of New York. Since then, he has held management positions in three agencies, including EPA and the Office of Management and Budget. He has spent several years in the Grants Administration Division in OA, and from 1983 to the present, served as Director of OA's Management and Organization Division.

Katz received his bachelor's degree in political science from Gettysburg College and his master's degree in governmental administration from the Wharton School at the University of Pennsylvania.

**David O'Connor** has been appointed to the position of Director of the Procurement and Contracts Management Division in the Office of Administration.

O'Connor brings a broad range of experience in the procurement and contracts management field with him. From 1974 to 1978, he worked for the Air Force Office of Scientific Research as a contract specialist and later as a contract price analyst. He began his employment with EPA in 1978 as a contract specialist and has served as acting director of the Procurement and Contracts Management Division.

O'Connor received his bachelor's degree in economics from the Virginia Polytechnic Institute and State University. He has also been selected for the Agency's Excellence in Leadership and Management Award. □

U.S. Department of Agriculture

*Certain insects can be a helpmate to mankind. Here, the wasp lays an egg near the larva of an elm bark beetle. When the egg hatches, its larva will feed on the elm bark beetle larva, eventually killing it.*

Back Cover:
*Osprey at nest in Chesapeake Bay. This is one of the species of birds of prey seen more often in the U.S since the pesticide DDT was banned. Photo by Steve Delaney.*