A *U.S. News* test helps resolve cancer questions about pesticides

How safe is your food?

■ "A grim specter has crept upon us almost unnoticed." Thus did naturalist Rachel Carson's landmark work, *Silent Spring,* awaken the public to the profligate use of DDT and other pesticides. But 25 years later, her legacy is a tripling of pesticide volume—390,000 tons a year in the U.S., or more than 3 pounds for each person. No wonder 3 out of 4 people surveyed last February by the Food Marketing Institute, a trade group representing supermarket chains, consider pesticides and herbicides to be a "serious health hazard." And in a telephone survey in July by the Alliance for Food and Fiber, an organization representing California food growers, 45 percent of Californians disapproved of farmers' using pesticides.

Sheer chemical tonnage and public concern notwithstanding, most scientists believe the cancer threat from pesticides in food is minuscule next to smoking and other known causes. A sizable minority even believes that the threat pales beside the cancer risk posed by the chloroform in ordinary tap water and by natural substances in foods. But there are enough gaps—and occasionally chasms—in what is known about pesticides that scientists often clash over just how stringent pesticide regulations need to be.

Looking for residues

One key question is, just how much pesticide remains on food by the time it gets to the supermarket? Based on government and industry tests, the answer is, very little. If true, that's reassuring. To check this premise and to see whether residues of common pesticides are likely to exceed current legal limits, *U.S. News* commissioned an ambitious test. Last August, the month when growers' use of pesticides normally peaks, couriers collected samples of seven raw foods and two types of processed foods from wholesale markets in New York City, St. Louis and San Francisco. The foods, unwashed, were shipped within 24 hours to the National Food Laboratory, a Dublin, Calif., firm well known for its food research and testing. Each food item was checked for a carcinogenic pesticide commonly used on that food. The study was designed with the help of the Center for Investigative Reporting, a nonprofit group in San Francisco with extensive experience in pesticide research. Full results appear on the facing page.

What's most significant about the results, even though they are too limited to justify broad conclusions, is what they do not show: Of 87 tests for specific chemicals, 82 turned up nothing at all. In all five cases that tested positive, the pesticide residue was less than one fourth of the amount that is permitted by law. An orange from San Francisco's wholesale market registered the highest cancer hazard, containing 2.6 parts per million of benomyl, one of the most common fungicides used in agriculture. According to a worst-case estimate based on Environmental Protection Agency figures, if every orange eaten over a lifetime contains at least that amount of benomyl, there would be 1 additional cancer in every 166,000 people. Compare that with the 1 chance in 5,400 of dying in a car crash in the United States.

But how good are the EPA numbers? The way scientists assess the cancer hazard of any substance is to feed high doses of it to laboratory animals. If any dosage causes tumors in any species tested, the substance is labeled a carcinogen. By this definition, at least 53 of about 300 pesticides used on food crops in the United States are carcinogenic. Mathematical models turn the findings into numerical risk estimates. A pesticide considered a potent carcinogen might cause 1 additional case of cancer for every 10,000 people. An extremely weak carcinogen may carry a risk of 1 additional cancer in 1 billion people.

It sounds straightforward. But the assumptions that underlie such risk assessments are widely challenged. Many scientists question whether chemicals that cause cancers at high dosages in animals pose any hazard in the trace amounts in typical diets.

How tolerant?

In shaping public policy, caution is customary. The EPA limits pesticides' residues to specified amounts. The limit is called a tolerance. The more potent the carcinogen, the lower the tolerance level.

At least, that's how it is supposed to work. But as a blue-ribbon panel at the National Academy of Sciences (NAS) reported last May, the EPA's standards are glaringly inconsistent. Its regulations hold new pesticides to very high—even impossible—standards, yet permit older, more worrisome pesticides to stay on the market. Most of these pesticides were approved before 1978, when the agency began to demand more-stringent health data. Today, 10 of these older chemicals are still widely used in agriculture—and account for as much as 90 percent of our dietary cancer risk. What's more, they are extremely difficult to detect. Says Richard Wiles, staff director of the NAS panel: "The government has only a crude idea how much of these pesticides are being served up on our plates."

To better protect public health, the NAS report recommended that the EPA scrap its crazy-quilt rules and instead apply a "negligible risk" standard to all pesticides across the board. As the report defined it, a negligible risk would cause no more than 1 additional

CHARLIE ARCHAMBAULT FOR *USN&WR*

Is this collection of ordinary food items contaminated with pesticide residues? We put just such a market-basket assortment to the test

DOUG MENUEZ FOR *USN&WR*

JEFF REINKING FOR *USN&WR*

The raw materials and tools of food testing

U.S.News & WORLD REPORT

LEGALLY CLEAN, BUT QUESTIONS REMAIN

In the *U.S. News* test, two samples of eight different foods were collected in each of three cities. In addition, one sample of peanut butter was collected in each city. The 51 samples underwent 87 tests for pesticides. Five of the 51 samples showed some evidence of pesticide residues. All five easily passed legal limits now in effect, but three of the five would fail a negligible-risk standard that has been proposed by the National Academy of Sciences.

	Pesticide checked	Samples containing pesticide	Source of tainted food	Residue as proportion of legal limit	Meets proposed NAS risk standard
Oranges	Benomyl	1 of 6	San Francisco	1/4	No (1 in 166,000)
Apples	Daminozide	0 of 6		None	
	Maneb	1 of 6	New York	1/4	No (1 in 235,000)
Peaches	Benomyl	1 of 6	New York	1/100	Yes (1 in 14 mil.)
Strawberries	Folpet	1 of 6	New York	1/33	Yes (1 in 1 mil.)
	Organophosphates	0 of 6		None	
Peanut butter	Daminozide	1 of 3	St. Louis	1/30	No (1 in 303,000)
Tomatoes	EBDC's	0 of 6		None	
	ETU	0 of 6		None	
	Organophosphates	0 of 6		None	
Tomato paste	EBDC's	0 of 6		None	
	ETU	0 of 6		None	
Potatoes	EBDC's	0 of 6		None	
	ETU	0 of 6		None	
Carrots	Chlorinated hydrocarbons	0 of 6		None	

Note: Proposed National Academy of Sciences risk standard would ban pesticides judged to cause more than 1 case of dietary cancer for every 1 million people. Orange had 2.6 parts per million of benomyl; legal maximum, 10 ppm. Apple had 0.5 ppm of maneb; legal maximum, 2 ppm. Peach had 0.14 ppm of benomyl; legal maximum, 15 ppm. Strawberry had 0.76 ppm of folpet; legal maximum, 25 ppm. Peanut butter had 1 ppm of daminozide; legal maximum, 30 ppm.

case of cancer in every million people exposed to the pesticide in their diet over a 70-year lifetime.

How do the pesticides in the *U.S. News* study square up in the light of the proposed standard? All were approved before 1978, and three of the five residues that passed the current EPA standards would have flunked the NAS negligible-risk standard. Moreover, a fourth residue just squeaks by.

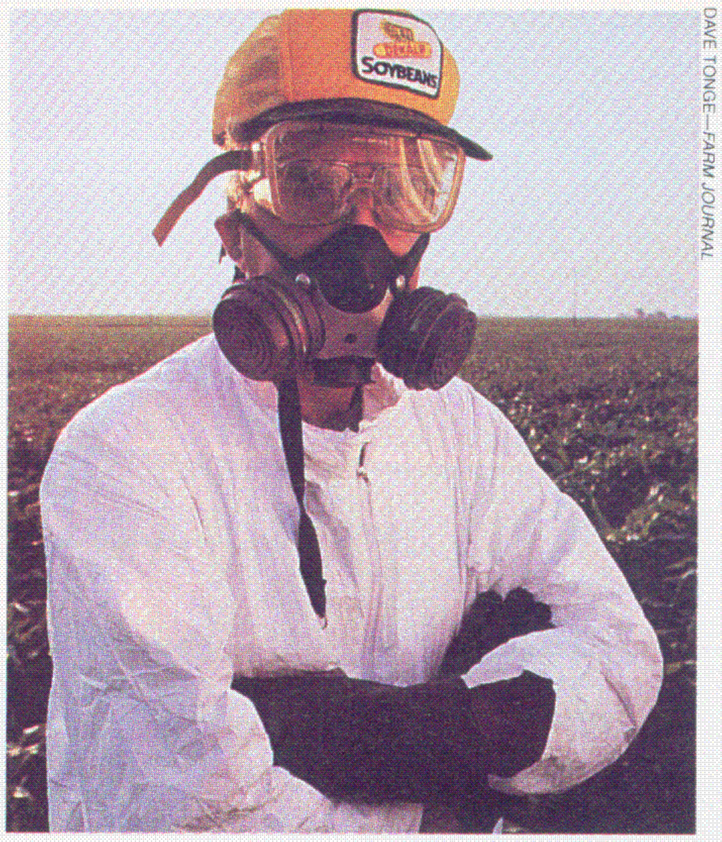
Several consumer groups feel that even the NAS recommendations don't go far enough. The main worries of these groups center on what we don't know. Ellen Haas, executive director of Public Voice for Food and Health Policy, is alarmed by what she calls "an astounding dearth of adequate health data." Although somewhat exaggerated, her point does have validity: About three dozen pesticides have never been tested in animal-cancer studies. The EPA says that many of them are obsolete or seldom used, but it can't furnish a precise number. The question of pesticide combinations also remains open. A 1984 study by the National Resources Defense Council found that 42 percent of pesticide-tainted food samples had been treated with more than one pesticide.

Repellent carcinogens

Many scientists disagree with the position of the NAS and the consumer groups, however. These scientists are led by Bruce Ames, the biochemist who developed today's most widely used test for identifying potential cancer-causing substances. In their view, the present regulations go quite far enough because, says Ames, "the dietary dose is so small as to pose a trivial risk."

Ames and his followers argue that most common foods contain large amounts of natural substances at levels hundreds or even thousands of times more carcinogenic than residues of the most dangerous pesticides concocted by the chemical industry. Fruits and vegetables apparently produce these substances for the purpose of repelling insects, fungi and other predators—a surprise that came to light when scientists began to test natural-food constituents under the same guidelines that regulatory agencies use to identify man-made carcinogens.

Suppose that before the potent carcinogen EDB was banned, you consumed traces of the pesticide in your food in an amount typical of most U.S. adults. By Ames's calculations, a daily glass of wine is 10,000 times more likely to give you cancer than is ingesting residues of EDB—and 1,000 times more dangerous than the leftover residues of Rachel Carson's hated DDT. The natural cancer-causing agents in 1 leaf of basil, 1 teaspoon of brown mustard or even a single raw mushroom are hundreds or thousands of times more carcinogenic than residues of DDT and EDB.



DAVE TONGE—FARM JOURNAL

Illinois farmer Dan Chambers, equipped to spray pesticides on his crops

Ames doesn't want to kill your appetite. He doubts that even natural carcinogens are concentrated enough in the normal diet to cause harm. Rather, he wants hazards put in perspective. Says Ames: "Just remember you're consuming 10,000 times more of Mother Nature's pesticides."

Potato chemistry

The NAS panelists think Ames's arguments make sense—but feel they can't afford to treat pesticide risks casually. Clearly, diet *can* have a big impact on cancer. In Japan, for example, there's abundant stomach cancer but relatively little breast cancer. When Japanese immigrate to the U.S. and adopt a Western diet, however, their likelihood of developing these cancers reverses, becoming the same as for the rest of the U.S. population. But isolating the responsible substance, or substances, is devilishly hard. A potato alone contains 150 chemicals—before it's doused with pesticides.

Given the unknowns, the NAS panel chose to act conservatively. Says panel member Dr. Arthur Upton, a New York University cancer specialist: "We haven't lived with many [man-made] pesticides long enough to say with certainty that they pose a trivial risk."

There are other reasons for regulating pesticides apart from the food-safety issue. Even Ames believes farmers may inhale dangerous amounts of pesticides or absorb chemicals through their skin. Worse, pesticides are being detected in the ground water in intensively farmed areas, exposing farmers and nearby populations to additional hazards through their drinking water. The concentrations are usually too low to pose any threat, but the situation is sure to worsen. Pesticides break down slowly beneath the ground, where there are few bacteria and no sunlight.

The EPA is expected to enact the panel's recommendations as early as next January. Meanwhile, if you're concerned about carrying chemicals home with your tomatoes, consumer groups advise washing fruits and vegetables with soapy water. Ames simply suggests a varied diet, so that no one chemical—whether natural or created in a lab—overwhelms your body's defenses. Perhaps most important, keep the threat in perspective. If you smoke cigarettes or drink alcohol, concerns about chemicals in our food should be taken with a grain of salt. ■

by Kathleen McAuliffe with David Gilbert, William Kistner and David Weir from the Center for Investigative Reporting in San Francisco

LIFE'S HAZARDS

Are pesticides the problem?

The pesticides DDT and EDB are such potent cancer threats that they've been banned. Yet their cancer-causing potential, compared with that of ordinary city tap water and a variety of common foods, is believed to be tiny. The reason: Naturally occurring chemicals in these foods—the estragole in dried basil and the aflatoxin in peanut butter, for example—are much more carcinogenic than pesticides, because we consume them in far greater amounts. The ranking system below, comparing the cancer risk from DDT and EDB with that of eight substances found in many people's diets, was conceived by biochemist Bruce Ames of the University of California at Berkeley and Renae Magaw and Lois Swirsky Gold of the Lawrence Berkeley Laboratory. The hazards are based on a typical person's average daily exposure to the substance over a lifetime and are calculated as a percentage of the dose that causes cancer in half of exposed rodents. Hence the name of the numerical index: HERP, for Human Exposure Dose/Rodent Potency.

Cancer hazard	Food *(carcinogen)*
.0003	DDT, from residues remaining
.0004	EDB, before ban took effect
.001	Municipal tap water, 4 8-oz. glasses *(chloroform)*
.03	Peanut butter, 1 sandwich *(aflatoxin)*
.03	Comfrey tea, 1 cup *(symphytine)*
.07	Brown mustard, 1 teaspoon *(allyl isothiocyanate)*
.1	Dried basil, 1 leaf *(estragole)*
.1	Raw mushrooms, 1 *(hydrazines)*
2.8	Beer, 12-oz. bottle *(ethyl alcohol)*
4.7	Wine, 8-oz. glass *(ethyl alcohol)*