

Fields of Poison

California Farmworkers and Pesticides

by

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One in a series of reports by Californians for Pesticide Reform

Californians for Pesticide Reform

Californians for Pesticide Reform (CPR) is a coalition of public interest organizations committed to protecting public health and the environment from pesticide proliferation. CPR's mission is to 1) educate Californians about environmental and health risks posed by pesticides; 2) eliminate the use of the most dangerous pesticides in California; and 3) promote sustainable pest control solutions for our farms, communities, forests, homes and yards; and 4) hold government agencies accountable for protecting public health and Californians' right to know about pesticide use and exposure.

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The United Farm Workers of America, AFL-CIO, is the largest union of farmworkers in the country, with regional offices throughout California and in Texas, Florida and Washington State. Founded by Cesar Chavez and Dolores Huerta in 1963, the union now has 27,000 members and has won 18 elections since 1994. Because farmworkers are the single population most affected by pesticides, the UFW plays a central role in advocating for the ban of the most dangerous pesticides and for farmworkers' rights to a safe and healthy work place. The UFW approaches pesticide issues from an organizing perspective, and works with groups throughout North America who have joined the fight to improve the lives of millions of agricultural workers in the U.S.

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This report is dedicated to the
thousands of farmworkers
who labor in California's
agricultural fields.

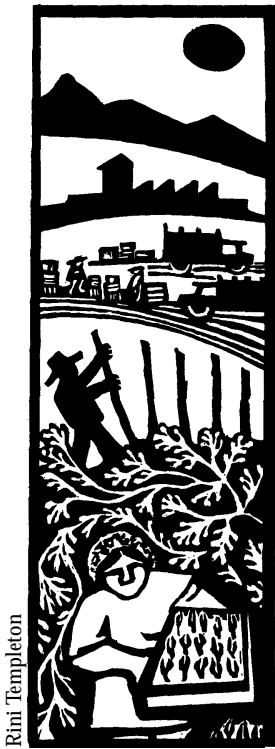


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Executive Summary

Agriculture is still one of the most hazardous occupations in the U.S. The death rate among agricultural workers nationwide was an estimated 20.9 per 100,000 workers in 1996 compared to the average for all industries of 3.9 per 100,000 workers. In addition to long workdays and high risk of physical

injury, the nation's estimated 2.5 million farmworkers face a greater risk of pesticide exposure than any other segment of the population.

In California, the state with the largest agricultural economy in the country, farm work is conducted by a workforce of about 600,000 men and women. From 1991 to 1996 the California Environmental Protection Agency's

Department of Pesticide Regulation (DPR) reported 3991 cases of occupational poisoning by agricultural pesticides, an average of 665 cases per year.

Unfortunately, the situation is even worse than these numbers indicate. Pesticide exposure incidents often go unreported because many farmworkers are afraid of incurring medical bills since few have health insurance and many do not realize they are entitled to Workers' Compensation. Many workers fear retaliation from employers or are not provided sufficient pesticide hazard training to recognize symptoms of pesticide poisoning. Some farmworkers bear the symptoms they experience simply as part of the job.

Farmworker Poisoning Data Limited Since the 1980s, California has had unique reporting systems for both pesticide use and pesticide-related illnesses. These data collection systems are intended to assist policy makers and the public in understanding the scope of pesticide use and poisonings in the state. Our attempts to use these data to understand farmworker exposure to pesticides, however, have uncovered significant limitations in the reporting systems.

Gaps in pesticide illness data, for example, limit efforts to pinpoint with certainty which crops and which pesticides used in production of those crops are responsible for the greatest number of farmworker poisonings. Nearly a third of the reported cases between 1991 and 1996 identify no specific crop associated with the poisoning incident. Many case reports contain little or no information on specific pesticides involved, type of work, symptoms or medical tests. This is partly because many doctors know little about pesticide poisoning and many are not filing required pesticide illness reports with county officials, so the opportunity for immediate investigation is lost.

In addition, the California pesticide illness reporting system addresses only acute health effects. Chronic effects are not accounted for, despite evidence that farm work is associated with elevated risk of certain cancers, birth defects, spontaneous abortion and developmental problems.

Despite these limitations, the data collected through California's pesticide use and pesti-

The nation's 2.5 million farmworkers face a greater risk of pesticide exposure than any other segment of the population.

cide illness reporting systems reveal disturbing trends, including increasing use of pesticides and continued high numbers of pesticide poisonings.

Reported Poisonings by Crop, Activity and County

Ten crops account for half of all reported agriculture-related pesticide illnesses (Table I). All other identified crops account for about 22% of reported illnesses, and in about 29% of the cases no specific crop was identified.

The majority of pesticide poisonings occur when farmworkers are doing fieldwork, such as picking, field packing, weeding, and irrigating. From 1991 to 1996 the two most common sources of exposure leading to pesticide-related illnesses were drift from pesticide spraying (44%) and field residues (33%).

The greatest number of poisonings were reported in Kern County (534), with a majority occurring in cotton and grapes. The 15 counties with the most reported pesticide-related poisonings are listed in Table II. In nine of those counties, the majority of reported poisonings had no specific crop listed

Table I. Acute Poisoning Cases—Top 10 Crops, 1991–1996*

Crop	Total Cases
grapes	539
cotton	399
broccoli	307
oranges	165
ornamentals	104
almonds	102
tomatoes	102
lettuce	101
strawberries	78
alfalfa	70
Subtotal	1967
all other crops*	880
no crop given	1144
Total	3991

*For a list of all crops included, see Appendix C. Source: California DPR 1999.

as a source, severely limiting efforts to target regulatory actions to the most problematic crops. Data from all 48 counties in which pesticide poisonings were reported are listed in Appendix F.

Many Poisonings Are Not Reported California's Pesticide Illness Surveillance Program offers a limited view of the extent of farmworker pesticide exposure. Although it is the most extensive reporting system in the U.S., many agricultural poisoning cases are never reported. The primary barriers to accurate reporting are intimidation from employers and fear of job loss. The following excerpt from a farmworker interview illustrates the extent of employer intimidation in some cases:

When Magdalena fell ill during her work as a picker at a large strawberry farm in Watsonville, California,¹ she told her foreman that her spreading rash was a result of pesticide exposure. She was grudgingly given permission to go to the company doctor, with the understanding that she would have to pay for the visit herself if the doctor did not declare her illness to be pesticide related. Within days, the worker was fired with only the explanation that she "wasn't putting enough into her work."

Retaliation against injured workers is illegal but all too common, and can have a chilling effect on an entire workforce. Federal and state laws prohibit retaliation against workers who are exercising their rights, but until the laws are effectively enforced, they offer little consolation to an injured—or fired—worker.

Table II. Top 15 Pesticide Poisoning Counties, 1991–1996

County	Total Cases
Kern	534
Fresno	515
Monterey	428
Tulare	399
San Joaquin	200
Santa Barbara	180
Kings	167
Stanislaus	138
Imperial	128
Merced	127
Ventura	119
San Diego	114
Los Angeles	84
Madera	79
Riverside	77

Source: California DPR 1999.

¹ Farmworker accounts are excerpted from worker testimony and county pesticide episode investigation reports. Names have been omitted or changed to protect the workers.

Counties with greater agricultural pesticide use and more cases of agricultural pesticide illness issue very few fines.

Enforcement of Laws Is Weakest in Areas of High Pesticide Use
California's county-based system for enforcing pesticide laws has serious weaknesses. A few counties do conduct fairly thorough inspections and investigations and issue fines for violations quite regularly. Unfortunately, these counties are the exception rather than the rule.

By comparing the five counties issuing the greatest number of fines to the five counties reporting the most agricultural pesticide use for 1995, it is evident that counties with greater agricultural pesticide use and more cases of agricultural pesticide illness issue very few fines (Table III). No county in the Central Valley, the

state's agricultural heartland, issued more than an average of 25 fines per year. In contrast, primarily urban Los Angeles County issued an average of 124 fines annually. (See Appendix I for the enforcement record of all counties.)

Statewide, county agricultural commissioners issue fines for about a tenth of the violations

they document. In fiscal year 1996/97, only 657 fines were issued statewide for pesticide violations. The vast majority of actions (5,153) were "Notices of Violation" and "Letters of Warning," which carry no fine and are not recorded in permanent statewide records. Hundreds of additional documented violations led to no action at all. This means that for more than 85% of the documented violations for this period, no central record exists of either the nature of the violations or the names of businesses receiving warning notices.

When fines are issued, they are generally very low. Of the fines issued from 1991 through 1996, almost half were less than \$151, and less than 5% exceeded \$1,000. The large fines issued generally result from investigations of episodes of pesticide drift or early field reentry affecting large crews of workers. This approach is analogous to the highway patrol issuing speeding tickets only when a huge pile-up occurs, and just sending a letter that says, "Please don't speed," to other violators.

Recommendations

The most important and urgently needed step to reduce exposure is eliminating use of those pesticides which endanger the health and well-being of farmworkers throughout the state. Farmworker experiences show that even pesticide applications which follow the letter of the law can result in exposure or illness. Phasing out use of the most dangerous pesticides—those that cause cancer or reproductive harm, or are extremely toxic to the nervous system—would represent a tremendous step toward a more sustainable, healthy and humane agricultural system.

To achieve this goal and reduce the level of farmworker exposure to those pesticides which remain registered, we recommend that state agencies take the following steps:

- 1. Rapidly phase out use of the most toxic pesticides and promote healthy and sustainable alternatives.** California's Department of Pesticide Regulation (DPR) should develop and implement a plan to phase out use of pesticides that cause can-

Table III. Top 5 Counties for Agricultural Pesticide Fines vs. Top 5 Counties for Pesticide Use

County	Average # Fines/Year (1991-1997)	Pesticide Use (1995)* (thousand lbs.)	Pesticide Illnesses (1996)
Los Angeles	124	208	8
Orange	53	994	6
San Luis Obispo	42	161	2
Sacramento	43	2,429	5
Riverside	40	4,471	5
Kern	24	24,108	268
Fresno	19	39,805	99
Tulare	17	17,927	43
Monterey	12	10,122	50
San Joaquin	8	11,646	30

*1996 pesticide use data have not yet been officially released by DPR. Use is listed as thousands of pounds of active ingredient.

Sources: Fine data from California DPR 1998a; Pesticide use data from Liebman 1997; Illness data from California DPR 1999.

cer or reproductive harm, or are highly poisonous acute nerve toxins. The California Environmental Protection Agency and the California Department of Food and Agriculture should commit significant resources to research and training in support of organic and other sustainable agricultural practices.

2. Improve regulations to reduce farmworker exposure. DPR should take a number of immediate steps, including banning aerial spraying of pesticides, prohibiting back-pack spraying for restricted use pesticides, and expanding buffer zones and posting and notification requirements.

3. Strengthen enforcement of existing laws. DPR should abolish the option of issuing notices of violation that carry no fine, set minimum mandatory penalties, increase fine levels for moderate and serious violations, and abolish leniency toward violators who claim to be unfamiliar with regulatory requirements. An independent review board should be established to evaluate the performance of county agricultural commissioners in enforcing pesticide regulations.

4. Improve reporting of pesticide poisonings. The Department of Health Services should expand its existing program to train doctors about pesticide poisoning diagnosis, treatment and reporting requirements, and should establish and fund a program to monitor long-term health impacts of pesticide exposure among farmworkers. California Occupational Safety and Health Administration (CalOSHA) and the Medi-

cal Board of California should exercise their authorities to fine doctors who fail to report pesticide poisonings promptly to county health officers. In addition, “safety incentive” contests which provide bonuses or prizes to work-crews when no injuries or illnesses are reported should be prohibited.

5. Improve farmworker access to medical treatment. Existing regulations requiring employers to take workers promptly to a doctor if pesticide poisoning is suspected should be enforced. Funding for migrant clinics and other health care providers for farmworkers should be increased, and agricultural employers should provide health insurance and/or establish a fund to finance farmworker health care costs.

6. Ensure farmworker and public right-to-know. DPR should expand workers’ right-to-know by requiring adequate posting of restricted entry intervals and descriptions of acute and chronic health effects associated with each pesticide applied, both in an understandable format and language. Farmworkers should also be guaranteed “adequate warning” about exposure to carcinogens and reproductive toxins as required under Proposition 65, and DPR should establish a public database with information on the amount of pesticides used, violations reported, number of workers affected by the violations and the number of pesticide illnesses for each user/grower. These data should be released to the public no more than six months after the end of the year for which the information is reported to DPR.

1

Introduction: Farmworkers on the Frontline of Pesticide Exposure

"I have had headaches, dizziness, nausea, stomach pain and vomiting because I was poisoned by pesticides at work. I told the foreman how I felt and he told me that I was hung over. He ignored me and left. I am the pesticide sprayer and I often get wet with the liquid that they use on the plants. My clothing does not protect me, it is too thin and my arms get wet. I can never go to the doctor because I don't have enough money."

—Julio¹

Agricultural Work Is Dangerous

Agriculture is still one of the most hazardous occupations in the U.S. The death rate among agricultural workers nationwide was an estimated 20.9 per 100,000 workers in 1996, compared to the average for all industries of 3.9 per 100,000 workers (National Safety Council 1996). Rates of injury or illness among farmworkers are also high. Since 1990, injury rates in agricultural production have ranged from 9.4% to more than 12%, well above the average of occupational injuries for all industries (6.6% in 1996) (AFL-CIO 1999, Bureau of Labor Statistics 1995, Runyan 1993).

In addition to long workdays and high risk of physical injury, the nation's estimated 2.5 million farmworkers face a greater risk of pesticide exposure than any other segment of

the population. Agricultural workers may be directly exposed to pesticides in many ways—mixing or applying pesticides; during planting, weeding, thinning, irrigating, pruning and harvesting crops; or living in the midst of treated fields. Government estimates indicate that more than 20,000 farmworkers suffer from acute pesticide poisonings² each year in the U.S. (Blondell 1997, Federal Register 1987, U.S. GAO 1992).

Agricultural work in the U.S. is performed primarily by members of ethnic or racial minorities. About 79% of migrant and seasonal farmworkers in the country are Latino—the vast majority of Mexican origin, 3% Puerto Rican and a small proportion from other Latin American countries. European Americans make up about 18% and African and Asian Americans make up the remainder (Mines et al. 1997).

Children Are More Vulnerable to Pesticide Exposure

Children are disproportionately exposed to many environmental toxins, including pesticides. Those who live on or near farms or have family members who work on farms generally experience greater exposure than the "average" child. In addition, children are generally more susceptible to the effects of pesticides than adults.

According to a recent study of pesticide-related health risks of farm children (Solomon and Mott 1998), three major factors are particularly important. Compared to adults:

- Children drink more fluids, breathe more air, and eat more food per unit of body weight so their potential for exposure is proportionately greater.
- Children often have greater contact with environmental contaminants because of activities which involve contact with soil and floor surfaces, and hand-to-mouth behavior.
- Because children's bodies and brains are immature and still growing and developing, environmental toxins can have more serious effects on children.

Childhood cancers are also a major concern. There is evidence of associations between prenatal or infant exposures to pesticides and childhood brain tumors, leukemia, non-Hodgkin's lymphoma, sarcoma, and Wilms' tumor. Solomon and Mott cite a California study in which use of pesticides in the home or garden during pregnancy or lactation was associated with a more than three-fold increased risk of childhood leukemia.

In addition to the adult workforce, the U.S. farm labor workforce includes an estimated 300,000 children between the ages of 14 and 17; no estimates are available for younger children (Dobnik and Anthony 1997, U.S. GAO 1998). These young people are particularly vulnerable to pesticide exposure (See box on previous page).

Agricultural work is also poorly compensated. Nationwide, 62% of farmworkers live in poverty, with median seasonal incomes as low as \$2,500 for farmworker women and \$5,000 for farmworker men (Mines et al. 1997). In California, where the growing seasons stretch through most of the year, annual farmworker income is slightly higher, averaging between \$5,000 and \$7,500 (Rosenberg et al. 1998).

Economic insecurity, poor housing, language barriers, lack of health insurance, and poor work conditions exacerbate the problems of pesticide exposure for most farmworkers. Recommendations to bathe at the end of each workday, wear clean work clothes every day and wash work clothes separately from family clothes ring hollow when one's living quarters have no running water or washing machine. At least 800,000 farmworkers across the country lack adequate shelter and may be found camping in parking lots, living in their cars or in groups of 10 to 12 in trailers, or occupying garages, tool sheds, caves, tents and hotel rooms (Greenhouse 1998).

Laws Provide Limited Protection for Farmworkers

Farmworkers have historically been excluded from basic protections that workers in other industries have enjoyed for decades. In many states farmworkers are denied the right to organize, Workers' Compensation for workplace injuries, and higher pay for overtime work.³ Farmworkers are specifically denied protection of the right to organize under the National Labor Relations Act, and only some states, including California, have enacted Agricultural Labor Relations Acts to fill this void.

In 1992, the U.S. Environmental Protection Agency (EPA) established the Worker Protection Standard (WPS) to implement its man-



Jocelyn Sherman, UFW

More than 300,000 children labor in agricultural fields nationwide

date "to reduce the risks of illness or injury resulting from workers' and handlers' occupational exposures to pesticides" (U.S. EPA 1992). The WPS includes information and training requirements, posting and restricted entry rules for fields where pesticides are applied, and requirements for other specific measures to ensure safety of workers. Federal law allows each state to enforce these protections if adequate laws, regulations and enforcement procedures are adopted at the state level.

Enforcement of the national WPS and state safety regulations is uneven, and many loopholes and exclusions exist (Moses 1989, Sandoval 1999). California, for example, has had pesticide safety regulations in place for more than 25 years, yet the majority of violations documented by county officials between 1991 and 1997 resulted in no penalty or fine, and pesticide illnesses and injuries among farmworkers have not declined since 1991.

California Farmworkers Are Routinely Exposed to Toxic Pesticides

In California, the state with the largest agricultural economy in the country, farm work is conducted by a workforce of about

Farmworkers have historically been excluded from basic protections that workers in other industries have enjoyed for decades.

Many of California's specialty crops are labor-intensive, increasing the potential for direct contact with pesticides.

600,000 men and women (Department of Health and Human Services 1990). Accurate information on the ethnic breakdown of this workforce does not exist. Although the average annual income of California farmworkers is slightly higher than the national average, the cost of living in many agricultural areas is also high. Many farmworkers live in "labor camps," where large families often share one- or two-room shelters near agricultural fields.

Jobs performed by farmworkers in California range from field preparation to planting, weeding, irrigating, pruning, harvesting and product packaging. Many of California's specialty crops (e.g., strawberries, grapes, broccoli, cut

flowers) require labor-intensive field preparation, maintenance and harvesting—in contrast to the highly mechanized production of field crops such as wheat and soybeans. This labor-intensive management increases the potential for direct farmworker contact with pesticides at many stages, including soil preparation with chemical fumigants; overhead application of insecticides, herbicides, and fungicides; dusting plants with pesticides prior to harvest; and postharvest treatment and handling. Farmworkers are often responsible for mixing and applying pesticides and are also exposed during and following application both in fields where they work and from application in neighboring fields.

"As a strawberry worker, I feel like pesticides are all around me: in the fields I pick, in the fields all around them, and from the fields that surround my home. Sometimes at work, they give us cream for our hands to use after they spray. I get rashes on my hands and arms, and my eyes get red and sore. Sometimes, when I come home from work, I can smell the chemicals in my clothes. My house is surrounded by lettuce fields which are also sprayed with pesticides, and about 100 yards away, there is a strawberry field which has recently been fumigated with methyl bromide. Right now, the tarps they use to keep the chemical in the earth are all peeling up and blowing in the wind."

—Carlos

Low income and fear of job loss provide strong incentives to stay on the job rather than take time off to visit the doctor when pesticide poisoning is suspected. Pesticide incidents in California often go unreported because many farmworkers do not have health insurance, fear retaliation from employers or are not provided sufficient pesticide hazard training to recognize symptoms of pesticide poisoning. Other barriers, such as insufficiently trained health care professionals who fail to recognize pesticide poisoning, reduce the official rate of reporting still further. Many farmworkers consider the symptoms they experience simply part of the job.

As Carlos' experience illustrates, farmworkers are also exposed to pesticides in and around their home, both through residue on clothing and drift from farm fields which surround rural neighborhoods in many agricultural regions. This cumulative exposure is not taken into consideration when setting standards for "safe" levels of worker exposure to pesticides, which assume that workers will only be exposed to a pesticide in the field. In addition, state farmworker safety regulations are poorly enforced and buffer zones in agricultural work areas around fumigated fields are much smaller than those around rural residences.⁴

This report was produced as a collaborative effort by Pesticide Action Network North America, the United Farm Workers and California Rural Legal Assistance Foundation, all members of Californians for Pesticide Reform.⁵ The report:

- highlights the dangers faced daily by thousands of farmworkers who labor in California's agricultural fields;
- explores failings of the regulatory system designed to protect farmworkers from pesticide exposure;
- recommends steps for improving the regulatory system; and
- proposes ways to move toward an agricultural system that is less reliant on the chemicals that pose serious danger to the industry's workers, consumers, and the environment.

2 Reported Pesticide Exposure Among California Farmworkers

Laura, a farmworker from Lamont, California, is a widow and mother of five. She and her oldest daughter are the sole providers for her family. Laura has been a farmworker for the last ten years working throughout the Northwest. Most recently, she has worked in California grape fields. When asked if she has ever felt ill in the fields, Laura responds:

"Yes, I have felt sick. I have had headaches, felt dizzy and nauseated. However, I never went to the doctor because the symptoms would go away.⁶

"About a year and a half ago when I was working, I had a very bad headache and felt like vomiting. Then I kept having to scratch my hands. A few days later, I noticed that I had a rash on my hands and neck. I figured the rash would go away on its own. But when it didn't, I told the foreman, and he sent me to the doctor. The company doctor told me that I had an allergic reaction, and prescribed some pills and a lotion for the rash. I had to miss one day of work. I know that if I don't work I don't get paid so I prefer to go to work. I found out that other workers also had rashes on their hands. I don't know if they ever went to the doctor."

Since the 1980s, California has had unique reporting systems for both pesticide use and pesticide-related illnesses managed by the Department of Pesticide Regulation (DPR). These two reporting systems are key elements of California's regulatory program, a program widely considered the most extensive in the world (Maddy et al. 1990). The systems are designed to assist policy makers and the public in understanding the scope of pesticide use and poisoning in the state. Attempts to use the reporting systems' data to evaluate farmworker exposure to pesticides, however,

have revealed significant limitations of both systems.

For example, California's pesticide use reporting system only requires reporting of pesticide active ingredients. "Inert" ingredients are excluded from reporting requirements, despite their large volume in pesticide formulations and their potential or known toxicity (Liebman 1997).⁷ Pesticide illness data are also incomplete. Nearly a third of the reported cases between 1991 and 1996 identify no specific crop associated with the poisoning incident. Many case reports contain little or

How the Pesticide Illness Surveillance Program Works

California's Pesticide Illness Surveillance Program (PISP) requires physicians to report to county health officers any illnesses they know or suspect are related to pesticide exposure. County health officers must then report to county agricultural commissioners. The commissioners (trained by DPR) determine whether the cases identified are potentially related to pesticides. DPR staff then review commissioner reports and categorize incidents based on their interpretation of the relation between the illness or injury and pesticide exposure. A data set is then compiled which includes information on type of illness reported

(listed as eye, skin, respiratory and systemic—including nausea and headache), allergic response, and type of exposure (principally residue, drift or application).

DPR also reviews doctors' reports filed with Workers' Compensation claims for evidence of pesticide involvement. According to DPR officials, the majority of pesticide illness data are actually obtained from Workers' Compensation reports rather than pesticide illness reports (California DPR and ACSA 1994). This illustrates major weaknesses in the system. Many physicians do not file pesti-

cide illness reports as required under the PISP. Information included in reports filed for Workers' Compensation ("Doctor's First Report of Occupational Illness or Injury") may include less information than is required in the pesticide illness reports. In addition, DPR generally reviews the Workers' Compensation reports months after incidents occur, when supportive testing for pesticide residues is no longer possible. And finally, perceived lack of coverage under Workers' Compensation may discourage farmworkers from seeking medical attention and further limit documentation of poisonings.

no information on specific pesticides involved, making it virtually impossible to determine which pesticides are associated with reported illnesses.

In addition, the California pesticide illness reporting system addresses only acute health effects. Chronic effects are not accounted for, despite evidence that farm work is associated with elevated risk of certain cancers, birth defects, spontaneous abortion and developmental problems (see “Chronic Effects of Pesticide Exposure,” below).⁸ Other barriers to accurate accounting of pesticide illness include misdiagnoses by physicians (Goldman 1998) and employment discrimination toward workers reporting pesticide illnesses.

Despite these limitations, the data collected through California’s pesticide use and pesticide illness reporting systems reveal disturbing trends, such as growing reliance on toxic pesticides and continued high numbers of pesticide poisonings.

Pesticide Use Is Rising

From 1991 to 1995, pesticide use in California increased, despite growing public interest in pesticide-free organic food.⁹ During this period, pesticide use in production agriculture increased 37% to more than 192 million pounds of active ingredient (Liebman 1997). Pesticide use data for 1996-1998 are not yet available.

During the 1991–1995 period, use of the most toxic pesticides increased as well. This category includes cancer-causing pesticides, restricted use pesticides, acute nerve toxins and endocrine disruptors which increased by 129%, 33%, 22% and 17%, respectively (Table 2.1). Appendix B lists these *most toxic* pesticides, plus developmental and reproductive toxins, and extremely toxic systemic poisons used during this period. As use of these toxic pesticides increases, so too does the risk of exposure among the farmworker population.

Reported Farmworker Poisonings by Crop, Activity and County

Reported pesticide-related illnesses are not declining in California. DPR reviews about 2,000 potential pesticide poisoning cases every year. From 1991 to 1996 this included 3,991 cases related to pesticide use in agriculture, an average of 665 cases per year. Although the numbers of reported cases were lower in 1993 and 1994 compared to the previous two years, reported cases increased again in 1995 and 1996 to 721 and 761, respectively. (See Appendix A for explanation of data analyses.)

In 1996, in a particularly severe incident in Kern County, 230 grape workers were poisoned by drift from aerial spraying in an adja-

Group Poisonings Are Common

Farmworker poisonings do not occur as a series of isolated individual events. Rather, group poisoning events are common. From 1991 to 1996, 32 group poisoning incidents involving ten to 29 workers were reported, six incidents involving 30 to 49 workers, and three incidents involving 50 to 79 workers. The two recent events below illustrate group poisoning scenarios.

- In July 1998, 34 farmworkers, including a 13 year-old boy, became ill while weeding cotton near Firebaugh, Cali-

fornia. Thirty were taken immediately to a nearby clinic. The cotton field had been treated with the toxic pesticide carbofuran at 4 am and they began four hours of work at 6 am. Although carbofuran has a restricted entry interval¹ of 48 hours and requires both posting of treated fields and verbal notification of workers, neither was provided (CDC 1999).

- In September 1996, 22 farmworkers, including three pregnant women, were taken to a hospital after being

poisoned while harvesting grapes near Bakersfield, California. An additional 225 farmworkers were also exposed when a crop duster sprayed a nearby cotton field with a mixture of toxic pesticides including Lorsban, one of the most widely used insecticides in the U.S. and a leading cause of pesticide poisonings (California OSHA 1997, PAN 1996).

¹ A restricted entry interval (REI) is the period of time required between pesticide application and allowable reentry into a field for hand labor such as weeding and harvesting.

cent cotton field. Although this was an unusually large group, such clusters (“group poisonings”) are not uncommon. Group poisonings occurred in all six years (see box on previous page).

Grapes, Cotton and Broccoli Are Most Dangerous Crops
Ten crops account for nearly half of all reported agriculture-related pesticide illnesses: grapes, cotton, broccoli, oranges, ornamentals, almonds, tomatoes, lettuce, strawberries and alfalfa (Table 2.2). All other crops account for about 22% of reported illnesses, and in about 29% of the cases no specific crop was identified. (See Appendix C for a list of all crops in which poisonings were reported.) Pesticide use data are included in Table 2.2 for nine of the 10 crops listed. Statistical analysis shows a positive relationship between the amount of pesticides used on a particular crop and number of reported illnesses associated with that crop.¹⁰

Gaps in available data limit efforts to pinpoint with certainty which crops and which pesticides used in production of those crops are responsible for the greatest number of farmworker poisonings. The high proportion of cases in which no specific crop was identified (29%) makes it impossible to determine whether some crops account for even more poisonings than the data suggest, or whether additional incidents are more evenly distributed among all crops.¹¹ Furthermore, since data are not available on workforce size for specific crops, the proportion of farmworker poisonings relative to the total workforce for each crop remains unknown.

Similarly, limited data prevent clear identification of specific pesticides directly responsible for farmworker poisoning incidents. While overall pesticide use data are available by crop, data are incomplete with respect to which pesticides may have been associated with reported acute illnesses. Most reported poisoning cases list several possible poisoning agents. Of the 246 compounds listed as possible poisoning agents from 1991 to 1996, 71 (29%) appear on the list of *most toxic* pesti-

Table 2.1. Reported Use of Toxic Pesticides in California, Summary 1991–1995

Pesticide Category	Change between 1991 and 1995
Restricted Use Pesticides	Increased 33% to 48.0 million lbs. /year
Acute Systemic Toxins*	Steady at about 30 million lbs./year
Carcinogens	Increased 129% to 23.4 million lbs. /year
Reproductive Toxins	Steady at about 18 million lbs./year
Endocrine Disruptors	Increased 17% to 15.3 million lbs./year
Nerve Toxins**	Increased 21% to 6.8 million lbs. /year
Total Reported Pesticide Use***	Increased 30% to 208.8 million lbs. /year

* Defined by the U.S. EPA as Category I acute systemic toxins.

** Defined by the U.S. EPA as Category II nerve toxins.

*** Uses include: production agriculture, postharvest treatment, structural pest control, and landscape uses.

Source: Liebman 1997. Some figures were updated using corrected data from California DPR (1998b).

cides in Appendix B. In actual practice these most toxic pesticides constitute a disproportionately large share (43%) of compounds used in the ten crops with the worst record of poisonings (Appendix D). This suggests that as the level of pesticide toxicity increases, so too does the incidence and risk of poisoning.

Drift and Residues Cause Most Farmworker Poisonings

The majority of pesticide poisonings occur when farmworkers are doing fieldwork, such as picking, field packing, weeding, and irrigating. From 1991 to 1996 the two most common sources of exposure leading to pesticide-related illnesses were drift from pesticide spraying (44%) and field residues (33%) (Figure 2.1).

The fact that drift exposure is common indicates that some common application methods, such as aerial spraying and air-blast application, have a propensity to drift off target. Lack of posting and notification requirements when adjacent fields are scheduled for spraying puts fieldworkers in danger as well. The high incidence of field residue exposures indicates that restricted entry intervals (REIs) and field postings—designed to protect workers from residues—are inadequate and/or unenforced.

Gaps in available data limit efforts to pinpoint with certainty which crops and which pesticides used in production of those crops are responsible for the greatest number of farmworker poisonings.

Table 2.2. Acute Poisoning Cases—Top 10 Crops, 1991–1996

Crop	Total Cases							Million lbs. Active Ingredient (1995)
	1991–1996	'91	'92	'93	'94	'95	'96	
grapes	539	102	107	81	54	125	70	58.7
cotton	399	14	44	8	53	23	257	17.7
broccoli	307	115	63	2	6	80	41	1.3
oranges	165	4	52	9	63	26	11	9.9
ornamentals	104	23	25	14	12	23	7	3.4**
almonds	102	18	15	36	10	8	15	12.0
tomatoes	102	25	15	8	23	10	21	14.2
lettuce	101	22	9	37	22	8	3	3.9
strawberries	78	14	22	16	7	5	14	7.1
alfalfa	70	7	1	23	7	22	10	3.4***
Sub total	1967	344	353	234	257	330	449	
all other crops*	880	190	182	129	110	139	130	
no crop given	1144	190	190	140	190	252	182	
Total	3991	724	725	503	557	721	761	

* For a list of all crops included, see Appendix C.

** Illness data were listed for "ornamentals." Pesticide use was reported for nursery and greenhouse products combined, but not separately for ornamentals.

*** Illness data were listed for "alfalfa." Pesticide use was reported for "hay" of which alfalfa is a subset.

Sources: Pesticide illness data from California DPR 1999; Pesticide use data from Liebman 1997.

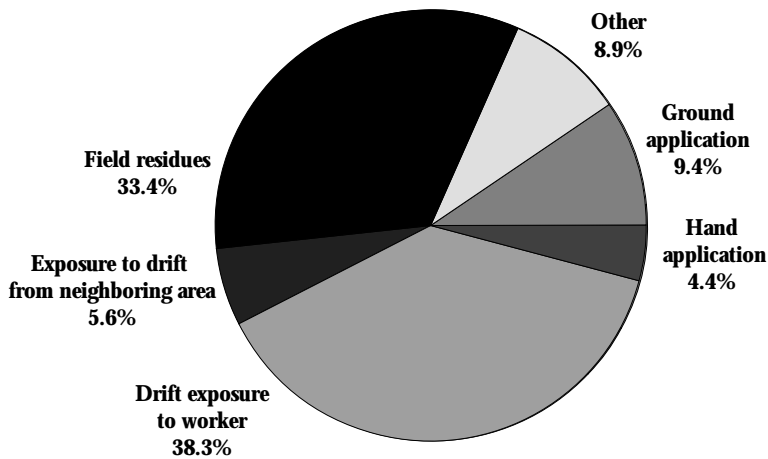


Figure 2.1. Activity or Type of Exposure While Poisoned, 1991–1996
Five activities account for 91.1% of all reported agriculture-related pesticide poisonings.

Source: California DPR 1998.

The profile of activities/type of exposure associated with poisoning incidents varies from crop to crop. Significant variation from the general pattern is found for almonds and strawberries, where ground application of pesticides accounted for 44% and 23%, respectively, of reported poisonings. In addition, hand application of pesticides caused 35% of poisonings in ornamental crops, and drift into neighboring areas accounted for 32% in oranges and 31% in alfalfa (for more details, see Appendix E).

Our analyses are consistent with findings in other reports indicating that the most severe poisoning cases (as defined by length of disability) resulted from early field reentry and exposure during application of highly toxic pesticides such as organophosphates (Weinbaum et al. 1995).¹² A full analysis of poisoning severity is outside the scope of this report.

Most Pesticide Poisonings Reported in Kern, Fresno and Monterey Counties

The greatest number of pesticide poisonings (534) were reported in Kern County, with a

majority of incidents occurring in cotton and grape fields. Fresno and Monterey Counties followed closely, with 515 and 428 reported cases, respectively. The 15 counties with the most reported pesticide-related illnesses between 1991 and 1996 are listed in Table 2.3. In nine of these counties, the majority of reported poisonings had no specific crop listed as a source, severely limiting efforts to target regulatory actions to the most problematic crops. Data from all 48 counties in which pesticide poisonings were reported are listed in Appendix F.

Acute and Chronic Health Effects of Pesticide Exposure

Pesticide exposure can cause both acute and chronic health effects. Acute effects such as vomiting, nausea, dizziness and headaches, fatigue, drowsiness and skin rashes can sometimes be identified and appropriately treated. Long-term or chronic effects such as cancer, birth defects, reproductive problems, developmental problems and nervous system damage are very difficult to link definitively to pesticide exposure since they develop long after exposure and may result from accumulated exposures to a number of environmental or workplace contaminants over many years.

The California pesticide illness reporting system addresses only acute effects. Chronic effects are not accounted for, despite evidence that farm work is associated with elevated risk of several chronic effects (see “Chronic Effects of Pesticide Exposure”) (Stubbs et al. 1984, Zahm et al. 1997).

Acute Effects of Pesticide Poisoning
Acute effects of pesticide poisoning most commonly reported to DPR were skin rashes (23%), systemic symptoms (20%) and eye damage (16%). Systemic symptoms included vomiting, dizziness, and headaches. Eye damage ranged from irritation to permanent damage. Respiratory illness was the sole symptom in only 4% of reported cases, but occurred with other symptoms in 19% of incidents (Figure 2.2). Single symptoms were

Table 2.3. Top 15 Pesticide Poisoning Counties and Major Crops Involved, 1991–1996

County	Total Cases Reported	Main Crop(s)	Percent of Cases by Crop*
Kern	534	Cotton	44.8
		Grapes	22.7
Fresno	515	No crop listed**	30.5
		Grapes	26.4
Monterey	428	Broccoli	35.5
		No crop listed	18.5
Tulare	399	Oranges	35.6
		No crop listed	22.1
San Joaquin	200	No crop listed	58.5
Santa Barbara	180	Broccoli	67.2
Kings	167	Cotton	54.5
Stanislaus	138	No crop listed	51.4
Imperial	128	Broccoli	18.8
		Alfalfa	18.0
		Watermelon	15.6
Merced	127	No crop listed	51.2
Ventura	119	No crop listed	35.3
		Celery	19.3
San Diego	114	No crop listed	23.7
		Ornamentals	14.9
		Flowers***	14.9
Los Angeles	84	No crop listed	58.3
Madera	79	Grapes	45.6
		Almonds/Cotton (9 cases each)	22.8
Riverside	77	Grapes	58.4

* Crop categories listed together for each county account for at least 50% of total poisoning cases in that county.

** When no crop was identified in the DPR data, the term “no crop listed” is used.

*** Different flowers are grouped here and are listed, along with all other crops, in Appendix C.

Source: California DPR 1999.

reported in 63% of the cases. The remaining cases had multiple symptoms.

Not surprisingly, mild to moderate pesticide poisoning may easily be misdiagnosed as stomach-flu, bronchitis or asthma. Even severe pesticide poisoning is frequently misdiagnosed.

“In one review of the medical records of 20 severely pesticide-poisoned infants and children transferred to a major medical center from other hospitals, 16 of the 20 had been

wrongly diagnosed at the time of the transfer. Mistaken diagnoses included bleeding in the brain from an aneurysm, head trauma, diabetic acidosis, severe bacterial gastroenteritis, pneumonia, and whooping cough.” (Solomon and Mott 1998, Zweiner and Ginsburg 1988)

When pesticide poisonings are recognized, it is often difficult to determine conclusively which pesticide or pesticides are responsible. In many cases, more than one pesticide may be used at a time and “inert” ingredients may be responsible for some or all of the observed symptoms. In addition, there are very few inexpensive and commonly available tests to identify the specific pesticide or type of pesticide implicated in a particular poisoning case.

Despite these limitations in available information, researchers have documented the types of pesticides most commonly associated with pesticide poisonings. Organophosphate pesticides (such as oxydemeton-methyl, methyl parathion and methamidophos) are responsible for most of the occupational deaths and poisonings in the U.S. and throughout the world (Blondell and Dobozy 1997, Keifer and Mahurin 1997, Moses et al. 1993, Savage et al. 1988). Organophosphates exert their toxic effects by blocking the body’s production of acetylcholinesterase (cholinest-

erase), an enzyme essential to proper functioning of the nervous system. Symptoms of poisoning by organophosphates and n-methyl carbamates, which also inhibit cholinesterase, include blurred vision, salivation, diarrhea, nausea, vomiting, wheezing, and sometimes seizure, coma and death.

Other major pesticide groups include:

- organochlorines such as endosulfan and DDT (banned in the U.S. in 1972);
- phenoxy and bipyridyl herbicides such as 2,4-D and paraquat (still in use in California), and
- fumigants, such as the highly toxic nerve gas methyl bromide.

Organochlorine pesticides can cause anxiety, tremor, hyperexcitability, and seizures potentially leading to death. A wide range of abnormalities in liver function have been reported in exposed individuals as well (Moses 1992).

Phenoxy herbicides exhibit relatively low toxicity for mammals. However, they can be contaminated with highly toxic dioxins, cause serious dermatitis and may cause birth defects, cancer and damage to the immune system (Costa 1997). Paraquat, a bipyridyl herbicide, is highly toxic and widely used throughout the world. It is a powerful irritant, and acute poisoning can damage the liver, kidney and heart and cause irreversible and progressive damage to the lungs, possibly leading to death. In California, paraquat is frequently applied in backpack sprayers, despite the potentially severe consequences of accidental exposure with this application method. There is no antidote to paraquat poisoning (Moses 1992).

Fumigants such as methyl bromide, 1,3 dichloropropene (Telone) and metam sodium are highly toxic and acutely hazardous to workers. Because they are gases, they are readily absorbed through the lungs, from which they spread rapidly throughout the body, severely affecting the central nervous system, lungs, liver and kidneys. There are no antidotes to fumigant poisoning (Moses 1998).

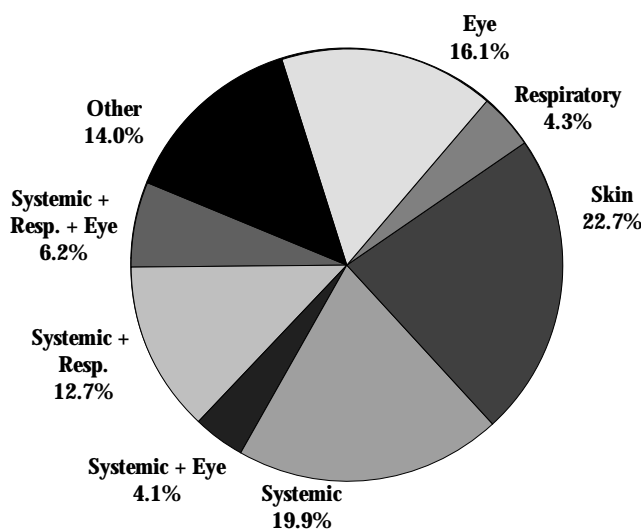
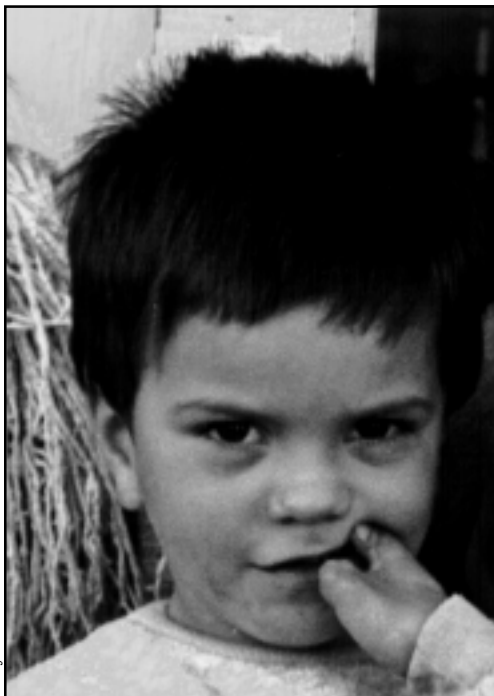


Figure 2.2. Acute Poisoning Symptoms, 1991–1996
All agriculture-related pesticide poisoning symptoms are described as skin, system, eye or respiratory effects alone or in various combinations.
Source: California DPR 1998.

Chronic Effects of Pesticide Exposure

While it is difficult to accurately diagnose acute effects of pesticide poisoning, diagnosis is extremely difficult with chronic or long-term effects. Chronic pesticide-related diseases may not develop until 15 or 30 years after exposure. The inherent difficulty in studying such diseases is exacerbated in migrant farmworker populations, which routinely move from state to state or even country to country.

These barriers mean that despite the fact that millions of farmworkers are exposed over extended periods of time to multiple pesticides, few studies have addressed the relationship between exposure and subsequent illness in this population (Levine et al. 1990). In 1993 the federal government conducted a nationwide analysis of all federal and state pesticide health monitoring systems, with a focus on farm-related exposures. Except for a few research studies, monitoring systems only included acute illnesses; none addressed delayed-onset or chronic effects. At the time of the study, only 25 states had laws or regulations requiring any pesticide illness reporting and only California had categories specific to



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Many pesticides are known to cause birth defects.

illness associated with occupational exposure to pesticides on farms (U.S. GAO 1993).¹³

Although very limited data are available, studies which have been conducted show disturbing evidence of chronic effects of pesticide exposure among farmworkers. The following is a brief summary of some of these findings:

Cancer: One cancer study conducted in 1993 found that when compared to the general population, both farmers and farmworkers have increases in multiple myeloma and cancers of the stomach, prostate and testis. In addition, farmworkers show unique increases in cancers of the mouth, pharynx, lungs and liver (Zahm and Blair 1993). The study also suggested that the true risk of elevated cancer among farmworkers may actually be higher, since farmworkers also experience higher death rates due to accident and other diseases.¹⁴

Birth defects and stillbirths: Although increased numbers of birth defects have been recorded among farm area residents (Garry et al. 1996), very few studies have looked at birth defects among farmworkers. In one study of 990 single births in Imperial County, limb reduction defects occurred among offspring of agricultural workers three to 14 times more frequently than among the general U.S. population (Schwartz et al. 1986). The risk was greatest for mothers residing in counties with high agricultural productivity (2.4 times) and high pesticide use (3.1 times). In another study, occupational exposure to pesticides during the first and second trimesters increased the risk of stillbirths and early neonatal deaths by 5.5 and 4.8 times, respectively, compared to unexposed groups (Pastore et al. 1995).

Developmental effects: Many pesticides are known to disrupt the human endocrine system. The endocrine system is a complex array of glands, organs and tissues that secrete hormones (chemicals produced by the body) into the bloodstream and regulate a range of

Although limited data are available, studies show disturbing evidence of chronic effects of pesticide exposure among farmworkers.

physiological and neurological systems.¹⁵ Reproductive organs appear to be at particular risk for developmental abnormalities when pregnant women are exposed to endocrine-disrupting chemicals.¹⁶ In both sexes the brain, skeleton, thyroid, liver, kidney and immune system are also potential targets for endocrine-disrupting chemicals (Colborn et al. 1993). Since endocrine-disrupting chemicals persist in body fat, they may also exert their effects long after exposure.

Even with limited data available for both acute and chronic effects, a startling picture emerges of the dangers facing the thousands of farmworkers working in California's agricultural fields. In the following sections, we explore in more depth the barriers farmworkers face in coping with and documenting pesticide poisonings, as well as the limitations in the enforcement systems designed to protect them.

3 Many Pesticide Poisonings Are Not Reported

Jaime has worked for a strawberry grower for several years.¹⁷ In 1996, his hand was blistered by a pesticide. He went to his doctor for treatment and was told to get a list of all the pesticides used in the fields where he worked. His supervisor refused his request and told him pesticides could not have caused the burn. Jaime returned to work.

“My hand was covered with oozing blisters. I worked until noon, and when I took off my gloves to eat, the glove for my right hand was full of liquid and a lot of skin had come off. It made me nauseous; I couldn’t eat and I decided to leave. I wanted to get Workers’ Compensation but the company didn’t agree. They did not believe me and they said that I should have gone to the company doctor. My supervisor also said that he wanted to see a blood sample. The dermatologist said that [blood work] had nothing to do with it because it was an external injury. I felt that the supervisor was just trying to threaten me.

“Finally, in order to get Workers’ Compensation I had to go to the company doctor. The company doctor told me that I should have gone to him earlier and that I was only trying to take advantage of the company. I told him that I did not like the service there and that I had only come because the company had sent me. He did not believe me and insisted that I was only trying to take advantage of the company. Finally, after many problems, I was able to get Workers’ Compensation, which I had deserved since the beginning.”

Jaime’s experience was better than most: he eventually succeeded in obtaining Workers’ Compensation. Many farmworkers injured by pesticides never see a doctor or receive Workers’ Compensation for their injury. The few analyses available indicate that nationwide, the majority of pesticide poisoning cases are never diagnosed or reported (Blondell 1996, U.S. GAO 1993).¹⁸

This chapter highlights the experiences of farmworkers whose pesticide poisonings go unreported and in many cases untreated. We examine various barriers to treatment and reporting of pesticide injuries and illnesses, including limited access to medical care, lack of information and training, employer intimidation and limited training of physicians regarding diagnosis and reporting of pesticide poisonings.

We then highlight some of the policy impacts of underreporting, including lack of attention to farmworker occupational health and safety, chronically underfunded medical services for the farmworker community and continued reliance on dangerous pesticides throughout the agricultural industry. More accurate re-

porting of poisonings would provide state officials, regulators and the public with a much clearer understanding of the full scope of the pesticide problem among farmworkers and more impetus to move toward solutions.

Most Farmworkers Lack Health Insurance and Access to Medical Care

The National Agricultural Workers Survey estimates that a majority of the 600,000 California farmworkers and their families have no health insurance of any kind—either individual or employer-provided (Rosenburg et al. 1998). Some uninsured farmworkers can seek treatment at federally funded migrant health clinics, but far too many simply go without treatment. Recent immigrants, now ineligible for Medicaid as a result of recent “Welfare Reform,” are now even less likely to seek medical treatment for work-related injuries.

Most farmworkers have limited access to routine medical screening and preventive care. A small minority who mix, load or apply pesti-

Most farmworkers do not know the names of the chemicals being used in the fields where they work.

cides directly and handle certain pesticides more than six days per month are required to participate in a medical surveillance program that includes testing for excessive exposure to these pesticides.¹⁹ Without more widespread screening and testing, the few blood tests available to identify poisoning by specific pesticides are not being used to diagnose or monitor pesticide exposure in the majority of farmworkers.

Although agricultural employers are required to carry Workers' Compensation insurance to cover medical expenses and time taken off from work when related to all occupational injuries and illnesses, this safety net has not

proven effective in the treatment of pesticide poisonings. The physicians or clinics that growers hire to cover their "Workers' Comp" cases are often a source of frustration for injured workers. Some complain that these "company doctors" provide minimal treatment and send them back to the field. Others find that these physicians are inclined to protect the company from Workers' Compensation costs, and therefore minimize workers' injuries or diagnose their conditions as unrelated to work (farmworker testimonies).²⁰

Some workers who seek medical attention for workplace injury—particularly for difficult-to-diagnose pesticide-related illnesses—are either denied medical attention or threatened with being billed if the case is not conclusively proven as caused by workplace exposure to pesticides.²¹ Many workers know from personal experience that pesticide poisoning is difficult to prove without cooperation of the grower in providing precise information about the chemicals to which the worker(s) may have been exposed.

Workers Are Not Provided with Adequate Information and Training

Most farmworkers, including many pesticide applicators, do not know the names of the chemicals being used in the fields where they

work. While growers are required to train workers regarding the general risks and symptoms of poisoning, agricultural laborers are not covered by the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard, which requires employers to inform workers of the risks associated with each chemical in the workplace (OSHA 1983).

Unfortunately, many farmworkers never receive even the minimal training required, let alone the level of information provided by law to workers in non-agricultural workplaces who may be exposed to toxic chemicals. During the course of several routine inspections in California's Central Coast, county officials noted that individual pesticide applicators and sometimes whole crews of strawberry workers and their supervisors had not received training regarding the symptoms of pesticide exposure.^{22, 23} Dozens of county inspections revealed that farms lacked the mandatory postings and written warnings regarding the risks of pesticide exposure (Appendix G).

As noted above, this lack of information can mean that sickened workers are not adequately diagnosed or treated, even if they do seek medical treatment. It can also mean that workers are deprived of their legal rights under California's Proposition 65. This 1986 law requires that workers potentially exposed to chemicals known to cause cancer and/or reproductive harm must be informed of such dangers. Many farmworkers never receive such a warning.

Grower Intimidation and Interference Silence Many Workers

The primary reason farmworkers are unlikely to report pesticide-related injuries and illnesses is fear of employer retaliation. For example:

- When Magdalena fell ill during her work as a picker at a large strawberry farm in Watsonville, California, she told her foreman that she believed her nausea and vom-

iting were a result of pesticide exposure. She was grudgingly given permission to go to the company doctor, with a warning that she would have to pay for the visit herself if the doctor didn't declare her illness to be pesticide-related. Within days, she was fired.

- When Carla and several other co-workers smelled chemicals in the air, many of them felt nauseous. Carla doubled over and vomited in the field, retching even after her stomach was empty. She was brought to the office and questioned. Her husband, also a strawberry worker, had to leave the field and drive her to the clinic. After a couple of days of bed rest, Carla returned to work. The company management did not speak to her or ask how she felt. At the end of the season, she was not recalled to work for the company, and they refused to give her job back for two years.

The experiences of Magdalena and Carla are not uncommon, and most farmworkers are aware of such cases. Some workers who ask to see a doctor are told that if they are found to be in any way fraudulent in their claim, they will be prosecuted for up to \$50,000 under Workers' Compensation fraud provisions.²⁴ Threats and retaliation keep a blanket of silence around work conditions that can include not only pesticide exposure, but pay scales well below minimum wage, sexual harassment and even threat of physical harm if workers blow the whistle on their employer. If workers are undocumented, their immigration status further silences them due to fear of deportation.

Worker complaints of chemical smells in the air, headaches, itching skin and nausea are often ignored and sometimes belittled by employers. Some are told that they must have the flu, others that they must "be hungover" or have "eaten bad tacos."²⁵ The examples below provide additional evidence of the type of ridicule and intimidation farmworkers often face from employers:

- After 32 workers were poisoned by a potent nerve toxin, carbofuran, in a cotton field near Fresno, their foreman's initial re-

Growers Discourage Injury Reporting

Increasingly, growers implement "incentive programs" that serve as a disincentive for injured workers to report accidents or work-related illnesses. The programs offer a barbecue or small bonus to a crew of 30 to 60 workers if no individual in the crew reports an injury. In this way, employers use peer pressure to discourage reporting and disingenuously portray these programs as "health and safety" programs.

sponse was that they must have eaten bad meat the night before. He offered milk and Maalox to soothe their stomachs. Only after several workers stumbled out of the field, some of them projectile vomiting, did the foreman and labor contractor send them to a clinic. Even then, many of the workers, disoriented and sickened by the toxic pesticide, had to drive themselves several miles to the clinic before they were decontaminated and treated.

- In Monterey County, an agricultural inspector met with a worker who had an initial complaint of rashes and blistering hands which he believed to be a result of pesticide exposure in the strawberry field where he worked. The inspector met with the injured worker and several others in a secluded spot where the workers told him that they feared their employer would shoot them for blowing the whistle on him. They continued to detail a wide variety of problems ranging from pesticide exposure to minimum wage violations, months of unpaid work and physical threats from their employer.

Retaliation against injured workers is illegal but all too common, and can have a chilling effect on an entire workforce. Federal and state laws prohibit retaliation against workers exercising their rights, but until these laws are effectively enforced, they offer little consolation to an injured—or fired—worker.

Retaliation against injured workers is illegal but common, and can have a chilling effect on an entire workforce.

Doctors and Clinics Need to Improve Reporting

Many doctors are unaware that they are required to report any illness suspected of being related to pesticide exposure, even when definitive diagnosis is not possible. Pesticide illnesses can be extremely difficult to diagnose. Many symptoms are systemic, and resemble those of the flu. In addition, the sheer number of chemicals potentially involved in a given incident can be staggering. Accurate diagnosis is further hampered by the fact that many workers have not been trained or provided with adequate information about the chemicals they may have been exposed to in the fields.

The effectiveness of DPR's Pesticide Illness Surveillance Program depends heavily on accurate and timely reporting by doctors of suspected pesticide poisonings. Yet doctors who frequently treat farmworkers report that they are over-burdened with enormous case loads, and either lack time to fill out paperwork for pesticide reporting or are simply unaware of the state's reporting requirements. OSHA has had authority to fine doctors for failure to report pesticide illness for years but has failed to do so. Recent regulatory changes allow the California

Medical Board to cite and fine physicians for failing to report specific diseases, including suspected pesticide illnesses.²⁶

The requirement to report, however, does not make reporting a reality. Many cases are identified through reviews of Workers' Compensation reports, rather than being directly reported to the county health department or agricultural commissioner. When weeks pass before a county learns of an incident, it can be extremely difficult for a thorough investigation to take place, and the incident is likely to be considered only "possibly" related to pesticides.

Policy Impacts of Underreporting

Close to 4,000 agricultural poisoning cases were documented in California between 1991 and 1996 (and an as yet untallied number since then). Federal and state agencies acknowledge that documented poisoning statistics greatly underestimate the size and scope of the problem, and ignore the chronic health impacts of pesticide exposure (Pease et al. 1993, U.S. GAO 1993). This underestimation perpetuates problems of inadequate farmworker medical services, lack of attention to farmworker health and safety, and continued reliance on dangerous pesticides in California agriculture.

Medical services available to farmworkers are limited and suffer from chronic underfunding. Federally-funded migrant clinics are only able to treat a small portion of the hundreds of thousands of farmworkers and their families who are uninsured in California. Many workers rely on emergency room services or simply go without medical care. Possible poisoning victims are untreated and incidents are unreported when farmworkers have no access to health care in areas chronically short of physicians and hospitals (Slesinger 1992). Farmworkers, who are known to suffer high injury and death rates as a result of their work, clearly need additional resources for medical services from state and local governments as well as their employers.

Scant attention to farmworker health issues reflects little political will to protect farmworkers from on-the-job hazards, including pesticide exposure. Farm work is consistently ranked among the top three most hazardous occupations in the U.S., and farmworkers suffer the highest rate of chemical-related occupational illness of all job categories in the country (Bureau of Labor Statistics 1987). Yet other hazardous industries have received much more attention from OSHA. Since its creation, OSHA standards, regulation and enforcement have brought about significant decreases in injuries in manufacturing and construction. For ex-

Farmworker poisonings result from routine, legal agricultural applications of pesticides, as well as violations of regulatory protections.

ample, the Mine Safety Act has reduced injury rates in mines by 57% since 1973. By contrast, agricultural injury and illness rates remain among the highest in the nation, ranging from 9.4% to more than 12% between 1990 and 1996 (AFL-CIO 1999, Bureau of Labor Statistics 1995, Runyan 1993).

Direct comparison between the federal government's response to mining versus agricultural health problems reveals particularly stark inequalities. Agriculture and mining are the two most hazardous industries in the country. Yet on a per worker basis, the federal budget for occupational safety in 1985 was estimated to be \$4.34 per worker for all industries, \$181 per mine worker and only 30 cents per agricultural worker (Schenker 1991).

The continued increase of pesticide use in California is another reflection of the lack of concern at the policy level regarding farmworker exposure to pesticides. Farmworker poisonings result from routine,

legal agricultural applications of pesticides, as well as violations of regulatory protections. Economically viable non-chemical alternatives exist and are in use on many crops throughout the state, particularly in the burgeoning organic production sector. Information about many of these alternatives, however, is not widely available to growers, who rely heavily on information provided by private pest control advisors. Recognition of the full scope of farmworker poisonings would contribute to the urgency of promoting safer and sustainable alternatives.

Farmworkers often fall through cracks in the system. Many workers have learned from painful experience that politically and economically powerful agribusiness interests often outweigh farmworkers' rights in setting regulatory and enforcement priorities. As a result, significant health needs of the farmworker community remain largely unmet, and pesticide poisonings continue.

4 Enforcement of Pesticide Laws Is Weak and Uneven

Inspection Finding: Paraquat [extremely toxic herbicide] being used without waterproof apron, faceshield or closed loading system. Worker wearing sandals. No training or supervision. No soap for washing. No current use permit or Notice of Intent. Grower told inspector that “applicator jumped the gun.”

Consequence: Told to comply with the law—no monetary fine.

—Santa Cruz County 4/6/98

Farmworker experience shows that even applications which follow the letter of the law can result in exposure or illness. Thousands of farmworkers are legally exposed to pesticide residues every year in California’s agricultural fields. The risk of poisoning is even higher, however, when laws designed to protect workers from pesticide exposure are not effectively enforced.

On its face, California’s system for enforcing pesticide laws is impressive. Agricultural commissioners’ offices in 55 of 58 counties have a duty to conduct numerous annual “spot

check” inspections of pesticide use practices and records and to investigate episodes of suspected pesticide poisoning or misuse. Investigations are triggered when pesticide illness reports are filed with the county or when a worker or other individual files a complaint with the agricultural commissioner about pesticide misuse. The Santa Cruz County inspection outcome above, how-

ever, provides a sobering example of the system’s shortcomings.

A few counties do conduct fairly thorough inspections and investigations and issue fines for violations quite regularly. Unfortunately, these counties are the exception rather than the rule, and they are generally counties with less intensive use of pesticides. Inherent conflict of interest, inadequate training of inspectors, a practice of not issuing fines for most violations and a low fine structure all contribute to weak enforcement of pesticide laws.

Commissioners Avoid Issuing Fines

County agricultural commissioners’ jobs include the sometimes conflicting duties of promoting prosperity of conventional agriculture and enforcing pesticide safety laws. In each county, the elected Board of Supervisors approves the appointment of the agricultural commissioner. This political situation exacerbates the conflict for commissioners in counties where agricultural interests have considerable political power.

Inspections of farms and pest control operations are also often less than thorough because, unlike OSHA inspectors, agricultural inspectors have no special training in industrial hygiene (identification, assessment and control of work hazards). Many inspectors do not speak Spanish, rendering questioning of farmworkers during routine inspections impossible and delaying interviews during poisoning investigations.

Agricultural commissioners issue fines for only about a tenth of the violations they document. In FY 1996/97, only 657 civil penalties (fines) and 184 orders to immediately “Cease and Desist” unsafe pesticide use were issued statewide for pesticide violations (Figure 4.1). The vast majority of actions (5,153) were “Notices of Violation” and “Letters of Warning,” which carry no fine and are not recorded in permanent statewide records. This means that for more than 85% of the documented violations for this period, no central record exists of either the nature of violation or the names of businesses receiving

No county in the Central Valley, the state’s agricultural heartland, issued more than an average 25 fines per year.

warning notices. As will be detailed below, hundreds of additional violations result in no action whatsoever.

Fines for Violations Are Low

Serious pesticide violations are defined as violations “creating an actual health or environmental hazard” or repeat violations “posing a reasonably possible health or environmental hazard.” The required fine ranges from \$401 to \$1,000, as specified by state regulation.²⁷ Higher penalties are possible if cases are referred for criminal prosecution, but this almost never occurs (averaging less than one case per year statewide). Fines for moderate violations, which “pose a reasonable possibility of creating a health or environmental hazard” or are repeat record-keeping violations, range from \$151 to \$400. Fines for minor violations which pose no health or environmental hazard may be less than \$151.

From 1991 to 1997, almost half of all fines issued statewide were less than \$151, and less than 5% exceeded \$1,000 (Figure 4.2 and Appendix H). The few large fines issued typically resulted from investigations of pesticide drift or early field reentry affecting large crews of workers. This approach is analogous to the highway patrol issuing speeding tickets only when a huge pile-up occurs, and just sending a letter that says, “Please don’t speed” to other violators.

By comparing the five counties issuing the greatest number of fines to the five counties which reported the most agricultural pesticide use for 1995, it is evident that counties with greater agricultural pesticide use and more cases of agricultural pesticide illness issue very few fines (Table 4.1). These include four Central Valley counties where leading labor-intensive crops include grapes and citrus, and Monterey County, a leading producer of lettuce, broccoli, and strawberries, crops also harvested by hand.

No county in the Central Valley, the state’s agricultural heartland, issued more than an average 25 fines per year. Fresno County, for example, approved 7,857 permits for restricted pesticide use in FY 1995/96 and re-

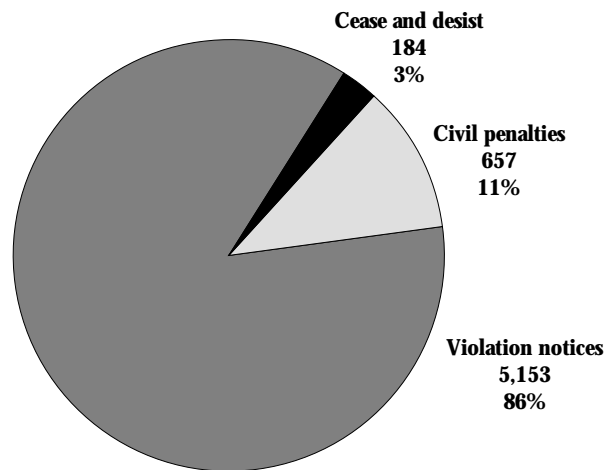


Figure 4.1. Statewide Pesticide Violation Actions, FY 1996/97

Source: California DPR 1997a.

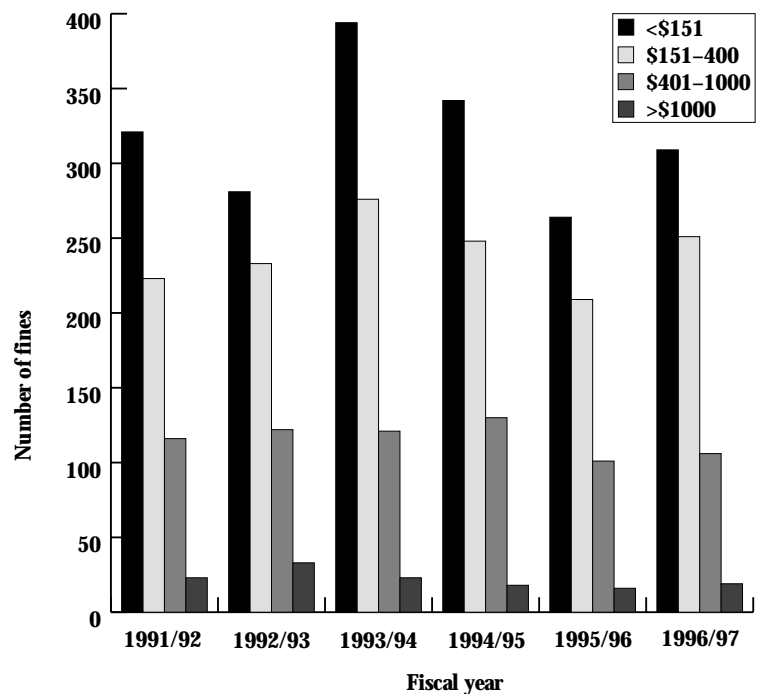


Figure 4.2. Statewide Fines, FY 1991/1992–1996/97

Source: California DPR 1998a.

Table 4.1 Top Five Counties for Agricultural Pesticide Fines vs. Top Five Counties for Pesticide Use

County	Avg. # Fines/yr. (1991–1997)*	Avg. Total Amount of Fines/Yr.	Pesticide Use** (1995)	Restricted Use Permits (1995–1996)	Pesticide Illnesses (1996)
Los Angeles	124	\$24,885	208	474	8
Orange	53	9,281	994	570	6
San Luis Obispo	42	10,673	161	955	2
Sacramento	43	9,793	2,429	606	5
Riverside	40	11,194	4,471	823	5
Kern	24	9,337	24,108	2,166	268
Fresno	19	8,634	39,805	7,857	99
Tulare	17	8,402	17,927	5,809	43
Monterey	12	5,458	10,122	1,395	50
San Joaquin	7	2,458	11,646	3,328	30

* Annual averages of number and dollar value of fines from FY 1991/92 to 1996/97.

** "Pesticide use" is agricultural pesticides, listed in thousands of pounds of active ingredient (Liebman 1997).

Sources: California DPR 1998a, 1997a.

ported 99 cases of pesticide illnesses. Yet this county assessed an annual average of only 19 fines for pesticide safety violations in FY 1991/92–1996/97. In contrast, primarily urban Los Angeles County approved only 474 permits and issued an average of 124 fines annually. (See Appendix I for the enforcement record of all counties.) For FY 1996/97 (most recent data available) the Central Valley counties of San Joaquin and Stanislaus assessed no fines. Both are among the top ten counties for agricultural pesticide poisoning (Table 2.3).

Pesticide Handlers Are Unprotected, Fieldworker Safety Is Neglected

Between FY 1991/92 and FY 1995/96, a total of 2,781 pesticide handler safety violations led to fines, indicating that handlers were not receiving legally required protection. During the same period, only 216 fieldworker pesticide safety violations led to fines (Table 4.2).

Pesticide Handlers Are Not Receiving Proper Protection

Workers who mix, load and apply pesticides ("pesticide handlers") are at the highest risk of death or severe acute poisoning because they handle concentrated pesticide formulations. The cornerstones of pesticide handler safety regulations are requirements for training, use of protective gear and clothing to reduce exposure, and provision of washing facilities to clean up after exposure. The profile of violations resulting in fines reveals that protective gear and training are frequently lacking. Failure to use, provide or maintain protective equipment for pesticide handlers was cited 1,155 times between 1991 and 1996.²⁸ (For details see Appendix G.)

Frequent failure to provide and maintain protective gear and closed systems is alarming

Table 4.2. Types of Safety Violations Cited that Resulted in Fines, 1991/92–1995/96

Violations	# Times Cited	% of Total
Pesticide Handler Protections:	2781	72.7
Protective Gear and Equipment	1679	
Training/Supervision/Warning	653	
Emergency Medical Care/Wash Facilities	449	
Drift, Negligence, Unlicensed Businesses	831	21.7
Fieldworker Protection	216	5.6

Source: California DPR 1998a.

and inexcusable. It is not, however, surprising to find that citations for failure to wear the gear are common. Protective gear, such as gloves, coveralls and respirators, is uncomfortable and unbearably hot in summer weather and can be cumbersome and slow down work. Because of these limitations, occupational health and safety experts consider personal protective gear the least desirable form of protection (Soule 1991). Emphasis must be shifted to eliminating use of the most toxic pesticides and providing engineering controls, such as enclosed tractor cabs with air filters.

Inadequate pesticide handler safety training was involved in 536 fines during the five-year period. Inadequate emergency medical care provisions for pesticide handlers played a part in 247 fines. A 1992 Monterey County poisoning case²⁹ illustrates the perils of delayed emergency treatment and inadequate training:

A 22 year-old pesticide applicator splashed the extremely toxic insecticide Phosdrin on himself when handling an improperly closed container. He was directed to shower and then go back to work applying Phosdrin throughout his shift. He began to feel ill but worked the full shift because he was afraid of reprimand. On the way home from work he drove to the doctor. His blood cholinesterase was found to be depressed 75% below baseline, the level needed for proper nervous system function. He was hospitalized and treated. It took over two months for his cholinesterase to return to baseline levels.

Fieldworker Safety Is Neglected
Current fieldworker pesticide safety regulations are designed to protect fieldworkers by prohibiting work in fields immediately following pesticide application and during restricted entry intervals (REIs). Provision of wash-water, soap and towels in fields is also required, as is posting of general information about pesticides. These regulations have major weaknesses. The U.S. EPA acknowledges that most REIs are set to prevent acute poisoning, but are not designed to protect workers from chronic health effects (U.S. EPA 1992). Workers are supposed to be directed to bathe and change to clean clothes at the end of each workday. However, they often



Jocelyn Sherman, UFW

Fieldworkers are frequently exposed to pesticide drift

lack adequate access to showers, extra clothes and laundry facilities to follow this advice. Workers do not know which fields to stay out of because posting is only required if the REI is eight days or greater or if posting is required on the label. Otherwise only oral warnings, notoriously unreliable and impossible to trace, are required.

From FY 1991/92 to 1995/96 only 216 violations of farmworker pesticide protections, such as REI violations, failure to provide wash-water, and failure to post treated fields, resulted in fines. Unfortunately, the small number of fines related to fieldworker safety violations does not mean all is well. Over this same time period agricultural commissioners conducted 15,028 fieldworker inspections statewide and noted 2,888 safety violations or “non-compliances.”

This disturbing record of neglect of hazards to fieldworkers must be reversed. Appropriately targeted, thorough fieldworker safety inspections with fines levied for violations could have a significant impact in documenting these violations and promoting better protection of fieldworkers.

This disturbing record of neglect of hazards to fieldworkers must be reversed.

When No Violation Is Found, Worker Illnesses Are Ignored

County inspectors are in the best position to monitor how well laws are protecting workers. However, in the two episodes highlighted below, workers clearly became ill but the cases were closed without further follow-up because no specific violations were found:

"I started working in this field about 9:30, moving pipe . . . when I started to get a headache and feel nausea. By the time I finished the row, the symptoms were strong. I could smell an odor in the field. The supervisor took me to urgent care. . . . No blood sample was taken until the next day."

Report Conclusion: The restricted entry interval for Metasystox R expired at 2:30 am. The irrigator entered the field about 7 hours later and his illness complaint was handled correctly by the supervisor. No regulations were violated, and no action will be taken at this time.

—Santa Barbara Investigation 10/21/98
(Santa Barbara Episode #1998-994)

[A worker] was spraying the end of the strawberry field. . . . The wind was blowing five to seven mph south to north. This was the direction he was traveling when pesticide got in his eyes around the goggles he was wearing. . . . Later he was experiencing redness and itching around both eyes.

Report Conclusion: Because label requirements were followed for personal protective equipment and the application method was done in a suitable manner, no violation [enforcement action] is recommended.

—Monterey Investigation 6/6/97

A Closer Look at Worker Safety Violations: County Case Studies

A sample of pesticide exposure investigation reports and pesticide use inspection records for 1995–1998 was collected from the top strawberry producing Central Coast counties of Monterey, Santa Barbara, Santa Cruz and Ventura to get a closer look at the types of violations found and actions taken. This summary is limited to worker safety violations and does not include use reporting or other record-keeping violations.

Information on these specific inspections was requested because strawberry production is both pesticide and labor intensive. In the strawberry industry growers use as many as 148 different pesticides in various formulations, often in combinations of up to four pesticides. Strawberries are the most chemical

intensive crop in the state of California (Liebman 1997) and also one of the most labor intensive, with a harvest season that extends for eight to nine months of the year. For every strawberry worker, an estimated 200 pounds of pesticides are applied.³⁰

This review of county records reveals a disturbing pattern of failure to issue fines for violations that create a clear risk of injury or illness (see Appendix J for full summary of findings):

- Failure to provide wash-water, soap and towels for fieldworkers resulted in a Notice of Violation in only 28 instances and a minimal \$151 fine in three instances. In contrast, field sanitation regulations require CalOSHA inspectors to assess a minimum \$750 fine for inadequate handwashing facilities for fieldworkers.³¹
- In 75 instances, failure to provide adequate protective gear for pesticide handling resulted in no action or only a Notice of Violation.
- Fines were rarely assessed for repeat violations uncovered in repeat inspections of a single employer's farm or spray operations.

Monterey County

Review of 192 pesticide field inspections conducted in Monterey County between 1995 and 1998 show that numerous violations with clear potential to cause illness resulted in no fine (Table 4.3). These included 40 violations of protective gear requirements; 11 instances of failure to provide washing facilities for fieldworkers; ten violations of Monterey County's field posting ordinance, which requires posting in fields after application of any pesticide with a reentry interval of at least 24 hours; four violations of statewide posting requirements; and five instances of use of equipment unsafe to operate.

Sixteen pesticide episode investigations conducted between 1996 and 1998 were reviewed. Fines were assessed as a result of five of these investigations. While four fines were in the serious range, they seem very low given the extent of worker illness and risk of illness in each case:

Table 4.3. Monterey County Summary

Type of Violation or Hazard	No Action	Notice/Warning	Fine*
Pesticide solution draining down road towards workers			\$300
No soap for mixer/loader/applicators			\$300
Use of high toxicity organophosphate above legal rate without protective gear			\$500
Crew allowed into posted field became ill			\$2,000
Crew weeding in posted field but no illness			\$200
Spraying within 500 ft. of road during school bus hours			\$150
Equipment in poor repair caused exposure and illness			\$400
Pesticides transported in van with workers		1	
No emergency medical care plan		3	
No washing facilities for applicators		6	
No Monterey County required field posting	2	8	
Fieldworker Pesticide Info Sheet A-9 not posted at field	7	22	
Adequate protective gear not provided	2	38	
Application equipment not safe to operate		5	
Inadequate respiratory protection program	1	7	
Violations of statewide posting requirements		4	
No washing facilities for fieldworkers		11	
No application-specific fieldworker training	3	3	
Violation of methyl bromide worker buffer zone		2	
Methyl bromide reentry interval violation		1	
No applicator training		6	
Field supervisor not trained		3	
Safety/training violations for methyl bromide field fumigation			\$800
Methyl bromide buffer zone misrep., worker entry, ripped tarp			\$3,000
Insecticide drift resulting in illness of 12 fieldworkers			\$2,000
Percent of Total	10%	84%	6%

* Each fine specific to one episode. Fines for record-keeping violations not listed here.

- Drift of diazinon applied by an airblast sprayer in a neighboring apple orchard resulted in illness in 12 strawberry harvesters. The applicator was fined \$2,000.³²
- A grower was fined \$800 for not training two individuals who worked as shovelers in a methyl bromide application and for directing one worker to enter the fumigated field to repair the tarp without testing the air or providing respiratory protection. An additional \$400 fine for allowing a worker to enter the buffer zone while working as a field-guard was overturned on the grounds

that the worker may only have spent a brief time in the buffer zone. For the same incident, the fumigation company was also fined \$3,000 for misrepresenting the residential buffer zone on the permit, sending employees to repair the tarp without air monitoring or respiratory protection, and allowing the tarp to become damaged.

- A crew of 27 harvesters became ill after working for two hours in a field treated just a day and a half earlier with the organophosphate Metasystox R, which has an REI

of 72 hours. The grower and contractor were each fined \$1,000.

- A crew of four was found weeding in a posted field during an REI but the fine was only \$200 because “no illnesses resulted.”
- A greenhouse was fined \$500 for failure to provide protective gloves and clothing and for use of a highly toxic organophosphate above the allowable label rate, resulting in illness of the applicator.
- A grower was fined \$400 for failure to maintain safe equipment after a leaky valve caused applicator exposure and illness.
- As a result of a property loss investigation, compensation of \$1,500 was paid for damages from herbicide drift on a strawberry field.³³
- The agriculture commissioner’s office was contacted the day a worker first went to a doctor, who removed her from work for a week due to a depressed cholinesterase level.³⁴ The commissioner’s office attempted to contact the ill worker at the doctor’s office but for unexplained reasons did not visit the worksite until two weeks later. By that time it was too late to sample plants and the greenhouse floor for organophosphate pesticides. The employer denied using pesticides other than bleach. Sales records were not checked, and the names of household pesticides found in the storage area were not listed in the report.

Delays can seriously compromise investigations because pesticide residues degrade and memories fade.

Santa Barbara County
Half of the 18 Santa Barbara pesticide exposure investigations reviewed had unexplained delays in physician reporting to the agricultural commissioner, delays in commissioner initiation of investigation, or both.³⁵ Delays can seriously compromise investigations because pesticide residues degrade and memories fade.

Treatment of fumigant drift incidents was inconsistent. One October 1996 investigation, triggered by a neighbor’s complaint about a methyl bromide field fumigation,

resulted in a \$450 fine for drift, violation of the buffer zone and holes in the fumigation tarp. In contrast, a similar complaint about illness from drift of the fumigant metam sodium resulted in only a “Letter of Warning,” even though permit conditions were clearly violated.

In three investigations, safety violations were clearly documented but no fines or even written violation notices were issued. In two of these instances, repair of contaminated equipment was conducted without proper training or protective gear. In the third, improper use of valves caused organophosphate insecticide to spew onto the handler; the mistake was attributed to “human error” rather than inadequate training and supervision. In one case of potential drift affecting a crew of fieldworkers, no field samples were taken to assess extent of drift.³⁶

One hundred and twelve violation notices and five inspection reports were also reviewed. Santa Barbara County was quite proactive in levying fines for methyl bromide permit condition violations. In three instances of methyl bromide buffer zone violations and eight instances of violation of the county’s specific ambient temperature permit condition, the violators were assessed \$300 fines. Fines of \$151 were assessed in three instances for failure to provide washing facilities for fieldworkers, but only violation notices were issued in 17 other instances. Fines of \$151 were assessed twice for failure to wear protective gear, but no action was taken in four other violations of protective gear requirements.

Santa Cruz County
A review of 93 pesticide use inspection reports for Santa Cruz County for 1997 and 1998 revealed numerous violations with clear potential to cause human illness which resulted in no fine. These included 31 instances of failure to provide adequate protective gear, and ten instances of unsafe use of the highly toxic herbicide paraquat, which is corrosive to skin and eyes and can cause lung damage and even death.

Safety violations in paraquat use included mixing and loading without closed systems,

applying paraquat with backpack sprayers without required protective clothing, lack of washing facilities at the application site, mixing paraquat at twice the legal rate, and not preventing spills from spreading.

Only six violation notices were issued. For the other inspections where violations were found, no action was taken.

Ventura County

Inspection Finding: On February 7, 1996, fieldworkers were harvesting strawberries during a restricted entry interval (REI); an inspector stopped the operation. On February 8, 1996, during the same REI, the farm operator sent the fieldworkers back into the treated field.

Consequence: No enforcement actions were taken (California DPR 1997b).

The Ventura County agricultural commissioner's office has recently come under public scrutiny for falling short in carrying out its duty to enforce pesticide regulations and for failing to take necessary actions to protect workers and the public from pesticides. The reappointment of Agricultural Commissioner Earl McPhail, who has held his post for 20 years, is currently in jeopardy. Program deficiencies pointed out in DPR Annual Effectiveness Evaluations include multiple instances of failure to issue fines for serious or repeat violations, failure to issue any fines for FY 1995/96, failure to conduct enough inspections, and failure to complete investigations in a timely manner.

The Ventura County agricultural commissioner has had \$11,000 of funding (from the

pesticide mill tax) withheld by DPR since 1994 due to these serious pesticide enforcement program weaknesses. DPR conducts both annual and semi-annual evaluations of each agricultural commissioner's office, but rarely takes the action of withholding funding for enforcement program deficiencies. Ventura County inspection records are not presented in this report because they lack sufficient detail.

Conclusion

Striking problems in the state's regulation and enforcement of pesticide laws were revealed through our examination of statewide pesticide enforcement statistics and a closer look at several counties. When pesticide users are not held accountable for their actions, agricultural workers and the general public are forced to bear the costs of their disregard for safety rules. This longstanding policy of leniency towards pesticide violations also puts law-abiding pest control applicators and growers at a competitive disadvantage.

It is sometimes debated whether enforcement is an effective tool for improving safety. Once again, the highway safety example provides insight: the drop in the number of traffic fatalities since implementation of the mandatory seat-belt law and stiffer penalties for drunken driving indicate that enforcement can indeed be effective. Our recommendations for strengthening California's system of enforcement and reducing the risk of farm-worker poisonings are outlined in Chapter 5.

5

Recommendations: Protecting Farmworkers from Pesticides

“Pesticide exposure can cause serious acute illness among farmworkers. In the incident described in this report, workers entered a field well before the end of a label-specified restricted entry interval (REI) and incurred pesticide exposure that resulted in a moderately severe illness. The incident demonstrates that 1) posted and oral warnings based on the REI are necessary to prevent illness among workers performing hand labor in fields recently treated with pesticides and 2) failure to adhere to an REI can result in substantial morbidity [illness] among exposed workers. Because this incident demonstrates that sole reliance on these control measures may be inadequate, the substitution of safer, less toxic alternative pesticides should be adopted when feasible” (CDC 1999).

As demonstrated in the above excerpt from a recent Center for Disease Control (CDC) report, reliance on notification measures alone is in many cases inadequate to prevent farmworker poisoning by pesticides. Farmworker experiences show that even pesticide applications which follow the letter of the law can result in exposure or illness.

The most important and urgently needed step to reduce exposure is eliminating use of pesticides which endanger the health and well-being of farmworkers throughout the state. Phasing out use of the most dangerous pesticides—those that cause cancer or reproductive harm, or are extremely toxic to the nervous system—would represent tremendous progress toward a more sustainable, healthy and humane agricultural system. Substituting safer alternatives for toxic materials is a well-established first step in worker protection as outlined in the widely accepted principles of industrial hygiene (Soule 1991). Specific steps needed to reach this goal and effectively promote viable alternatives are outlined in Recommendation #1 below.

To reduce the level of farmworker exposure to those pesticides which remain registered, we recommend outlawing several hazardous use practices, improving protection from drift and residue exposure, and significantly strengthening the existing enforcement system. Improved reporting and treatment of

pesticide illnesses are also critical, as is access to accurate information on pesticide use, violations and illnesses for both farmworkers and the general public. Below we explore these recommendations in greater detail, including some of the specific steps needed to reduce farmworker exposure to dangerous pesticides.

1. Rapidly phase out use of the most toxic pesticides and promote healthy and sustainable alternatives.
 - California’s Department of Pesticide Regulation (DPR) should develop and implement a plan to phase out use of pesticides that cause cancer or reproductive harm or are highly poisonous acute nerve toxins. In addition, the agency should develop and implement a plan for reducing use of all pesticides, including setting annual goals for total use reduction and ensuring, at the same time, that toxicity is not increased.
 - DPR should immediately prohibit use of pesticides that are most hazardous to workers (highly acute nerve toxins, carcinogens and pesticides that cause reproductive harm) on labor-intensive crops.
 - California Environmental Protection Agency (CalEPA) should commit significant resources to organic agricultural research and programs to assist farmers in pesticide use reduction and in the transition to sustainable alternatives.³⁷

- CalEPA and California Department of Food and Agriculture (CDFA) should increase their research and training budgets in each of the following areas: organic agriculture, bio-intensive and integrated pest management programs and pesticide use reduction programs. These expenditures should be analyzed annually and compared with expenditures in support of conventional agriculture. Results of this analysis should be made public and widely available.

2. Improve regulations to reduce farmworker exposure.

- DPR should ban aerial spraying of agricultural pesticides, and prohibit use of backpack spraying for all restricted use pesticides and acute systemic toxins.
- DPR should expand posting requirements to apply to all agricultural pesticide applications. Warnings should be required prior to application along the perimeter of all areas where application occurs in such a manner that the warnings are highly visible to workers and other people who might enter the area. All posting signs should include pesticide name and reentry date and be written in the primary language(s) of the farmworkers.
- DPR should require that employers notify farmworkers 24 hours in advance of all pesticide applications in fields they work in or near.
- DPR should extend restricted entry intervals (REIs) to take into account multiple pesticide exposure and prevention of chronic health effects. Early reentry exceptions should be eliminated, and DPR should document and make public the scientific basis for REIs.
- DPR should establish and/or expand worker buffer zones for all fumigants and air-blast spraying.
- Growers should be required to provide washing and laundry facilities for farmworker use on any farm where pesticides are applied.

- Training requirements should be improved and enforced for all pesticide applicators and workers who enter fields or handle crops.
- Agricultural workers should be covered by OSHA's Hazard Communication Standard.

3. Strengthen enforcement of existing laws.

- DPR should set minimum mandatory penalties that county agricultural commissioners must issue for violations of pesticide laws that could endanger the health and safety of workers. The option of issuing "Notices of Violations" and "Letters of Warning" should be abolished.
- DPR should increase fine levels for moderate and serious violations and enforce the automatic "serious" designation for repeat "moderate" violations, as specified in pesticide regulations.
- DPR should require pesticide users to be familiar with regulatory requirements. The "ignorance excuse," a policy of leniency towards violators if they claim to be unfamiliar with relevant requirements, should be abolished. (The DPR Pesticide Policy Manual currently recommends issuance of a "Notice of Violation" rather than a fine for a violation that is a possible health and safety hazard if the violator is judged unfamiliar with pesticide regulatory requirements.)
- An independent review board should be established to annually evaluate the performance of each county agricultural commissioner, with participation from agricultural workers. Elected county officials should receive copies of all agricultural commissioner workplans and evaluations. DPR should exercise its authority to withhold funding from agricultural commissioners' offices that inadequately enforce regulations.
- DPR should require that every county agricultural commissioner's office have at least one bilingual investigator on staff.

- DPR should require special investigations of all pesticide illnesses resulting from legal use practices, rather than allowing agricultural commissioners to take no action in cases where no specific violations are found.
 - Poisoning investigations should always involve the Department of Health Services' Occupational Health Branch and/or OSHA, in addition to DPR.
 - State agencies should assess stiff penalties for employer retaliation against whistleblowers and for interference with workers' right to organize.
 - Agricultural inspectors should enforce existing law (CCR, Title 8, Section 3457), which mandates a minimum \$750 fine for inadequate sanitation facilities, as specified in CalOSHA regulations.
 - DPR should mandate that egregious violators whose actions endanger workers shall be referred for civil or criminal prosecution and/or have pesticide use permits and licenses revoked for a full growing season.
4. Improve reporting of pesticide poisonings.
- Work "safety incentive" contests that provide bonuses or prizes to work crews when no injuries or illnesses are reported in a given time period should be prohibited.

- Insurance companies should be required to immediately forward copies of "Doctor's First Report of Occupational Illness or Injury" involving pesticides to the Department of Health Services (DHS) and DPR Worker Health and Safety Branch.
- DHS should establish and fund a program to monitor long-term health impacts of pesticide exposure among farmworkers.
- DHS should expand its existing program to train doctors about pesticide poisoning diagnosis, treatment and reporting requirements. Crop-sheets highlighting symptoms of pesticide poisoning should be widely distributed to migrant health clinics and other physicians or health care providers.
- CalOSHA and the Medical Board of California should exercise their authority to fine doctors who fail to report pesticide poisonings promptly to the county health authorities.

5. Improve farmworker access to medical treatment.

- Failure of agricultural employers to provide workers and doctors with full information about chemicals involved in a possible exposure incident should constitute "interfering with access to medical treatment" and should be enforced aggressively. Regulations requiring employers to take exposed workers promptly to a doctor should be enforced.
- The federal government should increase funding for migrant clinics and other health care providers for farmworkers, including funding for free annual physicals to screen for symptoms of pesticide exposure. These free physical exams should be available to all, regardless of immigration status.
- Agricultural employers should be required to provide health insurance and/or establish a fund to finance farmworker health care costs.
- DHS should expand cholinesterase monitoring programs to include all field workers who could be exposed to organophosphates or carbamates during the course of their work.



Jocelyn Sherman, UFW

DPR should expand posting requirements.

6. Ensure farmworker and public right-to-know.

- DPR should expand workers' right-to-know to include posting of REIs and descriptions of acute and chronic health effects associated with each chemical. The information should be posted in a neutral location on the farm in an understandable format and language.
- The Office of Environmental Health Hazard Assessment should ensure that all farmworkers are guaranteed "adequate warning" about exposure to carcinogens and reproductive toxins, as required under Proposition 65.
- County agricultural commissioners should document all drift inquiries; monitor, analyze and publish trends in inquiries and complaints; and institute mandatory site visits in response to repeated inquiries and/or complaints.
- County agricultural commissioners should make the results of pesticide investigations

available to DHS and the public within three months of an investigation.

- DPR should release pesticide use and illness data no later than six months after the end of the year for which the information is reported, and should produce an analysis of pesticide use trends and reported poisonings.
- DPR should establish a public database with information on the amount of pesticides used, violations reported, number of workers affected by the violations and number of pesticide illnesses for each user/grower. This integrated database could be an expansion of the Agricultural Civil Penalties database of pesticide enforcement actions, and would be analogous to the national Toxic Release Inventory and the statewide Hot Spots database for air polluting chemicals.

Endnotes

- 1 Farmworker accounts are excerpted from worker testimony and county pesticide episode investigation reports. Names have been omitted or changed to protect the workers.
- 2 Symptoms of acute pesticide poisoning occur shortly after exposure and are followed by relatively rapid recovery. Acute effects may result from a single exposure to one substance or from multiple exposures over a short time period.
- 3 Under state law in 12 states (including California), Workers' Compensation coverage is the same in agriculture as for all other industries. In 13 states, no Workers' Compensation coverage is required under state law for farmworkers. In 25 states, coverage is more limited in agriculture than in other industries (U.S. Dept. of Labor 1998).
- 4 This is clearly illustrated in the disparity among "buffer zones" around farms where the soil fumigant methyl bromide is applied. The buffer zone required for workers in a neighboring field is in some cases less than half that required for residential areas, itself an inadequate distance. Independent monitors have documented levels of methyl bromide drift well above what the state considers "safe," at distances more than ten times the official residential buffer zone (Environmental Working Group 1998).
- 5 See Appendix A for an overview of research methods.
- 6 Farmworker testimony collected from staff at the Organización en California de Líderes Campesinas, Inc. The name has been changed to protect the worker.
- 7 Inerts are all those ingredients not classified as pesticide active ingredients. They are added to pesticide formulations to make the pesticide more potent or easier to use. They include solvents, spreaders, stickers, wetting agents, carriers, fillers and other chemicals (Marquardt et al. 1998). At least 382 chemicals on the U.S. EPA list of pesticide inert ingredients are or were once registered as pesticide active ingredients (Knight 1997).
- 8 California physicians report chronic effects in less than 2% of cases (Das 1999). This reflects the difficulty of recognizing chronic pesticide-related illness.
- 9 Nationwide and in California, the organic food industry has grown by more than 20% per year for the past seven years (Lipson 1997).
- 10 While pesticide use explained only 57% of the variation in number of poisonings among these ten crops, the relationship was statistically significant ($P = 0.02$). Since high volume does not necessarily mean high toxicity and also does not reflect intensity (volume per acre of harvested area), it is not surprising that the relationship is not stronger.
- 11 Possible explanations for incomplete data include lack of information submitted from the attending physicians; and/or lack of information about on-farm pesticide use, exposure during equipment maintenance, or exposure at pest control company facilities.
- 12 Specifically, early field reentry and exposure during application of organophosphate insecticides and mixtures of organophosphate and n-methyl carbamates (cholinesterase inhibiting nerve toxins) were found to cause the most severe poisonings. While some dangerous organophosphates (e.g., mevinphos and ethyl parathion) are no longer registered, other nerve toxins (e.g., oxydemeton-methyl, methyl parathion, and methomyl) remain in heavy use.
- 13 Since this survey was conducted some other states (e.g., Washington) now monitor farm-related pesticide illnesses.
- 14 For example, the incidence of pulmonary disorders among farmworkers is three times that of farmers, and pesticide exposure is most likely a contributing factor (Garcia et al. 1996). For farmworkers who do live longer, cancers often appear after they have left agricultural work and hence other occupations most likely appear on death certificates (Zahm and Blair 1993).
- 15 Hormones are transported throughout the body and function to control virtually every bodily process and to maintain "homeostasis," or balance among different body systems. Too little or too much hormone can cause a wide range of physiological or neurological problems.
- 16 The organs most at risk include mammary glands, fallopian tubes, uterus, cervix and vagina in female fetuses; and prostate, seminal vesicles, epididymides and testes in male fetuses. Endocrine-disruptors may exert their negative effects indirectly as well if they impair the immune or nervous systems or cause cancer in endocrine glands (Benbrook 1996).
- 17 Farmworker accounts are excerpted from worker testimony and county pesticide episode investigation reports. Names have been omitted or changed to protect the workers.
- 18 According to a General Accounting Office report, U.S. EPA has "no capability to accurately determine national incidence or prevalence of pesticide illnesses that occur in the farm sector" (U.S. GAO 1993).
- 19 Under the medical surveillance program, applicators are required to have baseline cholinesterase blood tests and periodic blood tests during any period they are working with specified pesticides (Category I and II organophosphates and n-methyl carbamates) more than six days out of 30 (California Code of Regulations, Title 3, Section 6728).
- 20 Farmworker testimonies were collected and translated (from 1996 to 1998) by United Farm Workers of America, AFL-CIO.
- 21 Ibid.
- 22 Ibid.
- 23 This is also reflected in County Agricultural Commissioner Inspection Reports for Monterey and Santa Cruz Counties, 1996-1998.
- 24 Op. cit. (farmworker testimonies).
- 25 Op. cit. (farmworker testimonies).
- 26 Fines can range from \$100 to \$2,500, and county health officers have the authority to refer non-reporting physicians to the medical board for sanction (California Code of Regulations, Title 8, Division 1, Chapter 4.5, Subchapter 1, Article 5; and HSC Section 2950).
- 27 California Code of Regulations, Title 3, Section 6130.
- 28 In a majority of cases the violation was cited as a general violation of California Code of Regulations, Title 8, Section 6738 (Duty to Provide, Maintain and Use Protective Gear).
- 29 Monterey County investigation PEIR # 92-2046.
- 30 This figure is based on a pesticide application rate of 302 lbs. per acre and a UFW estimated figure of 1.5 workers needed to harvest an acre of strawberries.
- 31 California Code of Regulations, Title 8, Section 3457. CalOSHA has responsibility for worker protection in all industries so it does not have as much enforcement presence in agriculture as the county agricultural commissioners.
- 32 Monterey County Investigation 15-MON-98.
- 33 From the following Monterey County Investigation Reports, listed in order of description: ACP 95/96-002; ACP 95/96-001; ACP 96/97-008; ACP 96/97-006; ACP-96/97-010; ACP 96/97-003; Investigation Report of 2/14/97.
- 34 Monterey County Investigation ACP-MON-96/97-005.
- 35 Santa Barbara Investigations with unexplained delays: 38-SB-96; 97-342; 98 SM01E1; 98-48; 96-2128; 97-1830; 97-1389; 98-994; 97-1189.
- 36 From the following Santa Barbara County Investigation Reports, listed in order of description: ACP-SB-96/97-006; Episode #98-48; Episode #98-SM01E1; Episode E97-1389; Episode #97-1304; Investigation #38-SB-96.
- 37 For additional information or a list of publications on promoting alternatives, contact Pesticide Action Network or Californians for Pesticide Reform.

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Appendix A

Methods

Illness Data Analysis

We analyzed California Department of Pesticide Regulation (DPR) illness reporting data from 1991 to 1996 and compared the results with analyses of pesticide use data from 1991 to 1995 (Liebman 1997). At the time of preparation of this report, use data for 1996 were not available to the public.

Illness data analyzed included all cases identified, after investigation by DPR, as definitely, probably or possibly related to pesticide exposure and which were listed as agricultural cases, or provided a crop name, or in which pesticide use was intended to contribute to production of agricultural commodities, or in which the affected person worked for a food processing facility (DPR 1999).

Accounts from Workers

Sources of worker accounts included testimony from farmworkers collected and translated by the United Farm Workers (UFW) and excerpts from county pesticide episode investigation reports. Names have been omitted or changed to protect the workers.

Enforcement Data Analyses

Analyses of fines and pesticide use violations were prepared using data from the Agricultural Civil Penalties (ACP) Database for FY 1991/92 to 1996/97. These data are maintained by the California DPR Enforcement Unit. Data from 1990/91 were not used because many penalties (fines) had never been finalized. Six year averages of both the number and total dollar amount of fines levied by individual counties are presented to show each county's general level of enforcement activity over six recent years. That enforcement activity was compared to the most recent available agriculture-related pesticide illness data (1996), because it is plausible that the level of agricultural pesticide poisoning in a county could be affected by pesticide enforcement activity in preceding years.

The profile of pesticide safety violations resulting in fines addresses only the roughly

10% of all violations documented by agricultural inspectors which resulted in fines and excludes record-keeping violations. This profile utilizes the ACP database for Fiscal Years 1991/1992 to 1995/1996 because 1996/1997 data were received after this more complex analysis was completed. The ACP database sometimes refers to regulation sub-sections which detail very specific requirements. For example, California Code of Regulations (CCR) Title 3, Section 6738(a)(3) requires employers to "Assure precautions to prevent heat stress during protective gear use are taken." More often only a general section number, such as 6738: "Provision of protective equipment," is listed or retrievable. In many cases a single fine involves a number of code and regulation violations. However, the ACP database is not coded to allow analysis of most common groups of regulations violated at the same time.

County Enforcement Data

We collected county agricultural commission reports from 1996 through 1998 which were available to the public under the California Public Records Act. Documents were collected from the following counties: Santa Barbara, Ventura, Santa Cruz and Monterey. Specific documents requested and analyzed included: pesticide use monitoring inspections, field worker safety inspections, pre-application site inspections, notices of violation, notices of proposed action and notices of proposed decision, and pesticide episode incident reports. Use inspections and violations were requested only for strawberry and raspberry farms in order to limit the volume of documents. Incident reports and documents related to Agricultural Civil Penalties (Notices of Proposed Action and Decision) were requested for all agricultural commodities. These original documents were analyzed in the context of statewide data compiled by DPR. Specific investigations of pesticide illness episodes cited in the text are identified by investigation number or date of incident.

Appendix B

Reported Use of Toxic Pesticides in California, 1995

This table is a compilation of data on the toxicology and reported use of pesticides in California in 1995 (the last year for which use data are available). Pesticides were included if they met two criteria: 1) they appear on the indicated official lists of toxic pesticides and 2) they were used in California in 1995. A description of the toxicology and hazard lists is included in the text.

Original source: Liebman (1997). Some figures were updated using corrected data from California DPR (1998b). Endocrine disruptors were also identified by Keith (1997).

Key to Hazard and Toxicity Lists

- A. U.S. EPA "Probable Human Carcinogens"
- B. California's Proposition 65 Pesticides that Cause Cancer
- C. California's Proposition 65 Pesticides that Cause Developmental Toxicity
- D. California's Proposition 65 Pesticides that Cause Female Reproductive Toxicity
- E. California's Proposition 65 Pesticides that Cause Male Reproductive Toxicity
- F. Endocrine Disrupting Pesticides
- G. U.S. EPA Category I Extremely High Acute Toxicity/Systemic Pesticides Labeled "DANGER/POISON"
- H. U.S. EPA Category II Organophosphate and Carbamate Nerve Toxins
- I. Restricted Use Pesticides. Six pesticides (atrazine, bentazon, bromacil, diuron, prometon, and simazine) are included on this list (potential to pollute ground water) only when used in a designated Pesticide Management Zone, that is, where they already have been detected in groundwater.

Pesticide active ingredient	Hazard and Toxicity	Pounds of active ingredient
Arsenic (inorganic) ⁵	B, G	125,055
Atrazine	F, I	36,192
Azinphos-methyl	G, I	432,248
Bendiocarb	H	1,526
Benomyl	C, E, F	196,154
Bentazon	I	655
Bromacil	I	95,478
Bromoxynil	C	119,815
Cacodylic acid	A, B	44,431
Cadmium	A, B, F	0
Captafol	A, B	0
Captan	A, B	752,677
Carbaryl	F, H, I	856,687
Carbofuran	G, I	247,861
Carbon disulfide	C, D, E	0
Carbon tetrachloride	A, B	0
Chlordanes ⁶	A, B, F	184
Chlordimeform	A, B, F	23
Chlorophacinone	G	11
Chloropicrin	G, I	2,798,239
Chlorothalonil	A, B	1,130,282
Chlorpyrifos	H	3,443,138
Chromium (chromic acid)	B, G	117,092
Creosote	A, B	444,461
Cyanazine	C	646,409
Cycloheximide	C	0
Cyhexatin	C	0
Cypermethrin	F	98,827
Daminozide	A, B	7,868
DDVP ⁷	B, G	6,159
DEF ⁸	G	885,595
Diazinon	H	1,228,066
Dicofol	F	594,789
Dicrotophos	G	113
Dimethoate	H	596,014
Dinocap	C	13
Dinoseb	C, E, G	73
Di-n-propyl isocinchomeronate ⁹	B	1
Disulfoton	G, I	97,688
Diuron	I	1,071,028
Endosulfan	F, G, I	238,455
Endothall, dipotassium salt	G	6,297
Endrin	F, G	0
Epichlorohydrin	A, B, E	0
Esfenvalerate	F	44,698
Ethion	H	79

Pesticide active ingredient	Hazard and Toxicity	Pounds of active ingredient
1,2-Dichloropropane	B	7
1,3-Dichloropropene	A, B, I	409,821
2,4,5-T ¹	F	0
2,4-D ²	F, I	462,204
3-Chloro-P-toluidine hydrochloride	I	0
4-Aminopyridine	I	22
Acifluorfen	A, B	6
Acrolein ^{3,4}	G, I	363,127
Alachlor	B, F	41,119
Aldicarb	F, G, I	358,659
Aluminum phosphide	G, I	90,968
Amitrole	A, B, F	1,858

Pesticide active ingredient	Hazard and Toxicity	Pounds of active ingredient	Pesticide active ingredient	Hazard and Toxicity	Pounds of active ingredient
Ethoprop	G, I	51,104	Pronamide ¹⁶	A, B	114,557
Ethyl acrylate	B	95	Propanil	I	40,022
Ethylene dibromide	A, B, G	90	Propargite	A, B	1,799,584
Ethylene dichloride (1,2-dichloroethane)	A, B	0	Propetamphos	H	77,985
Ethylene oxide	B, D, G	0	Propoxur ¹⁷	A, G	3,296
Fenamiphos	G, I	190,027	Propylene oxide	A, B	155,890
Fenoxycarb	A	1,673	s,s,s-Tributyl phosphorotrithioate ¹⁸	I	885,595
Fenthion	H	413	Simazine	I	841,310
Fenvalerate	F	25,770	Sodium cyanide	G, I	1,347
Folpet	A, B	2	Strychnine ¹⁹	G, I	713
Fonofos	G	74,936	Sulfotep	G, I	510
Formaldehyde (gas)	A, B, G	153,519	Sulfuryl fluoride	G	1,746,320
Formetanate hydrochloride	G	104,846	Sulprofos	H	171
Heptachlor	A, B, F	0	Terrazole ²⁰	A, B	369
Iprodione	A, B	587,301	Tetrachloroethylene ²¹	B	742
Lindane	A, B, F, I	4,653	Thiobencarb	I	571,075
Malathion	F	825,077	Thiodicarb	A, H	13,929
Mancozeb	A, B, F	678,316	Toxaphene	A, B, F, G	1,353
Maneb	A, B, F	1,295,589	Tributyltin ^{22, 23}	F, G, I	338
Metam sodium	A, I	15,131,385	Trichlorfon	H	4,552
Methamidophos	G, I	515,127	Trifluralin	F	1,428,913
Methanol	G	27	Vinclozolin	A, F	49,869
Methidathion	G, I	321,750	Warfarin	C, G	0
Methomyl	F, G, I	823,399	Zinc Phosphide	I	1,611
Methoxychlor	F	1,049	Zineb	B	494
Methyl bromide ¹⁰	C, G, I	17,519,744	Ziram	F	1,638,552
Methyl isothiocyanate ¹¹	G, I	123			
Metolachlor	F	179,109			
Metribuzin	F	30,670			
Mevinphos	G, I	79,347			
Molinate	I	1,411,346			
Naled	G	708,927			
Nicotine	C, G	235			
Nitrofen	B, F	24			
o-Phenylphenol ¹²	A, B	49,178			
Oxadiazon	B	21,485			
Oxamyl	G	66,403			
Oxydemeton-methyl	G, I	121,949			
Oxythioquinox	A	9,535			
Paraquat ¹³	G, I	862,832			
Parathion, ethyl ¹⁴	F, G	13,642			
Parathion, methyl ¹⁵	F, G	153,346			
p-Dichlorobenzene	B	2			
Permethrin	F	323,663			
Phorate	G, I	135,887			
Phosalone	H	52			
Phosmet	H	267,886			
Phosphamidon	G	664			
Potassium hydroxide	G	192			
Profenofos	H	245,809			

- 2,4,5-T is listed as an endocrine disrupter. DPR Pesticide Use Reports have two listings for 2,4,5-T: (1) 2,4,5-T Butoxyethanol ester, (2) 2,4,5-T Propylene glycol butyl ether ester. We lump these two into the single listing, "2,4,5-T."
- DPR Pesticide Use Reports specify a large number of related 2,4-D salts, amines and ester, all of which are included here.
- Acrolein is listed as a Restricted Use Pesticide when it is used as an aquatic herbicide.
- Acrolein is classified here as an herbicide, but can also be used as a rodenticide.
- DPR Pesticide Use Reports list arsenic acid, arsenic pentoxide, and arsenic trioxide, all of which we have combined into our listing here.
- The category "Chlordanes" includes related compounds (Oxychlordane, and cis- and trans-Nonalchor) which are known endocrine disruptors.
- DDVP is also known as dichlorvos.
- Also known as tribufos.
- Di-n-propyl isocinchomeronate is also known as Dipropyl isocinchomeronate.
- Methyl bromide is listed as a Developmental Toxin (OEHHA 1996) for structural uses but not for agricultural field use.
- Methyl isothiocyanate is classified as a Restricted Use Pesticide when

- labeled for agricultural production uses.
- The U.S. EPA lists "o-phenylphenol" as a B2 carcinogen; CA Proposition 65 lists "o-phenylphenate, sodium" as a carcinogen. Our category "o-Phenylphenol" includes use of three closely related chemicals that appear in DPR Pesticide Use Reports: orthophenylphenol, potassium salt, and sodium salt.
 - Paraquat refers to paraquat dichloride.
 - Parathion, ethyl is also known as ethyl parathion and as parathion.
 - Parathion, methyl is also known as methyl parathion.
 - Pronamide is also known as Propyzamide.
 - Propoxur is listed in the U.S. EPA carcinogens list as Baygon.
 - S,S,S-Tributyl phosphorotrithioate is also known as tribufos and DEF 6.
 - Strychnine includes strychnine and strychnine sulfate.
 - Terrazole is also known as Etradiazole.
 - Also known as perchloroethylene.
 - Tributyltin is classified as a Restricted Use Pesticide when it is labeled for control of "fouling organisms in an aquatic environment."
 - DPR Pesticide Use Reports list several related tributyltin compounds: tributyltin fluoride, tributyltin maleate, tributyltin methacrylate, tributyltin neodecanate, and tributyltin oxide. We lump these together into a single category, "tributyltin."

Appendix C

All Crops Listed in DPR's 1991–1996 Pesticide Illness Reports

Top ten crops: alfalfa, almonds, broccoli, cotton, grapes, lettuce, oranges, ornamentals, strawberries, tomatoes.

All other crops (as listed by DPR): anemones, apples, apricots, arbor vitae, artichokes, ash trees, asparagus, asters, avocados, azaleas, basil, beans, bedding plants, bell peppers, blackeyes, brussel sprouts, cabbage, cactus, caneberrries, cantaloupe, carnations, carrots, cattle, cauliflower, celery, cherries, chives, chrysanthemums, citrus, corn, cucumbers, cut flowers, cyclamen, dates, dried prunes, eggplant, elm trees, eucalyptus, fallow, figs, flowers, freesias, furniture, garbanzo beans, gardenias, garlic, gladiolas, grapefruit, green onions, gypsophila, heather, hedge, herbs, honeydew melons, hydrangeas, impatientes, iris, kiwis, lemons, lilies, lima beans, logs, lumber, melons, mums & kalancho, mushrooms, nectarines, nursery plants, nursery stock, oak trees, oats, olives, onions, orchids, ornamental cactus, ornamental trees, pasture, peaches, pears, peppers, pine trees, pistachios, plums, poinsettias, pomegranates, potatoes, potted begonias, potted plants, primulas, prunes, pyracantha, raisins, rappini, rice, roses, safflower, sage, seed, seed garlic, seed potatoes, seedlings, snapdragons, spinach, squash, stone fruit, sugarbeets, sunflowers, sweet corn, tangelo, tarragon, tomatillos, trees, tulips, turf, turkeys, veronicas, walnuts, watermelon, wheat.

Appendix D

Proportion of the Most Toxic* Pesticides Among Possible Poisoning Agents in Top 10 Crops

Crop	Proportion of Most Toxic Agents of All Agents Listed**
alfalfa	55.7
almonds	48.6
broccoli	54.7
cotton	38.0
grapes	19.9
lettuce	57.8
oranges	55.2
ornamentals	34.8
strawberries	33.9
tomatoes	33.0
other crops	33.9
no crop listed	32.3

* These include pesticides categorized as carcinogens, nerve toxins, restricted use pesticides, reproductive toxins, endocrine disruptors and acute systemic toxins (Liebman 1997).

** Since most compounds are listed more than once, these numbers represent the proportion of all listings of the *most toxic* compounds to the total of all listings of all compounds.

Appendix E

Top 7 Activities Associated with Pesticide Exposure (% of Total Number of Cases)

Activity	grapes	cotton	broccoli	oranges	ornamen.	almonds	tomato	lettuce	strawb.	alfalfa
ground application	13.4	4.0	0.7	13.9	0.0	44.1	3.9	5.0	23.1	2.9
hand application	4.3	1.0	0.7	2.4	34.6	2.9	4.9	2.0	5.1	4.3
drift exposure	7.6	79.7	84.7	12.1	17.3	10.8	27.5	22.8	23.1	25.7
drift into neighboring areas*	1.5	2.5	2.3	32.1	16.3	8.8	3.9	2.0	0	31.4
mix/loading, ground application	2.2	2.5	0	3.6	0	11.8	2.0	3.0	6.4	0
packing/processing	0	0	0.3	4.8	0	2.0	18.6	2.0	0	0
field residues	66.8	7.5	10.4	30.3	22.1	6.9	30.4	56.4	42.3	30.0
Total # cases	539	399	307	165	104	102	102	101	78	70
Percent of Total Included**	95.7	97.2	99.0	99.4	90.4	87.3	91.0	93.1	100	94.3

Other activities in dataset included: aerial applicator, cleaning/fixing equipment, exposure to concentrate, flagger, fumigation chamber, field fumigation, tarp fumigation, mixing/loading-aerial, mixing/loading-hand.

* Drift into non-targeted sites.

** Due to rounding, the sum of the percentages may not equal the total shown in the last row.

Appendix F

Pesticide Posionings by County, 1991–1996*

County	Total # cases	Main Crop(s)	# cases	% of county cases	County	Total # cases	Main Crop(s)	# cases	% of county cases
Kern	534	Cotton	239	44.8	San Mateo	35	Ornamentals	9	25.7
		Grapes	121	22.7			Flowers	8	22.9
Fresno	515	No crop**	157	30.5	Sacramento	29	No crop	12	41.4
		Grapes	136	26.4	Sutter	26	No crop	10	38.5
Monterey	428	Broccoli	152	35.5			Peaches	3	11.5
		No crop	79	18.5			Tomatoes	3	11.5
Tulare	399	Oranges	142	35.6	Alameda	25	No crop	13	52.0
		No crop	88	22.1	Solano	21	No crop	8	38.1
		Grapes	69	17.3			Tomatoes	2	9.5
San Joaquin	200	No crop	117	58.5			Ornamentals	2	9.5
Santa Barbara	180	Broccoli	121	67.2	Colusa	18	No crop	8	44.4
Kings	167	Cotton	91	54.5	Glenn	15	No crop	5	33.3
Stanislaus	138	No crop	71	51.4			Prunes	4	26.7
Imperial	128	Broccoli	24	18.8	Mendocino	14	Grapes	7	50.0
		Alfalfa	23	18.0	San Bernardino	13	Ornamentals	8	61.5
		Watermelon	20	15.6	Contra Costa	12	Peppers	7	58.3
Merced	127	No crop	65	51.2			No crop	5	41.7
Ventura	119	No crop	42	35.3	Tehama	12	Walnuts	4	33.3
		Celery	23	19.3	Humboldt	10	No crop	7	70.0
		Citrus	20	16.8	San Benito	10	No crop	3	30.0
San Diego	114	No crop	27	23.7			Lettuce	2	20.0
		Ornamentals	17	14.9	Yuba	8	Walnuts	5	62.5
		Flowers***	17	14.9	Del Norte	7	No crop	4	57.1
Los Angeles	84	No crop	49	58.3	San Francisco	4	No crop	3	75.0
Madera	79	Grapes	36	45.6	Shasta	3	No crop	2	66.7
		Alm/Cot	18	22.8	Calaveras	2	Other crops	2	100.0
		(9 ea.)			Lassen	2	No crop	2	100.0
Riverside	77	Grapes	45	58.4	Marin	2	Roses	1	50.0
Butte	73	No crop	53	72.6	Placer	2	Ornamental	1	50.0
Santa Cruz	71	No crop	25	35.2	Siskiyou	2	Other crop	1	50.0
		Strawberries	20	28.2	Lake	1	Grapes	1	100.0
Orange	56	No crop	23	41.1	Nevada	1	No crop	1	100.0
		Strawberries	11	19.6	Tuolumne	1	Grapes	1	100.0
Sonoma	55	No crop	23	41.8	Total	3991			
		Grapes	22	40.0					
Napa	47	Grapes	34	72.3					
Santa Clara	47	No crop	23	48.9					
Yolo	41	Tomatoes	10	24.4					
		No crop	8	19.5					
		Grapes	10	27.0					
San Luis Obispo	37	Grapes	10	27.0					
		Lettuce	5	13.5					
		No crop	5	13.5					

* Crops listed together for each county account for at least 50% of total poisoning cases in that county.

** When no crop was identified in the DPR data, the term "no crop listed" is used.

*** Different flowers are grouped here and are listed, along with all other crops, in Appendix C.

Source: California DPR 1999.

Appendix G

Pesticide Safety Violations Profile, 1991/92–1995/96

Fines for Violations of Pesticide Handler Protections, 1991–1996

Reg. #	Description	# Times Cited
<i>Protective Gear and Equipment</i>		
6738	Provision and Maintenance of Protective Gear	1,155
6736	Coveralls for Category I and II Pesticides	228
6793	Minimal Exposure Pesticides Protections	27
6746	Closed Systems for Category I Pesticides	72
6678	Service Containers Labeled	177
6742	Safe Equipment	20
<i>Training/Supervision/Warning</i>		
6724	Training of Pesticide Handlers	536
	In a manner employee understands	(36)
	Pesticide-specific training	(175)
	Inadequate training records	(99)
6702	Employer Responsibility	87
6723	Hazard Communication for Handlers	30
<i>Emergency Medical Care/Wash Facilities</i>		
6726	Adequate Provision for Emergency Medical Care	247
6602	Pesticide Labels at Use Site	148
6734	Decontamination Facilities for Handlers	28
6728	Medical Supervision	26

Fines for Drift, Negligence, Unlicensed Businesses 1991–1996

Reg #	Description	# Times Cited
6614	Duty to Protect Persons, Animals, Property	260
6434	Notice of Intent (NOI)	149
6600	General Standard of Care	113
12972	Failure to Prevent Substantial Drift	42
11791	False Claim, Careless Negligent Action	50
11701	Unlicensed Business	217

Fines for Violations of Fieldworker Protections 1991–1996

Reg #	Description	# Times Cited
6770	Field Reentry After Pesticide Application	44
6732	Field Posting During Restricted Entry Intervals	32
6618	Notice of Applications to and by Property Owner	31
6761	Hazard Communication for Fieldworkers	30
6766	Emergency Medical Care Provision	21
6768	Wash Facilities for Fieldworkers	42
6776e	Chemigation Posting	16

Appendix H

Number of Fines by Fine Level—Statewide Total, FY1991/92–1995/96

Fiscal year	Minor Violation <\$151 (%)	Moderate Violation \$151–400 (%)	Serious Violation \$401–1,000 (%)	>\$1,000 (%)
1991/92	321 (47%)	223 (33%)	116 (17%)	23 (3%)
1992/93	281 (42%)	233 (35%)	122 (18%)	33 (5%)
1993/94	394 (48%)	276 (34%)	121 (15%)	23 (3%)
1994/95	342 (46%)	248 (34%)	130 (18%)	18 (2%)
1995/96	264 (45%)	209 (35%)	101 (17%)	16 (3%)
1996/97	309 (45%)	251 (37%)	106 (15%)	19 (3%)

Source: California DPR 1998.

Appendix I

Average Annual Pesticide Fines— All Counties, FY1991/92–1996/97

County	Number of Fines per Year	Average Annual Total Fines	1996 Ag. Pesticide Illnesses	1995 Ag. Prod. Pesticide Use (Thousands lbs.)	1996/97 Permits, Restricted Pesticide Use
Alameda	15.0	\$3,492		159	147
Amador	2.0	250		136	103
Butte	12.0	2,887	4	3,505	1,417
Calaveras	3.2	1,317		33	107
Colusa	8.7	2,725	4	2,936	1,162
Contra Costa	13.5	2,671	2	357	296
Del Norte	0	0	3	222	26
Fresno	19.2	8,034	99	39,805	7,857
Glenn	9.3	2,713	2	2,286	810
Humboldt	0	0		60	40
Imperial	31.8	15,896	14	8,273	1,643
Inyo	0.2	8		10	78
Kern	24.0	9,337	268	24,108	2,166
Kings	7.2	1,835	24	6,475	1,915
Lake	0.5	58		950	176
Los Angeles	124.0	24,885	8	208	474
Madera	17.3	7,617	11	9,513	1,504
Marin	9.7	3,718		55	66
Mendocino	1.7	500	2	1,668	241
Merced	16.3	3,612	22	7,877	2,473
Modoc	0.5	408		143	152
Mono	0.2	25		10	0
Monterey	12.3	5,458	50	10,122	1,395
Napa	5.3	1,034	7	2,855	272
Nevada	0.8	25		10	37
Orange	52.7	9,281	6	994	570
Placer	4.0	1,383		226	213
Plumas	0.2	0		0	27
Riverside	39.5	11,194	5	4,471	823
Sacramento	42.7	9,793	5	2,429	606
San Benito	3.3	650		618	244
San Bernardino	31.5	8,974		472	349
San Diego	22.7	8,737	10	1,040	535
San Francisco	1.7	1,562		13	8
San Joaquin*	6.8	2,458	30	11,646	3,328
San Luis Obispo	42.2	10,673	2	1,681	955
San Mateo	3.5	1,467	6	201	182
Santa Barbara	26.8	9,088	13	3,386	640
Santa Clara	14.2	4,529	6	244	316
Santa Cruz	5.8	2,142	17	1,689	495
Shasta	1.0	633		289	200
Siskiyou	1.8	800		426	261
Solano	6.7	1,700		1,672	816
Sonoma	7.2	1,833	10	3,925	561
Stanislaus*	5.7	2,075	26	5,504	2,811
Sutter	15.5	3,308	5	3,497	1,549
Tehama	8.0	2,080		895	433
Tulare	16.7	8,402	43	17,927	5,809
Tuolumne	1.7	800		6	16
Ventura	5.5	1,671	42	5,553	1,475
Yolo	27.2	4,104	10	3,120	1,097
Yuba	2.2	800		1,735	474

* No Agricultural Civil Penalties (fines) were issued by San Joaquin or Stanislaus counties in Fiscal Year 1996/97.
Sources: California DPR 1997a, 1998, 1999, Liebman 1997.

Appendix J

Common Actions for Pesticide Safety Violations—Santa Barbara, Santa Cruz, Monterey Counties

Type of Violation*	No Action	Notice/ Warning	Fine
No washing facilities for applicators	5	12	1**
No Monterey County required field posting	2	8	
Field not posted prior to application		1	
Fieldworker Pesticide Info Sheet A-9 not posted at field	13	28	
Adequate protective gear not provided	36	39	21***
Application equipment not safe to operate		5	
Inadequate respiratory protection program	1	7	
No field posting		3	
No washing facilities for fieldworkers		28	3***
Inadequate or no fieldworker training	3	3	
Violation of methyl bromide buffer zone		2	4**
Methyl bromide reentry interval violation		1	
No applicator training	2	9	
Field supervisor not trained in pesticide safety		3	
Percent of Total	28%	67%	4.5%

* Only violations not resulting in illness are included in this table. For actions resulting from illness investigations see Chapter 4.

** Fine level \$300–\$450

*** Fine level \$151

Source: 1996–1998 Strawberry Inspection Reports for Santa Barbara, Monterey and Santa Cruz Counties.