Fields of Poison 2002

California Farmworkers and Pesticides

by
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One in a series of reports by Californians for Pesticide Reform

Dedication

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

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Executive Summary

Agricultural workers face greater threat of suffering from pesticide-related illnesses—including acute poisonings and long-term effects such as cancer and birth defects—than any other sector of society. Farmworkers, and often their children, are regularly exposed to pesticides in many ways: mixing or applying pesticides; planting, weeding, thinning, irrigating, pruning, harvesting, and processing crops; or living in or near treated fields.

To shed light on this issue, the statewide coalition Californians for Pesticide Reform (CPR) published *Fields of Poison: California Farmworkers and Pesticides* in June 1999. The report presented California Department of Pesticide Regulation (DPR) data showing that from 1991 to 1996 DPR reported nearly 4,000 cases of farmworker pesticide poisoning. Using government reports, worker testimonials, and other resources, *Fields of Poison* described a myriad of barriers to reporting pesticide-related illnesses and concluded that reported illnesses represented only the tip of the iceberg of a yet more serious problem. A third report focus was on the statewide rampant lack of worker safety law enforcement. This report updates *Fields of Poison.*

Since 1999, DPR—the primary regulatory agency responsible for enforcing federal and state worker safety laws—has improved pesticide illness reporting and completed important evaluations of enforcement program weaknesses. However, the most fundamental problems highlighted in *Fields of Poison* remain and farmworkers continue to face unacceptable threats of exposure to hazardous pesticides.

Reported cases down, but for unclear reasons

Statewide, reported agricultural pesticide poisonings have decreased from a yearly average of 665 cases (1991–1996) to 475 (1997–2000). Many cases, however, go unreported, so true figures may be much higher. While reduced use of some high toxicity pesticides may have contributed to the decrease in reported illnesses, the drop may also reflect doctors' failure to recognize and/or report pesticide-related illnesses; failure of insurance companies to forward doctors' illness reports to the proper authorities; or farmworker reluctance to seek medical attention for suspected pesticide exposure. We strongly suspect that rising health care costs, decreases in number of weeks worked, and other recent demographic and political changes have heightened farmworker reluctance to seek medical attention for pesticide illnesses and exacerbated underreporting.

Pesticides involved in poisoning cases are among the most hazardous

Fourteen of the top 20 pesticides linked to reported illnesses are classified as particularly hazardous, Bad Actors (Table I). The fumigant metam-sodium was the most frequently listed Bad Actor. Of particular note is the number of exposures to organophos-

Table I. Top 20 Pesticides Implicated in Reported Poisoning Cases, 1998–2000

Pesticide[a]	# Cases '98-'00	Bad Actor[b]	
Not determined	509		
Adjuvant	251		
Sulfur	202		
Metam-sodium	194	Yes	developmental toxin, carcinogen
Chlorpyrifos	156	Yes	nerve toxin, moderate acute toxicity, suspected endocrine disruptor
Sodium hypochlorite	110	Yes	high acute toxicity
Dimethoate	103	Yes	nerve toxin, high acute toxicity, developmental toxin, possible carcinogen
Propargite	66	Yes	high acute toxicity, developmental toxin, carcinogen
Petroleum oil	59		
Glyphosate	55		
Methomyl	54	Yes	nerve toxin, high acute toxicity, suspected endocrine disruptor
Carbofuran	40	Yes	nerve toxin, high acute toxicity
Diazinon	38	Yes	nerve toxin, moderate acute toxicity, developmental toxin
Myclobutanil	38	Yes	slight acute toxicity, developmental toxin
Naled	36	Yes	nerve toxin, moderate acute toxicity, developmental toxin
Copper hydroxide	36		
Iprodione	35	Yes	slight acute toxicity, carcinogen
Spinosad	33		
Oxydemeton-methyl	32	Yes	nerve toxin, high acute toxicity, developmental toxin
Methyl bromide	31	Yes	high acute toxicity, developmental toxin
Esfenvalerate	28		
Mancozeb	26	Yes	developmental toxin, carcinogen

Source: California DPR PISP data 2002, and the PAN online pesticide database (www.pesticideinfo.org).

a. All pesticides DPR considered implicated in agricultural poisoning cases from 1998 to 2000. More than one pesticide may be listed for a given case; hence the total number of pesticides listed exceeds the number of reported poisoning cases. In addition to pesticides, this list includes the categories "not determined" and "adjuvant."

b. PAN coined the term Bad Actor to describe pesticides that are 1) known or probable carcinogens, 2) reproductive or developmental toxicants, 3) neurotoxic cholinesterase inhibitors, 4) known groundwater contaminants, or 5) of high acute toxicity.

phate nerve toxin insecticides. For example, agriculture continues to widely use chlorpyrifos—recently banned for almost all home use.

Grapes and soil fumigation lead in numbers of poisonings

Grapes continue to rank first in reported illnesses, attributed in part to frequent high level applications of sulfur. Soil (first identified in 1998 as an application site) ranks second with 222 cases listed (Table II). Of those cases, 195 (97%) involved exposure to soil fumigants.

Most reported poisonings occur in Central Valley counties

The counties with the greatest number of reported pesticide poisonings from 1997 to 2000 were Tulare, Fresno, Kern, and Kings in California's Central Valley, and Monterey on the Central Coast (Table III).

Worker safety regulations are inadequate and often violated

Fifty-one percent of poisoning cases from 1998 to 2000 occurred when pesticides **drifted** from the site of application onto workers. Another 25% resulted from dermal contact with pesticide **residues**. Violations contributed to 373 (55%) of the drift and 143 (43%) of the residue cases (Figure I). DPR found no relevant violations in 286 (42%) and 189 (56%) of drift and residue cases respectively. In other words, in a substantial number of cases, apparent compliance with existing laws and regulations failed to protect workers from poisoning.

Table II. Acute Poisoning Cases—Top 10 Crops,[a] 1997–2000 and 1991–1996

Crop	# Cases '97–'00 (4 years)	# Cases '91–'96 (6 years)
Grapes	331	539
Soil	222	b
Oranges	124	165
Cotton	116	399
Packing/processing	99	c
Almonds	98	102
Alfalfa	58	70
Ornamentals	54	104
Lettuce	44	101
Lemons	40	24
Tomatoes	38	102
Broccoli	32	307
Strawberries	27	78
subtotal	**1283**	**1991**
All other crops/sites	488	856
Unknown	128	1144
Total	**1899**	**3991**
Annual average	**475**	**665**

Source: California DPR PISP data 2002.
a. Top ten crops/application sites for each period.
b. Prior to 1998 soil was not listed as an application site.
c. Prior to 1997 packing/processing was not considered an application site.

Table III. Number of Reported Poisonings in Top 10 Counties, 1997–2000

County	# Cases
Tulare	427
Fresno	221
Monterey	178
Kern	175
Kings	96
San Joaquin	73
Riverside	68
San Diego	68
Madera	63
Merced	60
subtotal	**1429**
Other counties	470
Total	**1899**

Source: California DPR PISP data 2002.

DPR reports reveal widespread violations and investigation flaws

From 1997 to 2001, DPR staff observed 572 pesticide-related field operations in 20 counties and reported that over one-third violated one or more safety regulations. Common violations included failure to provide useable protective equipment, washing/decontamination facilities, and fieldworker access to pesticide use information. DPR found that 88% of protective equipment violations were due to employer negligence, and only 12% to worker failure to utilize available protective equipment.

A DPR review of county illness investigations revealed serious investigation flaws including interviewing workers in the presence of their employers and using employer-affiliated translators at least one third of the time. A DPR analysis of illness episodes between 1991 and 1999 showed that 68% of early reentry illness episodes were due to failure to notify workers that a field was under a restricted entry interval. In the California Agricultural Workers' Health Survey conducted by an independent research institute, only 57% of farmworkers surveyed in seven California communities reported receiving pesticide safety training.

Poor enforcement of laws, most county agricultural commissioners still issue few fines

California county agricultural commissioners continue to issue few fines when violations are found, responding instead with letters of warning and violation notices. During fiscal year 2000–01, DPR issued only 520 fines statewide for

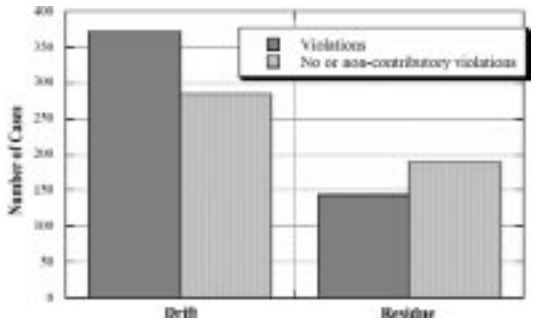

Figure I. Occurrence of Violations and Non-violations in Drift and Residue Poisoning Cases, 1998–2000

Source: California DPR PISP data 2002.

agricultural pesticide safety violations, along with 4,069 letters of warning or notices of violation (Figure II). Most fines ranged from $151 to $400, an amount DPR designates for moderate violations that pose a reasonable possibility of creating a health or environmental hazard or for repeat record keeping violations. The annual number of fines (Figure III) in the moderate and serious categories has remained relatively constant since *Fields of Poison,* but the number of fines for minor violations has dropped.

Better enforcement models exist, as the outcome of a mass metam-sodium poisoning case in Tulare County in November 1999 demonstrated. One hundred and fifty Earlimart residents were evacuated, 24 people were hospitalized, and countless others fled in their own vehicles or hid in their homes after vapors from a nearby field drifted into town. Residents continue to suffer from new and exacerbated cases of asthma and other respiratory illnesses. Persistent Earlimart residents and the United Farm Workers Union forced the pesticide application company to pay a $75,000 fine and put another $75,000 into trust funds to pay victims' medical bills. Tulare County also adopted stricter controls for metam-sodium applications. However, implementation has been imperfect. Victims waited long months for Wilbur Ellis to pay their medical bills and Tulare County controls remain weaker than those Santa Barbara and San Luis Obispo counties adopted after a metam-sodium incident in Santa Barbara County.

Figure II. Statewide Pesticide Enforcement Actions, FY 2000/2001
Source: DPR 2002a.

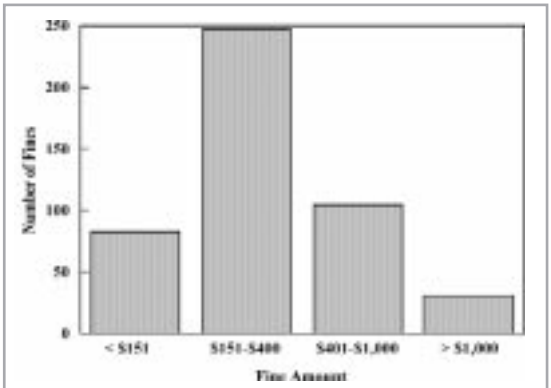

Figure III. Statewide Fines 2000
Source: DPR Enforcement Database 2000.

Recommendations: Urgent need for safer agriculture and better worker protections

Use of hazardous pesticides and inadequate regulations continue to seriously threaten California farmworker health and wellbeing. Only the elimination of hazardous pesticides and their replacement with safer, less toxic pest management tools is a sustainable solution to agricultural chemical exposure. Persistent effort to reduce and eliminate use of hazardous pesticides through development and implementation of ecologically sustainable production methods is the cornerstone for reducing the burden of acute and chronic pesticide illness.

DPR and county agricultural commissioners share responsibility for regulating agricultural pesticide use in California. DPR's evaluation of enforcement program weaknesses is a good first step, but progress towards more effective enforcement has been slow. Now is the time to move beyond studying the problem and start acting. We call upon DPR and the county agricultural commissioners to:

1. **Eliminate use of the most hazardous pesticides to reduce the problem of immediate and chronic pesticide poisoning at the source.**
   Initial targets for elimination should include a) fumigants and other highly toxic pesticides, and b) pesticides that degrade slowly, leaving residues on crops that pose long-term risks for workers and their families.
2. **Actively promote safe and sustainable alternatives.**
   To move California toward a more sustainable, healthy, and humane agricultural system, we urge DPR and other state agencies to actively promote implementation of safe and sustainable pest management alternatives.

3. **Reduce pesticide drift through improved regulations.**
   Two immediate goals include a) phaseout of aerial application, fumigation, and other drift-prone application methods, especially for Bad Actor pesticides, and b) buffer zones around fields being treated to protect fieldworkers in nearby fields, children at school, and other community members.

4. **Reduce exposure to pesticide residue.**
   Residue exposure occurs when field reentry intervals are too short or when workers are not properly notified of applications. Some intervals must be dramatically lengthened and DPR should support regulations requiring warning signs around all fields before pesticide applications to supplement existing requirements for oral warnings.

5. **Strengthen enforcement of existing laws.**
   Significant fines are needed to a) motivate growers and pesticide application companies to obey the law and b) show workers that their reports of violations will secure serious prosecution of perpetrators and bring health care and compensation to victims. Counties must issue fines for all pesticide safety violations and DPR must improve county enforcement and raise maximum fine levels.

   A state program should be created to cover medical expenses due to non-work-related exposure to agricultural pesticides, funded by offenders. The Earlimart (Tulare County) settlement should serve as a model.

6. **Improve farmworker access to pesticide information and healthcare.**
   DPR should prioritize improved farmworker training and the access to pesticide spray records that worker safety and right-to-know regulations require.

7. **Improve pesticide incident investigation.**
   Counties must improve the quality and utility of pesticide incident investigations and collect complete information in a manner that protects workers from retaliation.

8. **Improve pesticide illness reporting.**
   State and county agencies should work together to reduce delays and gaps in pesticide illness reporting and expand existing programs to train doctors in pesticide illness diagnosis, treatment, and reporting requirements.

9. **Reduce pesticide exposure among children through better childcare and housing.**
   Inadequate housing and childcare are underlying causes of excessive pesticide exposure of farmworker children in California and nationwide. Both employers and government agencies must invest substantially more in improved housing and childcare so farmworkers can follow recommendations to bathe after pesticide exposure and keep children out of fields.

1 Farmworkers Continue to Face Pesticide Exposure Risk with Few Protections

This report is a sequel to *Fields of Poison: California Farmworkers and Pesticides* released in June 1999 (see box). *Fields of Poison* was the first comprehensive report on the extent of pesticide-related illnesses among California's 700,000 farmworkers (about 35% of the U.S. farmworker population)[1] and the failure of regulatory agencies to enforce laws and regulations designed to protect farmworkers from pesticide exposure.

In California, the Department of Pesticide Regulation (DPR) is the primary regulatory agency responsible for enforcing federal and state worker safety laws. Since 1999, DPR has slightly improved pesticide illness reporting and completed some important evaluations of enforcement program weaknesses. Improvements and weaknesses are discussed in this report (Appendix A explains report preparation methods).

Fields of Poison: California Farmworkers and Pesticides

Fields of Poison (Reeves et al. 1999) analyzed California Department of Pesticide Regulation (DPR) data showing that from 1991 to 1996, DPR reported nearly 4,000 cases of farmworker pesticide poisonings, an annual average of 665. It discussed both the myriad reasons why illnesses remain largely unreported and county level worker protection law enforcement—or lack thereof. The enforcement section demonstrated shameful lack of real deterrence against breaking the law, as more than 85% of documented violations incurred no fine. Of fines issued, less than 5% exceeded $1,000; nearly half fell below $151.

The report presented specific recommendations to DPR, the agency responsible for implementing pesticide-related worker safety laws. Key recommendations included:

- Implementing phaseout plans for the most hazardous pesticides.
- Improving regulations to decrease two principal exposure sources—pesticides that drift away from intended application site onto workers or into nearby homes and schools, and pesticide residues that contaminate workers who enter sprayed fields before safe to do so.
- Strengthening enforcement of existing laws by a) creating real deterrents (i.e., meaningful fines) for growers and applicators who break the law, and b) demonstrating to workers that reporting violations will bring appropriate redress and benefit.
- Improving pesticide incident investigation and reporting.

Unfortunately, most fundamental problems persist. Farmworkers still face greater threat of exposure to hazardous pesticides than any other sector of society. This report reveals the status of both the numbers of reported pesticide-related illnesses and enforcement actions. It highlights:

- the failure of current regulations to prevent farmworker poisoning due to both pesticide drift and entry into fields with unsafe pesticide residues;
- the urgent need to improve drift protection and effectively notify workers that fields recently have been sprayed; and
- the pressing need for stricter worker protection law enforcement.

California farmworkers are routinely exposed to toxic pesticides

Agricultural workers are regularly exposed to pesticides in many ways—mixing or applying pesticides; planting, weeding, thinning, irrigating, pruning, and harvesting crops; or living in or near treated fields. The U.S. Environmental Protection Agency (EPA) estimates that U.S. agricultural workers experience 10,000–20,000 acute[2] pesticide-related illnesses each year, based on extrapolation from physician-reported cases in California (Blondell 1997). This is probably a serious underestimate since many illnesses are never officially reported. To be included in official reporting, workers must identify the problem and seek treatment and physicians must correctly diagnose and report poisonings to state authorities. Despite efforts to improve physician reporting, as California law requires, compliance remains low (DPR 2002b). Furthermore, according to a 1993 government 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).

Our understanding of the extent of chronic or long-term pesticide-related illnesses is even more limited since such effects are rarely recognized or documented (Das et al. 2001; Pease et al. 1993).

1 Farmworker population estimates are highly debated. A May 2000 national-level electronic discussion (migrant_health_research@eGroups.com) seemed to agree on about 1.8 million based on Agriculture Census and Commission on Agricultural Workers numbers (3,352,028) modified by D. Lighthall, California Institute for Rural Studies. *Fields of Poison* (1999) considered 2.5 million the best estimate, which we round off to 2 million.

2 Symptoms of acute pesticide poisoning occur shortly after exposure and are usually 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.

Causes of chronic illnesses are particularly difficult to document for a number of reasons, including slow developing illness from exposure to multiple pesticides (or other environmental toxins) at multiple times and locations. Nevertheless, a growing body of evidence links farmworker pesticide exposure to chronic effects such as birth defects (Schwartz et al. 1986; Schwartz and LoGerfo 1988), spontaneous abortion (Vaughn et al. 1984), and cancer (see "Pesticides and Cancer" box for more detail on links between pesticides and cancer).

Children are particularly vulnerable and exposed

Children are more vulnerable than adults to pesticide exposure. Their developing bodies and brains are more susceptible to toxins than adults'; their respiratory and metabolic rates are greater and hence per pound, they eat, drink, and breathe more than adults; and their proximity to the ground combined with hand-to-mouth habits increases their exposure to pesticide residues. A U.S. General Accounting Office (GAO) report on farmworker children and pesticides concluded that children who work in farm fields are "especially vulnerable to the adverse effects of pesticides and are not adequately protected from pesticide exposure." GAO also called on EPA to reevaluate pesticide restricted entry intervals (REIs) to ensure that farmworker children are protected (U.S. GAO 2000).

In addition to field exposure, children encounter pesticide residues on their parents' clothes and skin and pesticide drift in their homes, schools, and play areas. In a recent study in the apple growing Yakima Valley of Washington State, researchers measured levels of organophosphate pesticide metabolites in urine and found that 56% of children whose parents worked in the orchards received organophosphate pesticide doses exceeding U.S. EPA's chronic reference dose for azinphos-methyl—a highly toxic nerve poison (Fenske et al. 2000).[3]

Farmworkers receive poorer health care than most Californians

Conditions of poverty where they live and work exacerbate the risks and consequences of pesticide exposure among farmworkers. The threat that sick leave (even a few hours) may lead to reduced pay or job loss is a strong deterrent against taking time off to visit the doctor. A U.S. Department of Labor (DOL) study reveals that U.S. agricultural workers wages declined throughout the 1990s relative to non-agriculture workers to an average $5.94/hr. In the late 1990s the median farmworker family earned less than $10,000 and 61% had family incomes below the poverty level. The average number of weeks worked dropped from 26 in 1990–1992 to 24 in 1996–1998. Most cases of discontinuous work resulted from layoffs. From 1996 to 1998, use of social services such as Medicaid, food stamps, unemployment insurance, and the Women, Infants and Children (WIC) program also declined (U.S. DOL 2000).

Immigrant status has a strong influence on access to and knowledge about social services. As immigration increased throughout the 1990s, the number of undocumented workers increased 1% annually from 1996 to 1998. Across the U.S. in 1997–1998, 81% of U.S. farmworkers were foreign born, about 77% from Mexico (U.S. DOL 2000). Farmworker demographics are similar in California where 92% of farmworkers are foreign-born (Villarejo et al. 2000).

Pesticides and Cancer

A growing body of evidence links pesticide exposure to cancer among farmworkers

- Recent analysis of cancer among 146,000 California Hispanic farmworkers who had been UFW members showed that, compared with the general Hispanic population, they were more likely to develop certain types of leukemia by 59%, stomach cancer by 70%, cervical cancer by 63%, and uterine cancer by 68% (Mills and Kwong 2001).
- Multiple studies have shown that farmers are more likely to develop leukemia, brain, prostate, and skin cancer and non-Hodgkin's lymphoma than the general population (Zahm et al. 1997). Farmworkers generally live and work under conditions of even greater pesticide exposure.
- Review of Central California Cancer Registry data shows an association between exposure to the pesticides 2,4-D, atrazine, and captan and leukemia among Hispanic males (Mills 1998).
- Several studies link pesticide exposure in parents to increased risk of childhood cancer (Fear et al. 1998; Kristensen et al. 1996; Sharpe et al. 1995).
- Farmers and farmworkers experience similar increases in multiple myeloma and cancers of the stomach, prostate, and testis, while farmworkers show unique rises in cancers of the mouth, pharynx, lung, and liver (Zahm and Blair 1993).

See also a recent Californians for Pesticide Reform publication examining the issue of pesticides and cancer (Solomon 2000) and Pesticide Education Center Cancer Study Summaries (Moses 1996).

3 Report calculations assumed that all metabolites resulted from exposure to azinphos methyl, the main organophosphate used on apples.

Many farmworkers do not own vehicles and must increasingly rely on employers or others for transportation to social service agencies or health care facilities (U.S. DOL 2000). The initial report from a large-scale California Agricultural Workers Health Survey (CAWHS) indicates that over two-thirds of persons sampled had no health insurance and only 7% were covered by any of various government-funded programs targeting low-income persons. Only 11.5% had insurance through their employer. Three of seven CAWHS sites had community or migrant clinics to serve the farmworker population. Although 16.5% said their employer offered insurance, some found it cost-prohibitive. Nearly half of CAWHS subjects and family members reportedly paid "out-of-pocket" for most recent medical visits (Villarejo et al. 2000).

Current laws and enforcement efforts fail to protect farmworkers

Farmworkers have lacked basic protections enjoyed by workers in other industries for decades. In many states, farmworkers are denied the right to organize, Workers' Compensation for workplace injuries,[4] and higher pay for overtime work. Farmworkers are specifically excluded from the right to organize under the National Labor Relations Act, which only some states, including California, have redressed by enacting Agricultural Labor Relations acts. In California, while workers in other industries are entitled to overtime pay after working eight hours a day or 40 hours in a week, farmworkers are only eligible after a 10-hour day or 60-hour week.

The federal Worker Protection Standard (WPS) provisions together with supplemental California regulations do not adequately protect workers. In 1995, U.S. EPA implemented WPS to "reduce the risks of illness or injury resulting from workers' and handlers' occupational exposures to pesticides" (U.S. EPA 1992). WPS establishes posting and restricted entry rules for fields where pesticides are applied and requires employers to provide pesticide training, protective equipment, and access to emergency medical care. Many of these requirements had already been in place in California for many years. In California, WPS and additional pesticide safety requirements are implemented and enforced by DPR in coordination with agricultural commissioners in each county. These laws, however, are not sufficiently strong or comprehensive enough to adequately protect workers. For example, fieldworkers are entitled to general training only every five years, which need not include information on specific pesticides used in fields where they work. Enforcement is also sorely lacking. Chapter 4 describes California pesticide enforcement deficiencies.

The best protections are safer alternatives and collective bargaining

Only elimination of hazardous pesticides and their replacement with safer, less toxic pest management tools is a sustainable solution to exposure to agricultural chemicals. Persistent efforts to reduce and eliminate use of hazardous pesticides through development and implementation of ecologically sustainable production methods is the cornerstone for reducing acute and chronic pesticide illness.

Collective bargaining agreements (union contracts) best secure the right to a living wage, protection from pesticide hazards, treatment for pesticide illness, and incident reporting.

4 Under state law in 12 states (including California), Workers' Compensation coverage is the same in agriculture as in other industries. In 13, no state law requires farmworker coverage. In 25, coverage is more limited in agriculture than in other industries (U.S. DOL 1998).

2 Case Studies of Fieldworker Pesticide Poisonings

I have worked for this company for two months, hoeing fields. I haven't been given any pesticide training, but the boss does some training for the crew on other things, like working with your equipment safely. On Saturday, I was picked up at about 4:45am… An airplane went over us, and got some spray on the van (the windows were open). The airplane turned, and came back, going south to north and the van got sprayed again. About three minutes later, I started feeling ill, and got a stomachache, headache, and nauseated. There was a strong smell.

There was a strong odor at the field when we arrived at the work site at about 5:20am and I continued to feel ill. My friend felt ill and then she vomited. There were complaints about strong odor and sickness so we were pulled out. Then we went to work in another field and did one circuit. There was a strong smell in that field also and more complaints were made. The boss stopped us working and said we could leave if we wanted. I asked for an illness note that I could take to a doctor, but I didn't get one. I was feeling worse, so we left. My dad took me to the hospital about noon. They admitted me for the night.

Kings County 1999

The following seven examples—five due to pesticides drifting through the air after application and two from pesticide field residues—illustrate the real circumstances under which reported poisonings occur. Drawn primarily from county investigation reports, they include descriptions of workers' illnesses and employers' responses as well as enforcement outcomes.

Drift exposure cases

1. Tulare County, June 2000

On June 9, 2000, 24 farmworkers developed headache, nausea, vomiting, burning eyes, and weakness working in a vineyard next to an almond orchard where chlorpyrifos (Lorsban) and propargite (Omite) were being applied by helicopter. They were taken to a hospital, decontaminated, and released. At this writing, some crew still experience health problems they attribute to this poisoning. In the hospital a physician stated in English to other staff that she thought the women were faking the illness and should be labeled across the forehead, "faker number 1, faker number 2," and so forth. She was later compelled to apologize in the local newspaper. The application company, GK Lewis, had received seven citations in the past four years by Kern County for pesticide drift violations (Botello 2000; KGET 2000; Tulare County 2000).

Outcome: Environmental samples confirmed drift. GK Lewis was fined $1,700 for failure to prevent contamination of property not involved in the pesticide application and failure to perform pest control in a careful and effective manner. The helicopter pilot, working under contract, was fined $1,000 for allowing substantial drift onto a non-target area. Twenty-six cases are listed in DPR's pesticide illness database.

2. Monterey County, April 2000

On April 22, 2000, a helicopter applied a mixture of oxydemeton-methyl, dimethoate, and tralomethrin to a broccoli field about 800 feet from two cauliflower harvesting crews. The wind was blowing toward the crews. Twenty-three of 25 harvesters, including the supervisor, experienced symptoms that included headache, nausea, lip numbness, swollen lips and tongue, excessive sweating, irritated throat, nose, and eyes, trembling, and momentary blackout. These symptoms are consistent with organophosphate pesticide poisoning; lip numbness is a unique indicator of exposure to synthetic pyrethroids such as tralomethrin. Workers were transported to the doctor and an investigation was promptly initiated (Monterey County 2000a).

Outcome: The agricultural commissioner concluded there was no evidence of drift because pesticide residues were not found where the crew had been working, although residues were found at the field's edge. No investigation was pursued as to the possibility that workers' symptoms resulted from breathing pesticide vapors moving through the field. Twenty-two cases are listed in DPR's pesticide illness database.

3. Tulare County, November 1999

On November 13, 1999, vapors of metam-sodium breakdown products from a potato field under fumigation drifted into the town of Earlimart causing nausea, headache, breathing difficulty, and burning eyes and throat. One hundred and fifty residents were evacuated and 24 hospitalized, while countless others fled in their own vehicles or remained in their homes because they were not told to leave. To date, Earlimart residents continue to suffer from new or exacerbated cases of asthma and other respiratory illness that they attribute to this

exposure. Resident evacuation was handled poorly. Evacuees were told to remove all clothing and washed down with no respect for modesty or protection from the cold (DPR 2000a; Tulare County 1999).[5]

Outcome: In a historic settlement brought about through persistent efforts of Earlimart residents and the United Farm Workers Union, the pesticide application company, Wilbur Ellis, agreed to pay a $75,000 fine without admitting wrong-doing and was ordered to place another $75,000 into two trust funds to pay victims' medical bills. Victims had to wait five months for Wilbur Ellis to pay emergency medical bills. Costs for ongoing care of 28 victims with continued respiratory problems were not covered until the settlement payment 14 months later.

Also in response, Tulare County adopted a half mile buffer zone for metam-sodium sprinkler application and a prohibition of night-time metam-sodium application. This falls short of the one mile buffer zone for these applications imposed by Santa Barbara and San Luis Obispo counties following a 1999 incident in Cuyama Valley. DPR's pesticide illness database lists 170 cases.

4. San Benito County, October 1999

A crew of 28 workers were harvesting celery when a helicopter began applying a mix of methomyl and several other pesticides to a block of celery north of the field being harvested. Workers were directed to go to their cars—closer to the field being sprayed—and leave. Twenty harvesters developed symptoms consistent with pesticide poisoning including vomiting, stomachache, headache, body ache, itching, nausea, rash, irritated eyes, fatigue, and difficulty breathing. Three sought medical attention on their own (San Benito County 1999).

Outcome: The agricultural commissioner's report concluded that the "facts and findings uncovered during the investigation gives no indication that reported symptoms were the result of improper application or drift." The investigation suffered many shortcomings. Considerable weight was given to supervisors' statements that they did not see spray drift, while workers' reported symptoms were disregarded. Initially only the three who sought medical attention were interviewed. Later interviews with other workers occurred within view of the supervisor. The interviewing inspector was not fully bilingual. The helicopter pilot was interviewed by phone two days after the incident and discrepancies between his written statement and phone interview were never resolved. Collection of leaf samples to check for drift residue was delayed and the state and county refused to analyze workers' clothes because workers left them with a legal aid office for safe keeping. Twenty cases are listed in DPR's pesticide illness database.

5. Kings County, July 1999

At 5:30 a.m. a crew of 25 farmworkers began weeding cotton. They noted a strong odor and experienced headache, nausea, and shortness of breath. The adjacent field had been sprayed by a plane an hour earlier with the pesticides naled, chlorpyrifos, and mepiquat chloride. Three of the workers were exposed to additional drift from the application while driving to work. After about 30 minutes they were sent to work in another cotton field that also had a strong odor and was adjacent to a field that had been sprayed by plane that morning. When they complained of feeling ill the farm labor contractor told them they could go home but would not take them for medical care. Sixteen left and nine later sought medical attention. One worker did not seek medical attention because she needed to stay home to care for children. Many had symptoms that persisted over a week (Kings County 1999; DHS 2001a).

Outcome: Samples confirmed drift or overspray of chlorpyrifos into the first field and the workers' van. As a result the California Department of Health Services Occupational Health Branch recommended, "For application scenarios similar to this incident, regulatory agencies should consider

5 Earlimart community members Lucy Huizar and Teresa De Anda described this case at a November 2001 CPR/Pesticide Watch conference in Santa Cruz, California.

enforcement of the Restricted Entry Interval in the ¼ mile zone around the treated field as a minimum precautionary measure" (DHS 2001a). The county agricultural commissioner fined the grower $1000 for failing to notify the labor contractor of pesticide applications within ¼ mile of the work area. The pesticide applicator was assessed $1000 for allowing drift onto an adjacent field and $1000 for allowing drift onto a vehicle resulting in illness. The labor contractor was fined $6,750—$700 each for failing to ensure the nine workers who sought medical attention were taken to the doctor, and $450 for failing to train workers and to post the pesticide safety leaflet. Nine cases are listed in DPR's pesticide illness database.

Residue exposure cases

1. Monterey County, June 2000

A crew of 21 fieldworkers entered a vineyard to tend vines and complained of heavy dust and a strong odor. The forewoman called her supervisor and learned that sulfur (which has a 24 hour reentry time) had been applied less than two hours earlier. Workers who felt ill with headache, eye and throat irritation, nausea, and breathing difficulties were told to drive themselves to an urgent care facility (Monterey County 2000b).

Outcome: The farmer agreed to post all fields before pesticide treatment. The farm was fined $3,200—$800 for each of four serious violations: 1) violating the reentry interval, resulting in illness, 2) failing to transport workers to the doctor when pesticide illness was reasonably suspected, 3) failing to provide pesticide training for crew supervisors and field crew, and 4) failing to inform workers of pesticide application). Twenty-one cases are listed in DPR's pesticide illness database.

2. Kern County, September 1999

On September 27, 1999 at 3:00 p.m., eight workers were transported to the doctor when it was learned that the cotton seed field they had been working in all day had been treated with the cotton defoliant tribufos (DEF) at 3:00 a.m. That day only one worker experienced slight headache and nausea. In subsequent weeks and months seven repeatedly sought medical attention for abdominal cramping, shortness of breath, fatigue, headache, nausea, rash, chest pain, and hair loss. Three have spent time in the hospital (DPR 2000b; Kern County 1999).

Outcome: DPR issued Suggested Permit Conditions recommending that counties enforce a seven-day reentry interval for all hand labor activities after tribufos application to cotton. The field owner was fined a total of $4,208—$401 for each of eight workers for failing to comply with reentry restrictions on the label and $1000 for failing to provide notice that the field was under a restricted entry interval. The applicating company was fined $1405 for failing to notify the property owner before pesticide application and submitting the pesticide application notice late. Seven cases are listed in DPR's pesticide illness database.

3 Reported Farmworker Poisonings in California, 1991–2000

Number of pesticide poisonings remains high and underreporting remains a serious problem

The two statewide reporting systems that DPR manages—one for pesticide use, the other for pesticide-related illnesses—are "widely considered the most extensive in the world" (U.S. GAO 1993). They are designed to help policy makers and the public understand the scope of pesticide use and poisoning in the state. Although the systems provide vital information for the evaluation of farmworker exposure to pesticides, both have important limitations.

For example, California's pesticide use reporting (PUR) system only requires reporting of pesticide active ingredients. It excludes "inert" ingredients, despite their large volume in pesticide formulations and potential or known toxicity (Liebman 1997; Marquardt et al. 1998).[6]

California's pesticide illness reporting system—Pesticide Illness Surveillance Program (PISP)—is critically deficient, as it addresses only acute health effects. Chronic effects are rarely reported (Das et al. 2001) and not cited at all in PISP. Other barriers to accurate accounting of pesticide illness include physician misdiagnoses (Goldman 1998), preference for medical care in Mexico (Mines et al. 2001), and fear that reporting a work-related illness may lead to employer reprisal and loss of work (U. S. GAO 1993).

Despite these limitations, data collected through California's PUR and PISP reveal disturbing continued use of toxic pesticides and worker poisoning. The Pesticide Use box summarizes current use.

Reported cases down, but reasons for drop are unclear

The 1999 *Fields of Poison* report showed that from 1991 to 1996, DPR found an annual average of 665 pesticide poisonings[7] among farmworkers (Reeves et al. 1999). Those numbers appear to have substantially reduced, with an annual average of 475 from 1997 to 2000. However, it is premature to declare the decrease a positive step since its reasons are unclear.

Pesticide Use Trends: Good News and Bad News

The total pounds of pesticides reported used on California cropland increased 51% between 1991 and 1998—from 129 to 195 million pounds of active ingredients. The number of acres planted remained approximately constant at around 8.5 million. This indicates a dramatic increase in intensity of pesticide use—up 60% from 14.4 to 23.0 pounds per acre, largely due to greater use of soil fumigants on carrots, cotton, and tomatoes.

Approximately one-third of pesticides reported used in California are known to be particularly toxic to humans, classified as acute poisons, carcinogens, neurotoxins, reproductive or developmental toxins, or known California groundwater contaminants. Between 1991 and 1998, use of these "Bad Actor" pesticides soared from 50.4 to 63.9 million pounds. Carcinogenic pesticides increased 127% to 27.5 million pounds (Kegley et al. 2000). In 1999, though total reported pesticide use decreased, pounds of California Bad Actors peaked at an all-time high of 72 million pounds.

Between 1998 and 2000, pesticide use on cropland finally began to decline, down 12%, from a high of 195 million pounds in 1998 to 172 million in 2000, mostly due to decreased use of some soil fumigants and the fungicide sulfur. 2000 data show that total reported use of California Bad Actor pesticides declined 14% to 62 million pounds, with substantial decreases in carcinogens, neurotoxins, and reproductive and developmental toxins. For neurotoxic pesticides, public pressure, proactive farmers, surface-water contamination concern, and implementation of the federal Food Quality Protection Act are finally beginning to make a difference, leading to reduced overall use on orchard crops such as oranges, walnuts, almonds, peaches, and prunes. The Montreal Protocol—the international agreement that phases out production and use of the toxic soil fumigant methyl bromide—is also having an impact, with use dropping from an average of around 15 million pounds per year during the mid-1990s to around 11 million in 2000. Use of another soil fumigant, metam-sodium, also decreased substantially, because of decreased acreage in tomatoes, carrots, and potatoes—crops typically treated with large amounts, between 140 and 180 pounds per acre (DPR 2001a; PAN online database: www.pesticideinfo.org).

Not all pesticides show these declines. Use of groundwater contaminating pesticides rose in 2000, as did the number of acres treated with them. Fumigants remain a serious problem as farmers appear to be replacing methyl bromide with equally hazardous fumigants such as Telone (1,3-dichloropropene) and chloropicrin—both California Bad Actor pesticides—and sharply increasing use. The high toxicity of these gaseous pesticides, tendency to drift offsite, and exorbitant application rates (100–400 pounds per acre) make them among the most hazardous used in California (PAN 2001).

6 Inerts—pesticide formula additives not currently classified as active—serve to enhance pesticide potency or application. They comprise solvents, spreaders, stickers, wetting agents, carriers, fillers, and other chemicals. Of approximately 2,300 inerts, one quarter are chemically, biologically, or toxicologically active and 610 known to be hazardous (Marquardt et al. 1998).

7 Reported poisonings are those DPR determines to be definitely, probably, or possibly related to pesticide exposure. Appendix A provides a more complete description of methods used in this report.

For example, the drop in reported illnesses might indicate reduced use of some high toxicity pesticides (see the Pesticide Use box, previous page). Unfortunately, the data preclude the required comparisons, since prior to 1998 DPR did not consistently indicate which pesticides in mixtures were held responsible for reported poisonings. Furthermore, as this chapter shows, in cases where specific pesticides were mentioned, organophosphate and carbamate nerve toxins were commonly associated with reported poisonings both prior to and after 1998. The drop in reporting may also be influenced by doctor failure to recognize and/or report pesticide-related illness, insurance company negligence in forwarding doctors' illness reports to proper authorities, or farmworker reluctance to seek medical attention for suspected exposure.

We strongly suspect that rising health care costs, decreased number of weeks worked, and other recent demographic and political changes that Chapter 1 describes have increased farmworker reluctance to seek medical attention for themselves and their families and hence exacerbated the underreporting *Fields of Poison* describes. Pesticide poisoning episodes Chapter 2 details further illustrate barriers to care farmworkers face.

Grapes and soil fumigation lead in numbers of poisonings

Grapes continue to rank first in reported illnesses, attributed in part to frequent high level applications of sulfur. Soil—identified first in 1998 as an application site—ranks number two with 222 cases listed (Table 3.1; see Appendix B for yearly breakdowns). Of those, 195 (97%) involved exposures to soil fumigants, 170 of which were from the 1999 Tulare County metam-sodium drift incident (see Chapter 2). Metam-sodium was the poisoning agent in another 13 cases as well. Nine cases were attributed to methyl bromide or methyl bromide plus chloropicrin.

California DPR recently improved pesticide illness data by including more information on crops and sites involved. The number of cases in which no crop or site was identified fell from 29% in 1991–1996 to 7% in 1997–2000, easing identification of those most problematic.

Some of the most hazardous pesticides are consistently linked to poisoning cases

Fourteen of the top 20 pesticides linked to reported illnesses are classified as particularly hazardous, Bad Actor[8] pesticides (Table 3.2). The fumigant metam-sodium was the most frequently listed Bad Actor (194 cases). Sulfur, the most prevalent pesticide not designated a Bad Actor, was listed in 202 cases. Seventy-eight (42%) of the 185 pesticides related to reported illnesses are Bad Actor pesticides (Appendix C gives a complete list of pesticides cited in illness reports).

Fourteen of the top 20 pesticides linked to reported illnesses are classified as "most hazardous" for their high toxicity and long-term effects.

Of particular note are the number of cases due to exposure to organophosphate pesticides—among the most toxic pesticides targeted under the Federal Food Quality Protection Act, a law created to reduce non-occupational exposure to pesticide residues, especially among children.[9] For example, chlorpyrifos—recently banned for almost all domestic use—continues to be used in agriculture, threatening the health of farmworkers and their families. Chlorpyrifos was implicated in 156 reported poisonings. Similarly, dimethoate was implicated in 103.

In 1998, California DPR improved the analytical power of the Pesticide Illness Surveillance Program (PISP) database by including DPR's interpretation of degree of

Table 3.1. Acute Poisoning Cases—Top 10 Crops,[a] 1997–2000 and 1991–1996

Crop	# Cases '97–'00 (4 years)	# Cases '91–'96 (6 years)
Grapes	331	539
Soil	222	b
Oranges	124	165
Cotton	116	399
Packing/processing	99	c
Almonds	98	102
Alfalfa	58	70
Ornamentals	54	104
Lettuce	44	101
Lemons	40	24
Tomatoes	38	102
Broccoli	32	307
Strawberries	27	78
Subtotal	**1283**	**1991**
All other crops/sites	488	856
Unknown	128	1144
Total	**1899**	**3991**
Annual average	**475**	**665**

Source: California DPR PISP data 2002.

a. Top ten crops/application site for each period.
b. Prior to 1998 soil was not listed as an application site.
c. Prior to 1997 packing/processing was not considered an application site.

8 PAN developed the term Bad Actor for pesticides in one or more of the following categories: 1) known or probable **carcinogens,** as designated by the International Agency for Research on Cancer (IARC), U.S. EPA, U.S. National Toxicology Program, and the California Proposition 65 list; 2) **reproductive or developmental toxicants,** so described by Proposition 65; 3) neurotoxic **cholinesterase inhibitors,** as classified by California DPR, the Materials Safety Data Sheet for the particular chemical, or PAN staff evaluation of chemical structure (for organophosphorus compounds); 4) known **groundwater contaminants,** so designated by California (for actively registered pesticides) or from historic groundwater monitoring records (for banned pesticides); and 5) pesticides with **high acute toxicity,** as assessed by the World Health Organization (WHO), U.S. EPA, or U.S. National Toxicology Program.

9 The Food Quality Protection Act of 1996 (Sect. 408 of the Federal Food, Drug and Cosmetic Act) directed U.S. EPA to reassess allowable pesticide residues in food (tolerances) and ensure a "reasonable certainty of no harm" from all sources of exposure except direct occupational exposure. An additional safety factor was prescribed for setting tolerances for children if evidence shows greater susceptibility or exposure. FQPA excluded direct exposure of farmworkers, including their children, to field pesticide residues.

relationship of each listed pesticide to the associated poisoning. Table 3.2 data show the top 20 pesticides considered by DPR to be primary or potential contributors to reported illnesses occurring between 1998 and 2000.

Poisonings are not isolated incidents

A single poisoning event can affect many workers. From 1997 to 2000, 36% of reported poisonings involved groups of 10 or more workers (Table 3.3). Three 1997 Tulare County cases involved 43, 12, and 14 individuals and occurred in grapes and oranges, but no pesticides were listed in DPR reports. For the other group poisonings, approximately 65% of pesticides listed were Bad Actors.

Table 3.2. Top 20 Pesticides Implicated in Reported Poisoning Cases, 1998–2000[a]

Pesticide[a]	Number of Cases[b]	Bad Actor	Nerve Toxin[c]	Acute Toxicity[d]	Develop. Toxicant[d]	Carcinogen[d]	Endocrine Disruptor[d]
Not determined	509						
Adjuvant[e]	251						
Sulfur[f]	202		No	Slight	Not Listed	Not Listed[g]	Not Listed
Metam-sodium	194	Yes	No	Not Avail.	Yes	Known, P65[h]	Not Listed
Chlorpyrifos	156	Yes	Yes	Moderate	Not Listed	Not Likely	Suspected
Sodium hypochlorite	110	Yes	No	High	Not Listed	Unclassifiable	Not Listed
Dimethoate	103	Yes	Yes	High	Yes	Possible	Not Listed
Propargite	66	Yes	No	High	Yes	Known, P65	Not Listed
Petroleum oil	59		No	Not Avail.	Not Listed	Not Listed	Not Listed
Glyphosate	55		No	Slight	Not Listed	Not Likely	Not Listed
Methomyl	54	Yes	Yes	High	Not Listed	Not Likely	Suspected
Carbofuran	40	Yes	Yes	High	Not Listed	Not Likely	Not Listed
Diazinon	38	Yes	Yes	Moderate	Yes	Not Likely	Not Listed
Myclobutanil	38	Yes	No	Slight	Yes	Not Likely	Not Listed
Naled	36	Yes	Yes	Moderate	Yes	Not Likely	Not Listed
Copper hydroxide	36		No	Slight	Not Listed	Not Listed	Not Listed
Iprodione	35	Yes	No	Slight	Not Listed	Known, P65	Suspected
Spinosad	33		No	Slight	Not Listed	Not Likely	Not Listed
Oxydemeton-methyl	32	Yes	Yes	High	Yes	Not Likely	Not Listed
Methyl bromide	31	Yes	No	High	Yes	Not Likely	Not Listed
Esfenvalerate	28		No	Moderate	Not Listed	Not Likely	Suspected
Mancozeb	26	Yes	No	No	Yes	Known, P65	Suspected

Source: California DPR PISP data 2002 and PAN online pesticide database (www.pesticideinfo.org).

a. All pesticides DPR considered implicated in agricultural poisoning cases from 1998 to 2000; 1997 data are omitted because DPR made no determination of relationship of pesticide to reported illnesses. Starting in 1998 DPR determined a degree of relationship to reported illness for each pesticide; we include those assigned degree 1 (primary) or 2 (potential). In addition to pesticides, this list includes the categories "not determined" and "adjuvant."

b. DPR reported a total of 1344 agricultural poisonings from 1998 to 2000. More than one pesticide may be listed for a given case; hence the total number of pesticides listed exceeds the number of reported poisoning cases.

c. Cholinesterase (ChE) inhibitor. See PAN online pesticide database for classification details.

d. See PAN online pesticide database for classification details for Acute Toxicity, Developmental and Reproductive Toxicant, Carcinogen, and Endocrine Disruptor. Acute toxicity is a function of the toxicity of the chemical ingredients and their particular formulation in the pesticide product. Acute toxicity reported in this list is for the pure chemical ingredient only and may not be representative of particular pesticide products.

e. Adjuvants are added to a pesticide mixture before application to improve deposition or otherwise enhance pesticide effectiveness (Marer et al. 1988). They are not required to undergo extensive toxicology testing.

f. Sulfur is implicated in many reported pesticide illnesses because it is known to cause skin rashes and irritation of eyes and respiratory tract.

g. "Not listed" means none of the organizations evaluating the chemicals have placed it in this toxicity category. Its absence does not necessarily mean it is not toxic, only that it has not yet been evaluated by the agencies responsible.

h. P65 refers to California Proposition 65, also known as the Safe Drinking Water and Toxic Enforcement Act of 1986. This law requires that California maintain a list of chemicals known to cause cancer, reproductive harm, or developmental harm, with at least annual updates.

Table 3.3. Group Poisonings (10 or more individuals) 1997–2000

# Indiv.	County	Crop	Year	Pesticides[a]
170	Tulare	soil	1999	metam-sodium (BA)
58	Kings	eggs[b]	2000	dimethoate (BA)
53	San Diego	pack/process	1999	sodium hypochlorite
43	Tulare	oranges	1997	none listed
34	Fresno	cotton	1998	carbofuran (BA)
31	Riverside	alfalfa	1997	adjuvant
28	Ventura	lemons	2000	chlorpyrifos (BA), petroleum oil
26	Tulare	almonds	2000	propargite (BA), chlorpyrifos (BA), adjuvant
24	San Joaquin	pack/process	2000	resmethrin (BA)
22	Monterey	broccoli	2000	dimethoate (BA), oxydemeton-methyl (BA), tralomethrin, adjuvant
21	Monterey	grapes	2000	sulfur
20	San Benito	celery	1999	spinosad, methomyl (BA), tebufenozide, *Bacillus thuringiensis*
17	Tulare	oranges	2000	chlorpyrifos (BA)
16	Imperial	melons	1997	benomyl (BA), triadimefon (BA)
14	Monterey	lettuce	1997	dimethoate (BA), cypermethrin (BA), imidacloprid
14	Tulare	grapes	1997	no pesticides listed
13	Fresno	cotton	1999	chlorpyifos (BA), naled (BA)
12	Merced	nectarines	1998	chlorpyrifos (BA), copper sulfate
12	Monterey	apples	1998	diazinon (BA), fenarimol
12	Tulare	grapes	1997	benomyl (BA), captan (BA), myclobutanil (BA)
12	Tulare	oranges	1997	no pesticides listed
10	Colusa	rice	1997	methyl bromide (BA)
10	Imperial	melons	1997	methomyl (BA), esfenvalerate, endosulfan (BA)
10	Madera	grapes	1999	chlorpyrifos (BA), lime-sulfur

682 total

Source: California DPR PISP data 2002.

a. 1997 data do not rate pesticides according to degree of relationship. For 1998–2000 pesticides listed are only those determined to have contributed to the reported illness. BA = Bad Actor.

b. Eggs do not normally appear as a crop/site in DPR's PISP database but the size of this case warranted inclusion.

Most poisonings occur from drift or residue exposure

In addition to identifying the crop (or site) where the incidents occur and the pesticides involved, DPR attempts to classify the type of exposure (dermal contact with pesticide residue, pesticide drift from application site onto workers, pesticide spill, or direct pesticide spray).

Drift and residue exposures account for 51% and 25% of poisoning cases from 1998 to 2000. Of 681 drift cases, 170 (25%) involved the 1999 Tulare County Earlimart incident. Residue exposure caused 336 of reported cases. Most remaining exposures DPR listed were direct spray or spill and occurred most often among pesticide applicators. Figure 3.1 shows distribution of exposure types for 1998–2000, information not available in the same format for 1997.[10]

Most reported poisonings occur in Central Valley counties

Data on poisonings by county provide an important tool for evaluating compliance with and enforcement of worker safety laws and regulations. Counties with the greatest number of reported pesticide poisonings from 1997 to 2000 were about the same as for the previously studied period (Table 3.4). These include Tulare, Fresno, Kern, and Kings in the Central Valley and Monterey on the Central Coast. Appendix D lists additional counties. While no information is available on regional differences in level of pesticide illness reporting, we suspect that fieldworkers' preference for medical care in Mexico increases underreporting in counties nearer to the border.

Chapter 4 provides detailed analyses of statewide enforcement actions and highlights the handful of counties that have improved.

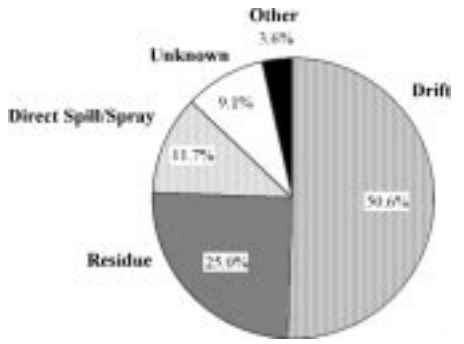

Figure 3.1. Exposure Routes for Poisoning Cases, 1998–2000

Source: California DPR PISP data 2002.

Table 3.4. Reported Poisoning Cases by Crop in Top 10 Counties, 1997–2000

County	Total # Cases	Crops Involved	# Cases by Site/Crop	% County's Cases
Tulare	427	soil	171	40.0
		oranges	105	24.6
		grapes	62	14.5
Fresno	221	cotton	68	30.8
		grapes	43	19.5
		almonds	24	10.9
		unknown	20	9.0
Monterey	178	lettuce	32	18.0
		broccoli	28	15.7
		grapes	25	14.0
Kern	175	grapes	58	33.1
		almonds	15	8.6
		unknown	15	8.6
		cotton	13	7.4
Kings	96	eggs	58	60.4
		cotton	21	21.9
San Joaquin	73	pack/process	24	32.9
		grapes	18	24.7
Riverside	68	alfalfa	31	45.6
		grapes	12	17.6
San Diego	68	pack/process	53	77.9
Madera	63	grapes	32	50.8
Merced	60	nectarines	13	21.7
		soil	8	13.3
		grapes	7	11.7
Subtotal	**1429**			
Other counties	470			
Total	**1899**			

Source: California DPR PISP data 2002.

10 DPR created a new PISP "exposure" category starting with 1998 data. Previously exposure and activity-related information was combined.

4 Worker Protection Laws: Frequent Violations and Inadequate Regulations

The key to improving our program is the strong enforcement of our laws. If farmers, businesses and homeowners do not comply with the restrictions we place on pesticide use, these toxic chemicals can and do cause problems. Consequently, it is incumbent on us at the Department and on our partners in offices of the County Agricultural Commissioner to ensure that pesticide users understand and comply with the laws and regulations we have established, and that violators are prosecuted.

Paul Helliker, Director of DPR
November 1999 DPR Enforcement Initiative

Farmworkers are poisoned both when existing regulations are insufficient to protect them from exposure to pesticides (most frequently as residue or drift) and when employers and pesticide applicators fail to follow worker protection laws. Focusing on the continuing problem of poor enforcement, DPR in November of 1999 produced the Enforcement Initiative: Proposals to Improve Enforcement of California's Pesticide Regulatory Program (DPR 1999). The initiative offers good ideas for improving evaluation and enforcement in California's pesticide regulatory program, including proposals to improve bilingual staffing and cultural sensitivity at both the state and county levels. In the two and a half years since the initiative was released several DPR evaluations confirm that violations are widespread and county investigations often incomplete. This has yet to translate into on-the-ground improvements.

DPR compliance assessment reveals widespread violations

Between June 1997 and March 2001, DPR staff observed 572 agricultural pesticide handling operations and fieldwork in 239 fields recently treated with pesticides in 20 counties. DPR reported aggregated statewide results in the Compliance Assessment Report: Pesticide Handler and Field Worker Safety Survey (DPR 2001b). Results were sobering. Over one-third of observed pesticide handling operations failed to meet requirements for use of protective equipment, safe use of closed pesticide handling systems,[11] posting of warning signs around treated fields, or posting of complete emergency medical care information (Table 4.1). The vast majority of protective equipment violations (88%) were due to employer failure to provide the required equipment either at all or in usable condition. Only 12% stemmed from worker failure to utilize available equipment.

Fieldworkers had access to pesticide application information less than a quarter of the time, and in over 20% of fields, decontamination facilities were lacking or inadequate (Table 4.2). We compiled results by county in Appendix E. Most Central Valley counties showed very poor compliance with pesticide safety requirements for both applicators and fieldworkers.

DPR uses Compliance Assessment results in negotiating annual work plans with each county to better target inspections (DPR 2000c). Review of individual negotiated work plans exceeds the scope of this report. DPR's Prioritization Plan for

Table 4.1. Pesticide Application Compliance Survey

Safety Requirement Checked	% in Violation	Sites Inspected[a]
Protective gear required by label used	42%	563
Closed systems safe to operate and used properly	35%	26
Treated field posted by property operator	35%	69
Emergency medical posting includes phone number	38%	538
Soap, water, towels provided for decontamination	30%	543
Source of Protective Gear Violation	**% by Source**	
Gear not provided or in poor condition, poor fit	88%	
Gear available in good condition but not worn	12%	

Source: DPR Compliance Assessment 2001b.

a DPR inspected 572 pesticide handling operations in 20 counties.

Table 4.2. Fieldworker Compliance Survey

Safety Requirement Checked[a]	% in Violation
Pesticide leaflet displayed	53%
Pesticide application records accessible	77%
Decontamination facilities provided or adequate	22%
Fieldworkers trained[b]	6%

Source: DPR Compliance Assessment 2001b.

a. DPR inspected 239 fields in 20 counties.

b. Compliance with WPS required fieldworker training and was evaluated by talking to several fieldworkers and supervisors in fields inspected.

11 Closed systems are procedures and equipment for transferring pesticides from containers to application equipment through hoses and pipes to prevent exposure to pesticides from splashes and spills.

2002/2003 (DPR 2002c) concentrates oversight inspections in Merced, San Joaquin, Sutter, and Tulare counties and calls on all counties to better target violators, document violations, and take enforcement action according to state guidelines.

The legislative analyst office's (LAO) 2002/2003 budget analysis characterized state pesticide enforcement activities as ineffective based on review of the Compliance Assessment and pointed out that over half of the state's pesticide enforcement budget is passed through to counties. LAO recommended legislation to hold counties accountable for enforcing regulations and tying county funding to achieving goals in negotiated work plans (LAO 2002).

Inadequate regulations and violations result in poisonings

Poisonings occur as a result of both inadequate regulations and violations of existing regulations. Table 4.3 shows the proportion of reported illnesses attributed, at least in part, to violations of worker safety regulations. Unfortunately, details of violation type (for example, lack of field posting and proper notification) are unavailable despite DPR's apparent intention to provide them (DPR 2001c).

Violations contributed to reported illnesses in 41% of all reported cases from 1997 to 2000. In another 38%, DPR determined that no relevant violation occurred. In other words, in a substantial number of cases, apparent compliance with existing laws and regulations failed to protect workers from poisoning. In the remaining 21% DPR failed to determine whether or not violations occurred, reflecting the inadequacy of investigations—a topic discussed below.

Table 4.3. Violations Contributing to Poisonings, 1997–2000

	# of Cases	% of Total
Total Number of Reported Cases	**1899**	
Violations Listed		
Early reentry	79	4.2
Failure to use required equipment	156	8.2
Other misuse	461	24.3
Early reentry and other misuse	48	2.5
Other	36	1.9
Violation subtotals	**780**	**41.1**
Non contributory	190	10.0
None—no violation found	526	27.7
Non-violation subtotals	**716**	**37.7**
No determination made (1997 cases)	361	19.0
Presence or absence of violation unknown	42	2.2
Unknown subtotals	**403**	**21.2**

Source: California DPR PISP data 2002.

Online Access to California Pesticide Regulation Documents

The California Department of Pesticide Regulation (DPR) website provides ready access to pesticide laws and regulations. It also provides the DPR pesticide enforcement manual that state and county officials use. Also available are pesticide policy and procedure updates ("enforcement letters") sent year-round to county agricultural officials. An online database of Enforcement Actions, searchable by employer name, provides access to information on fines issued for pesticide violations starting in 1999. To find these documents see www.cdpr.ca.gov and select Programs, then select Enforcement and scroll down to policies.

California Department of Pesticide Regulation
1001 I Street, PO Box 4015
Sacramento, CA 95812-4015
General information: (916) 445-4300; fax: (916) 324-1452

In specific cases of exposure to pesticide drift and pesticide residue, results followed the same pattern but were even more striking (Figure 4.1). Analysis of drift and residue exposure cases from 1998 to 2000 revealed that violations contributed to 373 (55%) of drift and 143 (43%) of residue cases. DPR concluded that no relevant violations occurred in 286 (42%) and 189 (56%) respectively. Here again, data indicate serious failure both of complying with regulations and of regulations to adequately protect.

Fieldworker pesticide training falls short

The WPS mandates that fieldworkers receive training at least once every five years to learn vital basic information such as how to reduce pesticide exposure through washing before eating, bathing after

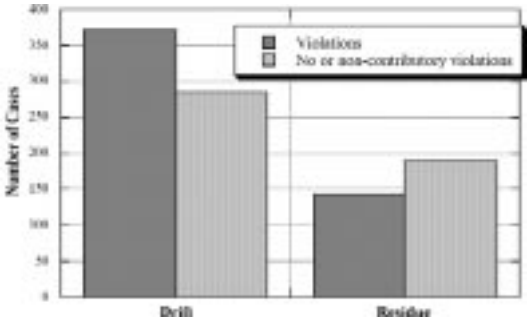

Figure 4.1. Occurrence of Violations and Non-violations in Drift and Residue Poisoning Cases, 1998–2000

Source: California DPR PISP data 2002.

work, and washing work clothes separately, and to recognize symptoms of possible pesticide illness. Employers must either train new employees or verify that they have already been trained. Since WPS has been in place more than five years, fieldworkers who have not received ongoing training are now entitled to retraining. While some counties have held recent fieldworker training sessions (Wilcoxen et al. 2001), concerted efforts to assure this training are not visible on the federal or state level. Only 57% of farmworkers surveyed recently in seven California communities stated they had received pesticide safety training (Villarejo et al. 2000). While DPR's Compliance Assessment reported high training compliance (Table 4.2), this was assessed only through brief conversations with one or two workers at each field. Review of the DPR 1999–2002 pesticide enforcement database shows few enforcement actions (fines) or letters of warning issued to employers for failure to train fieldworkers.

Illness investigations are seriously flawed, with the employer or other workers present in more than one third of worker interviews and employer-affiliated translators used at least one third of the time.

Weaknesses in county pesticide illness investigations and lags in illness notification

DPR Worker Health and Safety Branch reviewed 209 recent county reports of agricultural pesticide exposure episode investigations (Edmiston et al. 2001). As Table 4.4 shows, complete or required information was collected in only 63% of investigations. Information on interviews with workers was particularly troubling. Translators were used in only 30% of investigations. Of those, only 68% used translators not affiliated with the employer (43 of 209). Employers or other employees were known to be present during 36% of employee interviews. Coworkers were interviewed only 59% of the time and applicators only 67% of the time. As a result, DPR has modified investigation forms to encourage interviews of more field employees. Its report emphasized that, "without details on how the pesticide was handled, we (DPR) can not determine the adequacy of the current regulatory requirements."

It also revealed that an average 44 days elapsed before counties received medical reports of pesticide exposure episodes—an average of 61 days by Worker's Compensation and 26 by physician. (In California physicians must report suspected pesticide illnesses to the county health department within 24 hours.) Appendix F lists compliance by county. The report, however, assessed no association between average notification time and investigation completeness.

Table 4.4. Completeness of County Pesticide Illness Investigations

Review Criteria	Yes	No	Unknown
Required information collected	63%	37%	
Use of protective measures assessed	72%	26%	2%
Any translator used	30%	62%	8%
Translator independent of employer[a]	68%	17%	15%
Interviewed without employer present	49%	9%	42%
Employee interviewed alone	28%	27%	46%
Coworkers interviewed	59%	39%	2%
Applicators interviewed	67%	33%	

Source: Edmiston et al., 2001.

a. Pertains to the 30% of investigations where translator was used.

Most county agricultural commissioners still issue few fines

Fields of Poison detailed that California county agricultural commissioners issued few monetary fines (agricultural civil penalties) when violations were found, usually issuing only warning and violation notices. Unfortunately, with a few notable exceptions, this practice persists. During Fiscal year 2000/2001, only 520 fines were issued statewide for agricultural pesticide safety violations (Figure 4.2), along with 4,069 letters of warning or notices of violation with no fine. Since 1999, counties have

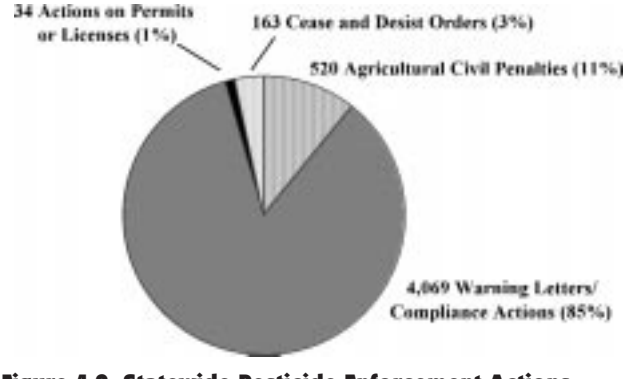

Figure 4.2. Statewide Pesticide Enforcement Actions, FY 2000/2001

Source: DPR 2002a.

Note: Actions on Permits can comprise removing a pesticide from the use permit or having a grower put conditions on how a pesticide may be used. Cease and Desist Orders specify that the activity in question must end.

been required to forward warning letters and violations notices to DPR for entry into a database.

Our analysis of the 2000 database reveals that work safety violations—including requirements for protective gear, washing facilities, and pesticide information—typically result in few very low fines or only warning letters (Table 4.5).

Table 4.6 shows that a handful of counties issued notably more fines in Fiscal Year 2000–2001 compared with the yearly average between 1991 and 1997, the period *Fields of Poison* covers. Enforcement actions in Ventura County increased from an annual average of five fines to 27. As *Fields of Poison* notes, the Ventura County agricultural commissioner was scrutinized by both DPR and the county for enforcement program deficiencies and had some funding withheld by DPR between 1994 and 1997.

Appendix G gives summary enforcement statistics for all counties. For most major agricultural counties, the number of violations observed in routine pesticide use inspection far exceeds the total of county issued warning letters, violation notices, and fines (agricultural civil penalties) (DPR 2002a). Figure 4.3 shows that the majority of fines issued in 2000 fell between $151 and $400, which DPR assigns for moderate violations that pose a reasonable possibility of health or environmental hazard or are repeat record keeping violations. The total annual number of fines in the moderate and serious categories has not risen since our previous report (Reeves et al. 1999) but number of fines for minor violations, which pose no health or environmental hazard, has dropped. Counties statewide assessed a total of only $175,697 in fines for agricultural pesticide safety violations in 2000 (DPR Enforcement Database 2000). This excludes the Earlimart settlement, assessed by DPR (see Chapter 2).

The number of safety violations far exceeds that of warning letters, notices, and fines. Fines are issued less than 20% of the time that violations are found.

Table 4.5. Warnings and Low Fines for Work Safety Violations in 2000

Main Violation Found in Inspection	Warning Letters	Fines	Average Fine
Closed systems	2	4	$176
Hazard communication for fieldworkers	67	1	50
Field posting	14	0	
Decontamination supplies for fieldworkers	6	3	150[a]
Fieldworker training	18	0	
Hazard communication for applicators	16	0	
Protective gear for applicators	46	19	264
Decontamination supplies for applicators	23	15	252

Source: DPR Enforcement Database 2000.

a. Field sanitation regulations require Cal/OSHA to assess a minimum $750 fine for failure to provide fieldworker washing supplies.

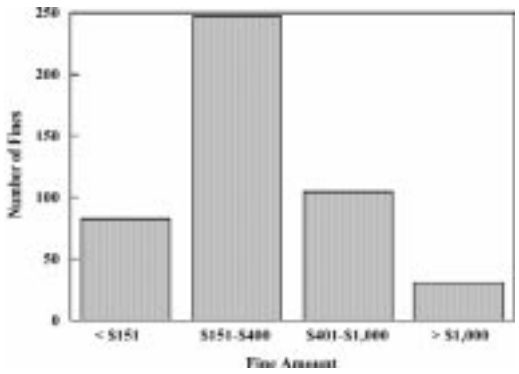

Figure 4.3. Statewide Fines 2000
Source: DPR Enforcement Database 2000.

Table 4.6. Counties with Recent Improvement in Agricultural Enforcement

2000/01 Activities/Actions	San Bernardino	Sutter	Ventura	Placer	San Diego	Santa Barbara	Total for State
Warnings/violation notices 00–01	212	220	94	9	562	65	4069
Fines (ag civil penalties) 00–01	42	30	27	27	35	38	520
Average annual fines (ag civil penalties) 91–97	32	16	5	4	23	27	

Sources: DPR 2002a and Reeves et al. 1999.

DPR enforcement power increased slightly

In 2000, Governor Davis signed DPR-sponsored legislation (SB1970—Costa)[12] into law. DPR gained authority to initiate an enforcement action for violations committed by a single pest control business in multiple jurisdictions (counties) and impose fines of up to $5,000 per violation after a hearing.[13] It also now has authority to convene a trial board hearing for alleged county agricultural commissioner misconduct.[14] To the best of our knowledge, these enhanced enforcement tools have not been utilized.

This new law gives agricultural commissioners authority to refuse, suspend, or revoke a pesticide use permit for grower failure to pay a civil penalty or comply with any final order issued by the commissioner.[15] The maximum fine that commissioners can assess for serious pesticide safety violation remains $1,000, as state regulation specifies.

Higher fines are possible when commissioners consider the number of employees affected. For example, a 1998 investigation by Sacramento County established that a grape grower had not provided or verified pesticide training for any of 51 fieldworkers employed that year. The county considered this violation moderate and assessed $151 per worker, resulting in a total of $7,701.[16] Implementation of California's worker safety laws is quite uneven among counties, with some issuing no fine and some much higher fines for similar violations. A recent U.S. EPA review of WPS enforcement in California observed that state enforcement guidelines allow significant leeway in determining violation severity and assessing penalties (Wilcoxen K. et al. 2001).

DPR recently adopted revised regulations for evaluating county pesticide use enforcement programs.[17] Developed by a work group of DPR and county staff, they require that DPR and counties cooperate to correct program deficiencies identified in evaluations and specify that if corrective actions are not taken the DPR director must undertake to improve performance. This may include reducing the amount of funding allocated to a county (from mill fee revenues) by up to 25%.

Stronger steps needed to protect farmworkers

DPR evaluation and acknowledgement of enforcement program weaknesses is a good first step, but enforcement progress has been slow. Both DPR Compliance Assessment and county inspection statistics show widespread pesticide safety violations. However, violations found in county inspections only result in fines about 10% of the time. It is time to move beyond studying the problem to action. Employers who fail to provide closed systems, protective gear, and water, soap, and towels for washing after exposure put employees in harm's way and should receive the maximum allowable fine. Growers and application companies who repeatedly fail in this can and should be denied pesticide use permits and operating licenses.

Statewide, fieldworkers are denied their right to know what pesticides have been used recently in the fields in which they labor, and DPR and counties have yet to move beyond documentation of the problem. The state should explore alternative means for ensuring that fieldworkers receive information on the specific pesticides to which they are exposed, acute poisoning symptoms, and chronic health effects. The state should develop model crop sheets that use pictures to show symptoms. These could easily be customized with pesticide use records on each grower's computer.

12 SB1970-Costa chaptered amendments to: California Code of Regulations, Food and Agricultural Code, Sections 2181, 2182, 12976, 12999.4, 12999.5, 14008, 14033.

13 California Food and Agriculture Code Section 12999.6.

14 California Food and Agriculture Code Section 2181, 2182.

15 California Food and Agriculture Code Section 12999.5.

16 Sacramento County Agricultural Commissioner Notice of Proposed Action File ACP-SAC-99/00-012.

17 DPR Regulation Number 02-003, Title 3 sections 6391, 6393, 6394.

5 Urgent Need for Better Worker Protection

While tougher enforcement of existing pesticide safety regulations is essential, enforcement alone will not adequately protect fieldworkers or pesticide handlers. Protective gear for handlers is uncomfortable, prone to leakage, and increases heat illness risk. As Chapter 4 explains, failure to properly mix and load high toxicity pesticides through closed systems and fieldworker poisoning from pesticide drift and residue remain large problems.

A phaseout of Bad Actor pesticides will more effectively mitigate poisoning risks by reducing need for protective gear and closed systems and removing a dangerous source of pesticide drift and residue. Few have been phased out in recent years.

Agricultural uses of hazardous pesticides are the last to go

In April 2001 U.S. EPA announced voluntary cancellation (requested by manufacturer Dupont) of the pesticide benomyl, a skin sensitizer and reproductive toxin responsible for 44 reported poisonings in California between 1997 and 1999 (DPR 2001d). Unfortunately this phaseout is the exception.

Early this year U.S. EPA issued a cancellation order for virtually all chlorpyrifos home-use products to reduce risks to children, with a phaseout across three years.[18] Almost all agricultural uses remain allowed, regardless of risks to farmworker children in the field, through drift, and from residue on parents' clothes. U.S. EPA recently proposed to cancel registration for many uses of the highly toxic organophosphate azinphos methyl due to its great risk to farmworkers. Yet the proposal offers four-year renewable registration for use of highly toxic azinphos methyl on apples, pears, and six other crops. U.S. EPA acknowledges its risks for farmworkers and applicators but concludes that growers' need for continued use outweighs the risks (U.S. EPA 2001).

The highly toxic pesticide, chlorpyrifos, banned for almost all home use, remains widely used in agriculture

Oral notification requirements fail to protect fieldworkers

As previously noted, pesticide poisoning due to early reentry into treated fields remains a problem. In California, posting of pesticide-treated fields is required when soil fumigants or pesticides with restricted entry intervals (REIs) of at least eight days are used, or if the pesticide label requires posting. Otherwise mere oral warnings—notoriously unreliable and impossible to verify—are required. Stiff opposition by agricultural interests has defeated repeated attempts to legislate more comprehensive field posting requirements. Most recently, in the summer of 2000, the Assembly Agricultural Committee refused to vote on SB1523 (Figueroa-D), which mandated posting of all fields treated with pesticides with REIs of 24 hours or more. The committee instead directed DPR to evaluate whether posting requirements should be expanded.

18 U.S. EPA Program Update: EPA Issues Cancellation Order for Chlorpyrifos Products. January 25, 2002.

Over a year later DPR released an analysis of illness episodes between 1991 and 1999 (Spencer et al. 2001). As Table 5.1 shows, 68% of early reentry illness episodes were due to failure to notify workers that a field was under an REI in situations where posting was not required. The analysis also revealed that irrigators and other fieldworkers are at particularly high risk of pesticide poisoning from early reentry (Table 5.2). A report summary of stakeholder meetings indicates that growers, applicators, and farmworker advocates all complain that paper signs lack durability. Yet DPR plans no change in existing posting requirements and to continue evaluating why notification has failed and how to improve it. When asked why requirements will not be expanded based on report results, DPR staff respond that one can't assume that field posting is the best solution when oral notification fails.[19]

In our view, the need for comprehensive field posting is especially urgent given the increasingly common practice of hiring farmworkers through labor contractors and management companies. Such workers, as well as irrigators and others who often work alone, rarely see central farm locations or farm personnel from whom they are supposed to receive written and oral communications regarding pesticide application.

Table 5.1. Probable Causes of Illness Episodes Involving Reentry Interval Violations

Probable Cause	Episodes 1991–1999	% of Total
Lack of oral notification	32	68%
Posting violation	8	17%
Notice ignored	5	11%
Workers sent into posted field	2	4%
Total episodes	**47**	**100%**

Source: Spencer 2001.

Table 5.2. Reentry Illnesses (1991–1999) by Job Type

Job	Illness Episodes with REI Violations	% Total
Fieldwork	20	43%
Irrigation	20	43%
Greenhouse work	3	6%
Nursery work	2	4%
Tractor driving	2	4%
Total with REI violations	**47**	

Source: Spencer 2001.

6 Recommendations

Inadequate regulation of hazardous pesticides seriously imperils the health and wellbeing of California farmworkers and their families. We challenge the California Department of Pesticide Regulation (DPR) and the county agricultural commissioners—who share responsibility for regulating agricultural pesticides use in our agricultural fields—with the following recommendations.

DPR has laid the groundwork with improvements in illness reporting and documentation of poor enforcement and high violation rates. NOW WE NEED ACTION.

First, we commend DPR for recent improvements in collecting, organizing, and making publicly available information key to identifying serious problem areas resulting in farmworker pesticide poisoning. The recent DPR summary of 2000 PISP data,[20] for example, was the most comprehensive to date and helped identify new areas deserving focused attention. We urge DPR to now proceed with concrete improvements in worker safety and enforcement.

Second, we urge DPR to implement California Medical Association (CMA) recommendations to enhance regulatory protection of California farmworker health and safety. In March of 2000, CMA—which represents more than 34,000 California physicians—resolved to:[21]

a) support efforts to reduce farmworker exposure to pesticides by calling on the State to reduce aerial spraying of pesticides, to take steps to reduce pesticide drift, and to eliminate applications where workers will have high risks of exposure;

b) recommend that DPR require effective posting for all agricultural pesticide applications in culturally appropriate language that is highly visible;

c) support strengthening enforcement of existing laws by increasing fine levels for serious violations of farmworker protection laws; and

d) encourage physician awareness of pesticide illness, and its reporting law.

19 Personal communication from Charles Andrews. DPR Worker Safety Branch, December 20, 2001.

20 DPR March 7, 2002 News Release. Keep pesticides away from children, DPR urges. Release and summary report available online at: http://www.cdpr.ca.gov/docs/pressrls/mar0702.htm.

21 California Medical Association, March 2000 resolution.

Finally, we urge specific recommendations for reducing pesticide exposure of workers and improving worker protection, followed by two additional comments.

1. **Eliminate use of the most hazardous pesticides to reduce the problem of immediate and chronic pesticide poisoning at the source.**
   Initial elimination targets to achieve major use reduction should include a) fumigants and other highly toxic pesticides prone to drift or that require use of extensive protective gear, and b) pesticides that degrade slowly, leaving residues that pose long-term risks for workers and their families.

2. **Actively promote safe and sustainable alternatives.**
   To move California toward a more sustainable, healthy, and humane agricultural system, DPR and other state agencies must actively promote implementation of safe and sustainable pest management alternatives. In addition to financial support of research, education, and outreach to farmers, transition assistance and incentives are needed to assist growers in conversion to safer alternatives, particularly for fumigants. Research funding should come from substantially raised mill fee charged on sales of higher toxicity pesticides, as a recent Green Watchdog report recommends (Wolff 2002).

   In 2000, the California Biological Agriculture Initiative (AB2663) was passed through efforts by a statewide coalition including Californians for Pesticide Reform and California Sustainable Agriculture Working Group. It does not provide funding for sustainable agriculture programs, but does give notice to the University of California (UC) that the governor and legislature should request adequate and permanent funding for all UC sustainable agriculture research and education programs, and that all of its agriculture programs should incorporate sustainable agriculture.[22]

3. **Reduce pesticide drift through improved regulations.**
   Two immediate goals should include a) phaseout of aerial application, fumigation, and other drift-prone application methods, especially for Bad Actor pesticides, and b) establishment of buffer zones around fields being treated to protect fieldworkers in nearby fields, children at school, and other community members.

   California currently only requires buffer zones between applications of certain cotton defoliants (tribufos and paraquat) and residential areas and schools, and minimal methyl bromide buffer zones.[23] Buffer zones around fields fumigated with methyl bromide, 1,3–D, and metam-sodium are further specified in recommended permit conditions.[24]

   Two pesticide illness investigations the California Department of Health Services Occupational Health Branch (CDHS) conducted demonstrate that current buffer zone regulations do not ensure adequate worker protection. In the 1999 Kings County aerial drift incident Chapter 3 describes, CDHS recommended enforcement of the REI in a 1/4 mile zone around the treated field as a minimum precautionary measure for similar application scenarios (DHS 2001a). In a 1999 investigation of worker illness due to drift from a sprinkler application of metam-sodium, CDHS recommended a minimum one-mile worker buffer zone for sprinkler applications for at least 72 hours to protect workers from exposure to metam-sodium breakdown products (DHS 2001b).

4. **Reduce exposure to pesticide residue.**
   Twenty-five percent of reported poisonings occurred when workers reentered treated fields before safe to do so. Such residue exposure occurs when reentry intervals are too short or when workers are not warned that a field is unsafe. Some reentry intervals should be dramatically increased to adequately protect agricultural workers, especially children who toil in the fields.

   DPR should use its recent evaluation of field posting to support regulations for posting of warning signs around all fields before any pesticide application as a supplement to existing requirements for oral warning (Spencer 2001). Signs should be durable and include pesticide names, date of application, and time after application when unrestricted reentry is legal.

5. **Strengthen enforcement of existing laws.**
   Significant fines are needed to motivate growers and pesticide application companies to obey the

22 These programs include Sustainable Agriculture Research and Education Program, Small Farm Center, Center for Agroecology and Sustainable Food Systems, and Centers for Biological Control at Berkeley and Riverside.

23 California Code of Regulations Title 3 sections 6450.2, 6470.

24 DPR Enforcement Letters: ENF 2001–056 Methyl Bromide Field Fumigation Permit Conditions Information Package; ENF 2001-40 Suggested Permit Conditions for Using 1,3-Dichloropropene Pesticides (Fumigant) August 7, 2001; California Management Plan: 1, 3-Dichloropropene January 30, 2002; ENF 2000-044 Permit Conditions for Applications of Metam-Sodium and Potassium N-methyldithiocarbamate (Metam-Potassium) Products, November 15, 2000.

law and to demonstrate to workers that their reports of violations will ensure serious consequences for violators and health care and compensation for those made ill.

a) Counties should issue maximum allowable fines for all serious and repeat violations observed.

b) DPR must hold counties accountable for enforcement, including withholding portions of the mill fee allotment or convening trial boards if necessary. Any mill fee withheld should be transferred to the nearest DPR district office and used to increase DPR enforcement activities in the county.

c) DPR should exercise authority to issue higher fines against companies who violate the law in multiple jurisdictions (counties).

d) Maximum allowable county and state fine levels should be raised.

A state program should be created to cover medical expenses resulting from non-work-related exposure to agricultural pesticides. Program funds should come from the parties responsible for the incidents. The Earlimart (Tulare County) settlement, which put $75,000 into a fund to pay medical expenses resulting from the drift incident, should be used as a settlement model.

6. Improve farmworker access to pesticide information and healthcare services.

DPR should prioritize improving farmworker training and access to pesticide spray records as worker safety and right-to-know regulations require. It should solicit worker input on how best to accomplish this, publicize effective programs as models, and develop crop sheets that rely heavily on pictographs that growers can customize using their own spray records and make available in the field in the type of flyer holders realtors use.

Farmworkers need access to culturally sensitive medical providers with training in pesticide poisoning diagnosis and treatment, for both work and non-work related incidents. Such training should be a priority for hospital and clinic staff in areas of high pesticide use.

7. Improve pesticide incident investigation.

Counties must improve quality and utility of pesticide incident investigations and collect complete information in an objective manner that protects workers from retaliation.

a) Workers should never be interviewed with employers or supervisors present.

b) All workers in a crew must be interviewed, not just those who seek medical attention.

c) Appropriate translators, not affiliated with employers, are essential.

d) Applicators should be interviewed as soon as possible after any incident.

e) DPR and counties need to investigate the role in worker illnesses of inhaled spray vapors moving through fields. Currently worker symptoms are ignored when field samples fail to prove drift of spray droplets.

f) Counties must collect samples of all relevant materials consistently, including plants, clothing, and soil, as soon as any possible pesticide drift or residue exposure is reported.

8. Improve pesticide illness reporting.

a) 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) Occupational Health Branch and DPR Worker Health and Safety Branch.

b) DHS and the Office of Environmental Health Hazard Assessment (OEHHA) must expand existing programs to train doctors about pesticide poisoning diagnosis, treatment, and reporting requirements.

c) DPR should coordinate with the California Occupational, Safety & Health Administration (Cal/OSHA) and the Medical Board of California to help them exercise their power to fine doctors who repeatedly fail to report pesticide poisonings promptly to county health authorities.

d) State and county agencies should cooperate to reduce delays in pesticide illness notification that Appendix F documents.

9. Reduce pesticide exposure among children through better childcare and housing.

Inadequate childcare and housing are also underlying causes of excessive pesticide exposure among farmworker children in California and throughout the U.S. Both employers and government agencies need to invest substantially more in housing and childcare so farmworkers can follow recommendations to bathe after pesticide exposure and keep children out of fields.

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Appendix A

Methods

Illness Data Analysis

The California Department of Pesticide Regulation's California's Pesticide Illness Surveillance Program (PISP) collects pesticide poisoning data from both the state's Workers Compensation system and physician reports to county health officers and county agricultural commissioners (see *Fields of Poison* for more details—Reeves et al. 1999). We analyzed DPR illness reporting data from 1997 to 2000 and compared results with our analyses in *Fields of Poison* for 1991 to 1996. We also refer to analyses of pesticide use data from the same period (PAN 2001).

Illness data included all cases, after investigation by DPR, that were: a) identified as definitely, probably, or possibly related to pesticide exposure, and b) listed as agricultural, that provided a crop name, 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). Our main difference from DPR reporting is that we excluded livestock, food workers, and janitors (most reported exposure for these occupations is to chlorine and other sanitizers) and lumber workers. We included turf (major departments in most university agriculture programs and users of substantial quantities of pesticides), golf course use, and commercial nursery use. Packing and processing was included when it involved preparation of fresh produce.

In 1997, DPR began a process to improve the PISP database. 1997 data did not include an "exposure" category, but drift and residue exposure information was included in the "activity" category and used for exposure comparisons among the four years.

Prior to 1998, DPR did not identify pesticides by their probable causal relationship to reported illnesses. Appendix C therefore lists those pesticides assigned a degree of 1 (primary contributor) or 2 (potential contributor) for 1998–2000 only.

Case Studies of Fieldworker Pesticide Poisonings

Sources of worker accounts included excerpts from county pesticide episode investigation reports and selected news articles. Names were omitted or changed to protect the workers.

Enforcement Data Analysis

Statistics on county inspections and enforcement and compliance actions were obtained from the Annual Report 5 Summary of Agricultural Commissioners' Activities for Fiscal Year 2000/2001.

Appendix E was compiled from individual county compliance assessment reports.

California DPR has developed an Enforcement and Compliance Database that includes Enforcement actions (agricultural civil penalties/fines) and Compliance actions (warning letters and violation notices) from 1999–2001. We used a subset of this database in our analyses.

Appendix B
Number of Reported Pesticide Illnesses in Top Ten Crops,[a] 1991–2000

Crop/Site	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	Total
grapes	102	107	81	54	125	70	105	80	87	59	870
cotton	14	44	8	53	23	257	26	47	36	7	515
broccoli	115	63	2	6	80	41	2	4	2	24	339
oranges	4	52	9	63	26	11	74	15	14	21	289
soil[b]								12	189	21	222
almonds	18	15	36	10	8	15	28	8	17	45	200
ornamentals	23	25	14	12	23	7	6	17	9	23	159
lettuce	22	9	37	22	8	3	24	10	7	3	145
tomatoes	25	15	8	23	10	21	13	12	0	13	140
alfalfa	7	1	23	7	22	10	39	14	4	1	128
strawberries	14	22	16	7	5	14	4	2	7	14	105
pack/process[c]							5	5	53	36	99
Subtotal	**344**	**353**	**234**	**257**	**330**	**449**	**321**	**221**	**372**	**231**	**3112**
all other crops[d]	190	182	129	110	139	130	173	115	163	175	1506
no crop given	190	190	140	190	252	182	61	24	25	18	1272
Total	**724**	**725**	**503**	**557**	**721**	**761**	**555**	**360**	**560**	**424**	**5890**

Source: California DPR PISP data 2002.

a. Soil and packing/processing are included in addition to the top ten crops.

b. Prior to 1998 soil was not listed as an application site/crop.

c. Prior to 1997 packing/processing was not listed as an application site/crop.

d. We did not include the 2000 Kings County case of poisonings due to dimethoate use on egg production/processing since eggs were not listed in pesticide illness reports of other years.

Appendix C
List of All Pesticides Related to Agricultural Poisoning Cases, 1998–2000[a]

Pesticide	Number of Cases[b]	Nerve Toxin[c]	Acute Toxicity[d]	Develop. Toxicant[d]	Carcinogen[d]	Endocrine Disruptor[d]
(A) Bad Actor Pesticides						
1,3-dichloropropene	1	No	High	Not listed	Known, P65[e]	Not listed[f]
2,4-DB (acid)	1	No	Slight	Yes	Possible	Not listed
Abamectin	22	No	High	Yes	Not listed	Not listed
Acephate	17	Yes	Slight	Not listed	Possible	Not listed
Acrolein	1	No	High	Not listed	Possible	Not listed
Aldicarb	6	Yes	Extreme	Not listed	Not likely	Suspected
Aluminum phosphide	4	No	High	Not listed	Not listed	Not listed
Azinphos-methyl	2	Yes	High	Not listed	Not likely	Not listed
Benomyl	21	No	Slight	Yes	Possible	Suspected
Bensulide	1	Yes	Moderate	Not listed	Not likely	Not listed
Bifenthrin	4	No	Moderate	Yes	Possible	Suspected
Bromacil	1	No	Slight	Not listed	Possible	Not listed
Bromoxynil	1	No	Moderate	Yes	Possible	Not listed
Butylate	1	Yes	Slight	Not listed	Not likely	Not listed
Captan	12	No	High	Not listed	Known, P65	Not listed
Carbaryl	6	Yes	Moderate	Not listed	Possible	Suspected
Carbofuran	40	Yes	High	Not listed	Not likely	Not listed
Carboxin	1	No	No	Yes	Not listed	Not listed
Chlorine	7	No	High	Not listed	Not listed	Not listed
Chloropicrin	17	No	High	Not listed	Not likely	Not listed
Chlorothalonil	10	No	High	Not listed	Known, P65	Not listed
Chlorpyrifos	156	Yes	Moderate	Not listed	Not likely	Suspected
Chlorthal dimethyl	1	No	No	Not listed	Possible	Not listed
Cycloate	1	Yes	Slight	Yes	Not likely	Not listed
Cypermethrin	7	No	High	Not listed	Possible	Suspected
Daminozide	3	No	Slight	Not listed	Known, P65	Not listed
DDVP	1	Yes	High	Not listed	Known, P65	Not listed
DEF	7	Yes	Moderate	Not listed	Not likely	Not listed
Diazinon	38	Yes	Moderate	Yes	Not likely	Not listed
Dicamba	1	No	Slight	Yes	Unclassifiable	Not listed
Dicofol	7	No	High	Not listed	Possible	Suspected
Dimethoate	103	Yes	High	Yes	Possible	Not listed
Diuron	7	No	Slight	Yes	Known	Not listed
Endosulfan	2	No	High	Not listed	Not likely	Suspected
EPTC	5	Yes	Moderate	Yes	Not likely	Not listed
Ethephon	1	Yes	No	Not listed	Unclassifiable	Not listed
Fenamiphos	2	Yes	High	Not listed	Not likely	Not listed
Fenbutatin-oxide	7	No	High	Yes	Not likely	Not listed
Fenpropathrin	1	No	High	Not listed	Not likely	Suspected
Fluazifop-butyl	1	No	Slight	Yes	Not listed	Not listed
Fluvalinate	10	No	No	Yes	Not listed	Suspected
Formetanate hydrochloride	3	Yes	High	Not listed	Not likely	Not listed
Fosetyl-Al	12	No	High	Not listed	Not likely	Not listed
Imazalil	6	No	Moderate	Yes	Probable	Not listed
Iprodione	35	No	Slight	Not listed	Known, P65	Suspected
Malathion	19	Yes	Moderate	Not listed	Possible	Suspected
Mancozeb	26	No	No	Yes	Known, P65	Suspected
Maneb	15	No	No	Yes	Known, P65	Suspected
Mefenoxam	6	No	High	Not listed	Not likely	Not listed

Source: California DPR PISP data 2002 and the PAN online pesticide database (www.pesticideinfo.org).

a. All pesticides DPR considered implicated in agricultural poisoning cases from 1998 to 2000. 1997 data are omitted because DPR made no determination of relationship of pesticide to reported illnesses. Starting in 1998 DPR assessed degree of relationship to reported illness for each pesticide; we include only those assigned degree 1 (primary) or 2 (potential). In addition to pesticides, this list comprises the categories "not determined" and "adjuvant."

b. DPR reported a total of 1,344 agricultural poisoning cases from 1998 to 2000. More than one pesticide may be listed for a given case; hence the total number of pesticides listed exceeds that of reported poisoning cases.

c. Cholinesterase (ChE) inhibitor. See PAN online pesticide database for classification details (www.pesticideinfo.org).

d. See PAN online pesticide database for classification details for Acute Toxicity, Developmental and Reproductive Toxicant, Carcinogen and Endocrine Disruptor. Acute toxicity is a function of the toxicity of the chemical ingredients and their particular formulation in the pesticide product. The acute toxicity reported in this list is for the pure chemical ingredient only and may not represent particular pesticide products.

e. P65 refers to California Proposition 65, also known as the Safe Drinking Water and Toxic Enforcement Act of 1986. This law requires the state of California to maintain a list of chemicals known to cause cancer, reproductive harm, or developmental harm and to update the list at least annually.

f. "Not listed" means none of the organizations evaluating the chemicals have listed it within this toxicity category. The absence of a chemical in a category does not necessarily mean it is not toxic. It may indicate it has not yet been evaluated by responsible agencies.

g. Adjuvants are materials added to a pesticide mixture before application to improve deposition or otherwise enhance pesticide effectiveness (Marer et al. 1988). They are not required to undergo extensive toxicology testing.

Pesticide	Number of Cases	Nerve Toxin	Acute Toxicity	Develop. Toxicant	Carcinogen	Endocrine Disruptor
Merphos	1	Yes	Not avail.	Not listed	Not listed	Not listed
Metam-potassium	1	No	Not avail.	Yes	Not listed	Not listed
Metam-sodium	194	No	Not avail.	Yes	Known, P65	Not listed
Methamidophos	5	Yes	High	Not listed	Not likely	Not listed
Methidathion	2	Yes	High	Not listed	Possible	Not listed
Methomyl	54	Yes	High	Not listed	Not likely	Suspected
Methyl bromide	31	No	High	Yes	Not likely	Not listed
Methyl iodide	1	No	Not avail.	Not listed	Known	Not listed
Methyl parathion	7	Yes	Extreme	Not listed	Not likely	Suspected
Metolachlor	4	No	Slight	Not listed	Possible	Suspected
Metribuzin	1	No	Moderate	Yes	Unclassifiable	Suspected
Molinate	1	Yes	Moderate	Yes	Possible	Not listed
Msma	1	No	Slight	Not listed	Known	Not listed
Myclobutanil	38	No	Slight	Yes	Not likely	Not listed
Naled	36	Yes	Moderate	Yes	Not likely	Not listed
Norflurazon	1	No	Slight	Not listed	Possible	Not listed
Oxydemeton-methyl	32	Yes	High	Yes	Not likely	Not listed
Oxytetracycline	1	No	Not avail.	Yes	Not listed	Not listed
Paraquat	20	No	High	Not listed	Not likely[d]	Not listed
Peroxyacetic acid	5	No	High	Not listed	Not listed	Not listed
Phorate	5	Yes	Extreme	Not listed	Not likely	Not listed
Phosmet	6	Yes	Moderate	Not listed	Possible	Not listed
Profenofos	3	Yes	Moderate	Not listed	Not likely	Not listed
Prometryn	1	No	Slight	Yes	Not likely	Not listed
Propargite	66	No	High	Yes	Known, P65	Not listed
Propiconazole	5	No	Moderate	Yes	Possible	Not listed
Pyrethrins	2	No	Moderate	Not listed	Probable	Not listed
Resmethrin	25	No	Slight	Yes	Not listed	Suspected
Simazine	8	No	Slight	Yes	Possible	Suspected
Sodium hypochlorite	110	No	High	Not listed	Unclassifiable	Not listed
Sulfotep	6	Yes	Extreme	Not listed	Not likely	Not listed
Thiabendazole	3	No	Slight	Yes	Probable	Not listed
Thiophanate-methyl	12	No	Slight	Yes	Probable	Not listed
Thiram	7	No	Moderate	Yes	Unclassifiable	Suspected
Triadimefon	4	No	Moderate	Yes	Possible	Suspected
Vinclozolin	3	No	Slight	Yes	Known, P65	Suspected
Zinc	1	No	Slight	Yes	Unclassifiable	Not listed
Ziram	2	No	Moderate	Yes	Probable	Suspected
(B) Other Pesticides						
Adjuvants[g]	251					
Not determined	509					
Unknown	15					
2,4-D	9	No	Moderate	Not listed	Possible	Suspected
8-Quinolinol	2	No	Slight	Not listed	Unclassifiable	Not listed
Agrobacterium radiobacter	1	No	Not avail.	Not listed	Not listed	Not listed
Ampelomyces quisqualis	1	No	Not avail.	Not listed	Not listed	Not listed
Azadirachtin	1	No	Not avail.	Not listed	Not listed	Not listed
Azoxystrobin	16	No	No	Not listed	Not likely	Not listed
Bacillus thuringiensis	50	No	Slight	Not listed	Not listed	Not listed
Beauveria bassiana strain gha	5	No	Not avail.	Not listed	Not listed	Not listed
Calcium hypochlorite	1	No	Not avail.	Not listed	Unclassifiable	Not listed
Chloroneb	2	No	Slight	Not listed	Not listed	Not listed

Appendix C, continued

Pesticide	Number of Cases	Nerve Toxin	Acute Toxicity	Develop. Toxicant	Carcinogen	Endocrine Disruptor
Cinnamaldehyde	1	No	Slight	Not listed	Not listed	Not listed
Clofentezine	2	No	Slight	Not listed	Possible	Suspected
Clopyralid	1	No	Not avail.	Not listed	Not likely	Not listed
Copper	2	No	Not avail.	Not listed	Unclassifiable	Not listed
Copper ammonium complex	1	No	Not avail.	Not listed	Not listed	Not listed
Copper hydroxide	36	No	Slight	Not listed	Not listed	Not listed
Copper oxychloride sulfate	8	No	Slight	Not listed	Not listed	Not listed
Copper sulfate	13	No	Moderate	Not listed	Not listed	Not listed
Cryolite	13	No	Slight	Not listed	Unclassifiable	Not listed
Cuprous oxide	1	No	Moderate	Not listed	Not listed	Not listed
Cyfluthrin	10	No	Moderate	Not listed	Not likely	Suspected
Cyhalothrin	11	No	Moderate	Not listed	Unclassifiable	Suspected
Cymoxanil	1	No	Slight	Not listed	Not likely	Not listed
Cyprodinil	4	No	Slight	Not listed	Not likely	Not listed
Dicloran	2	No	Slight	Not listed	Not listed	Not listed
Dienochlor	2	No	Slight	Not listed	Not listed	Not listed
Difenoconazole	1	No	Slight	Not listed	Possible	Not listed
Diflubenzuron	1	No	Slight	Not listed	Not likely	Not listed
Diquat	3	No	Moderate	Not listed	Not listed	Not listed
Dodecenyl pheromones	1	No	Not avail.	Not listed	Not likely	Not listed
Esfenvalerate	28	No	Moderate	Not listed	Not likely	Suspected
Fenarimol	18	No	Slight	Not listed	Not likely	Suspected
Fenhexamid	1	No	Slight	Not listed	Not likely	Not listed
Fludioxonil	2	No	Slight	Not listed	Unclassifiable	Not listed
Garlic	1	No	Slight	Not listed	Not listed	Not listed
Gibberellic acid	17	No	Slight	Not listed	Not listed	Not listed
Glyphosate	55	No	Slight	Not listed	Not likely	Not listed
Glyphosate-trimesium	1	No	Not avail.	Not listed	Not likely	Not listed
Hexythiazox	2	No	Slight	Not listed	Possible	Not listed
Hydrogen cyanamide	1	No	Not avail.	Not listed	Possible	Not listed
Hydrogen peroxide	5	No	Not avail.	Not listed	Unclassifiable	Not listed
Imazethapyr	1	No	Slight	Not listed	Not listed	Not listed
Imidacloprid	18	No	Moderate	Not listed	Not likely	Not listed
Indole-3-butyric acid	1	No	Not avail.	Not listed	Not listed	Not listed
Lime-sulfur	15	No	Not avail.	Not listed	Not listed	Not listed
Magnesium phosphide	1	No	Not avail.	Not listed	Not listed	Not listed
Manganese sulfate	1	No	Not avail.	Not listed	Not listed	Not listed
Mecoprop	1	No	Slight	Not listed	Possible	Not listed
Mepiquat chloride	16	No	Moderate	Not listed	Not likely	Not listed
Metalaxyl	8	No	Moderate	Not listed	Not likely	Not listed
Methoxychlor	1	No	Slight	Not listed	Unclassifiable	Suspected
Mineral oil	16	No	Slight	Not listed	Unclassifiable	Not listed
Neem oil	1	No	Slight	Not listed	Not listed	Not listed
Nonanoic acid	1	No	No	Not listed	Not listed	Not listed
Oryzalin	6	No	Slight	Not listed	Possible	Not listed
Oxyfluorfen	18	No	Slight	Not listed	Possible	Not listed
Paclobutrazol	1	No	Slight	Not listed	Unclassifiable	Not listed
Permethrin	16	No	Moderate	Not listed	Possible	Suspected
Petroleum distillates	3	No	Not avail.	Not listed	Unclassifiable	Not listed
Petroleum oil	59	No	Not avail.	Not listed	Not listed	Not listed
Piperonyl butoxide	3	No	Moderate	Not listed	Possible	Not listed
Potassium bicarbonate	1	No	Slight	Not listed	Not listed	Not listed

Pesticide	Number of Cases	Nerve Toxin	Acute Toxicity	Develop. Toxicant	Carcinogen	Endocrine Disruptor
Potassium salts of fatty acids	6	No	Not avail.	Not listed	Not listed	
Pyridaben	2	No	Moderate	Not listed	Not likely	Not listed
Pyriproxyfen	1	No	Slight	Not listed	Not likely	Not listed
Pyrithiobac-sodium	1	No	Moderate	Not listed	Possible	Not listed
Quaternary ammonia	15	No	Not avail.	Not listed	Not likely	Not listed
Rimsulfuron	1	No	Slight	Not listed	Not likely	Not listed
Sabadilla	3	No	Not avail.	Not listed	Not listed	Not listed
Sodium bisulfite	1	No	Slight	Not listed	Unclassifiable	Not listed
Sodium chlorate	7	No	Slight	Not listed	Not listed	Not listed
Sodium chlorite	7	No	Not avail.	Not listed	Unclassifiable	Not listed
Sodium tetrathio-carbonate	3	No	Not avail.	Not listed	Not listed	Not listed
Spinosad	33	No	Slight	Not listed	Not likely	Not listed
Streptomycin	3	No	Not avail.	Not listed	Not listed	Not listed
Sulfur	202	No	Slight	Not listed	Not listed	Not listed
Sulfur dioxide	3	No	Not avail.	Not listed	Unclassifiable	Not listed
TCMTB	1	No	Not avail.	Not listed	Possible	Not listed
Tebuconazole	4	No	Moderate	Not listed	Possible	Not listed
Tebufenozide	24	No	Slight	Not listed	Not likely	Not listed
Tralomethrin	22	No	Not avail.	Not listed	Not listed	Suspected
Trifloxystrobin	3	No	Slight	Not listed	Not likely	Not listed
Triflumizole	8	No	Slight	Not listed	Not likely	Not listed
Trifluralin	6	No	Slight	Not listed	Possible	Suspected
Triflusulfuron-methyl	1	No	Slight	Not listed	Possible	Not listed
Trinexapac-ethyl	1	No	Slight	Not listed	Not listed	Not listed
Uniconazole	1	No	Slight	Not listed	Possible	Not listed

Appendix D
Reported Poisoning Cases by Crop in Counties with More Than 10 Cases, 1997–2000

County	Total # Cases	Crops Involved	# Cases by Crop/Site	% County's Cases
Tulare	427	Soil treatment	171	40.0
		Oranges	105	24.6
		Grapes	62	14.5
Fresno	221	Cotton	68	30.8
		Grapes	43	19.5
		Almonds	24	10.9
		Unknown	20	9.0
Monterey	178	Lettuce	32	18.0
		Broccoli	28	15.7
		Grapes	25	14.0
Kern	175	Grapes	58	33.1
		Almonds	15	8.6
		Unknown	15	8.6
		Cotton	13	7.4
Kings	96	Eggs	58	60.4
		Cotton	21	21.9
San Joaquin	73	Pack/Process	24	32.9
		Grapes	18	24.7
Riverside	68	Alfalfa	31	45.6
		Grapes	12	17.6
San Diego	68	Pack/Process	53	77.9
Madera	63	Grapes	32	50.8
Merced	60	Nectarines	13	21.7
		Soil treatment	8	13.3
		Grapes	7	11.7
Imperial	57	Melons	27	47.4
		Alfalfa	12	21.1
Ventura	52	Lemons	30	57.7
Sonoma	45	Grapes	32	71.1
Stanislaus	42	Almonds	8	19.0
		Grapes	7	16.7
		Unknown	7	16.7
San Benito	34	Celery	20	58.8
Colusa	24	Rice	12	50.0
		Unknown	5	20.8
Santa Barbara	24	Soil treatment	8	33.3
Santa Cruz	24	Flowers	7	29.2
		Strawberries	6	25.0
Sacramento	21	Grapes	9	42.9
Yolo	21	Tomatoes	7	33.3
Solano	14	Tomatoes	9	64.3
Glenn	12	Almonds	3	25.0
		Prunes	3	25.0
Napa	12	Grapes	9	75.0
Sutter	12	Tomatoes	4	33.3
San Mateo	10	Ornamental	5	50.0
Subtotal	**1411**			
Other counties	64			
Total	**1475**			

Source: California DPR PISP data 2002.

Appendix E

DPR Compliance Assessment Results by County

County	Year	Application Inspections	PPE Supplied[a]	Emergency Medical Posting	Washing Supplies	Field Posting When Required[b]	Fieldwork Inspections	PSIS Leaflet Posted[c]	Spray Info. Available	Washing Supplies
Colusa	99	34	68%	70%	84%	2 of 4	6	50%	0%	84%
Fresno	97	20	29%	88%	65%	n/a	10	30%	13%	80%
Imperial	98	27	60%	75%	68%	6 of 8	17	94%	13%	88%
Kern	99	50	52%	70%	74%	n/a	9	50%	0%	100%
Kings	99	24	41%	88%	76%	5 of 12	14	14%	0%	29%
Merced	99	25	40%	72%	40%	n/a	6	0%	20%	67%
Monterey	97	40	90%	65%	77%	16 of 17	15	64%	0%	93%
N/apa	97	5	80%	60%	80%	n/a	5	20%	0%	40%
Riverside	98	17	58%	82%	83%	2 of 4	12	67%	17%	83%
Sacramento	00	51	67%	49%	59%	1 of 1	12	58%	55%	92%
San Diego	99	15	93%	100%	86%	5 of 7	23	17%	35%	78%
San Joaquin	99	31	46%	34%	45%	n/a	15	25%	25%	91%
San Luis	97	25	72%	96%	96%	5 of 7	20	63%	25%	90%
Santa Barbara	99	25	86%	90%	100%	1 of 2	21	57%	24%	100%
Santa Cruz	00	30	87%	90%	87%	1 of 1	18	50%	50%	100%
Solano	00	21	55%	53%	68%	n/a	16	56%	44%	69%
Sonoma	97	6	0%	60%	87%	n/a	9	55%	67%	67%
Sutter	98	41	83%	100%	67%	n/a	12	17%	8%	17%
Tulare	98	44	25%	n/a	47%	n/a	11	36%	0%	43%
Ventura	99	29	79%	52%	90%	n/a	13	38%	38%	88%
Total		**572**					**239**			
Average			**56%**	**57%**	**70%**			**47%**	**23%**	**78%**

Source: California DPR1997–2000. Individual county compliance assessments obtained from DPR by public records request.

a. Percent of inspections where label-required personal protective equipment (PPE) was supplied and worn.

b. For example, in Colusa, posting of warning signs around the field before pesticide application was required in four fields where applications were observed; only two fields were posted.

c. PSIS A9 is the Pesticide Safety Information Series leaflet—general information about field work pesticide hazards, worker rights, and precautions to avoid exposure—that must be displayed in any field where a Restricted Entry Interval (REI) has been in effect within the last 30 days.

Appendix F

Delays in Reporting of Pesticide Illnesses to County Agricultural Commissioners 1999–2001: Average Days for Notification from Physicians or Workers Compensation

County	Number of Episodes	County CAC Notified (days)[a]	Workers' Comp Notified (days)[b]	Dr. Reporting (days)[c]
Alameda	1	39	39	n/a
Amador	1	82	82	n/a
Butte	2	72	72	n/a
Colusa	1	41	41	n/a
Fresno	31	41	76	22
Glenn	4	24	36	1
Humboldt	2	25	42	7
Imperial	6	26	43	17
Kern	16	16	26	11
Kings	7	48	61	22
Lake	1	5	n/a	5
Lassen	1	110	110	n/a
Madera	8	14	14	14
Marin	1	68	68	n/a
Mendocino	2	56	n/a	56
Merced	7	39	63	14
Monterey	20	130	119	146
Napa	4	24	25	22
Nevada	1	6	n/a	6
Orange	3	37	35	40
Riverside	3	28	35	15
Sacramento	1	14	14	n/a
San Diego	3	23	39	6
San Joaquin	12	23	36	11
San Luis Obispo	1	27	27	n/a
San Mateo	2	65	65	n/a
Santa Barbara	4	25	22	26
Santa Clara	1	7	n/a	7
Santa Cruz	2	118	118	n/a
Solano	2	51	89	12
Sonoma	11	47	58	21
Stanislaus	18	24	38	10
Sutter	2	19	30	8
Tehama	1	223	223	n/a
Tulare	18	41	75	13
Ventura	3	87	87	n/a
Yolo	4	23	27	11
Yuba	2	38	38	n/a
Average # days		**47**	**58**	**21**

Source: DPR Evaluation of Investigation Reports 1999–2001 HS-1823.

a CAC (County Agricultural Commissioner) Notified (days): The overall average number of days it took for the agricultural commissioner to be notified for all episodes investigated in each county between 1999 and 2001.

b Workers' Comp Notified (days): The average number of days it took for the agricultural commissioner to be notified as a result of workers' compensation illness reporting to the state which DPR in turn forwards to the agricultural commissioner.

c Doctor Reporting (days): The average number of days it took for the agricultural commissioner to be notified as a result of doctor (physician) reporting of suspected pesticide illness. By law, physicians are required to report all cases of suspected pesticide poisoning to their county health officer within 24 hours and the county health department is required to immediately notify the agricultural commissioner.

Appendix G
Enforcement Record by County, Fiscal Year 2000–2001

County	# Violations in Ag. Use Inspections[a]	Number of Warning Letters[b]	Avg. # Fines	Avg. # Fines 1991–97[c]	# Permits Issued[d]
Alameda	190	137	5	15	118
Alpine	0	0	0	0	0
Amador	10	37	1	2	70
Butte	14	18	2	12	1142
Calaveras	15	24	4	3	51
Colusa	128	13	7	9	1126
Contra Costa	171	179	4	13	212
Del Norte	9	2	0	0	30
El Dorado	0	6	0	0	176
Fresno	382	166	21	19	5122
Glenn	120	21	10	9	796
Humboldt	2	4	0	0	42
Imperial	89	38	24	32	1489
Inyo/Mono	0	1	0	0	51
Kern	274	153	17	24	1808
Kings	70	32	6	7	1460
Lake	0	0	0	1	133
Lassen	0	0	0	0	117
Los Angeles	29	205	44	124	560
Madera	169	112	21	17	1486
Marin	4	26	2	10	47
Mariposa	9	3	0	0	31
Mendocino	69	28	3	2	93
Merced	178	78	4	16	1799
Modoc	0	0	0	1	81
Monterey	291	19	7	12	591
Napa	158	124	1	5	221
Nevada	0	0	1	1	30
Orange	55	661	25	53	422
Placer	24	9	27	4	170
Plumas/Sierra	0	14	0	0	37
Riverside	109	156	25	40	931
Sacramento	11	12	7	43	368
San Benito	7	9	2	3	189
San Bernardino	306	212	42	32	287
San Diego	481	562	35	23	1278
San Francisco	5	1	0	2	9
San Joaquin	290	49	4	7	1839
San Luis Obispo	214	162	28	42	776
San Mateo	5	13	1	4	120
Santa Barbara	392	65	38	27	838
Santa Clara	110	150	4	14	261
Santa Cruz	194	10	0	6	274
Shasta	19	26	7	1	158
Sierra	0	0	0	0	0
Siskiyou	0	1	0	2	146
Solano	90	16	1	7	481
Sonoma	77	47	3	7	403
Stanislaus	131	5	1	6	2397
Sutter	58	220	30	16	1303
Tehama	27	15	5	8	362
Trinity	0	0	0	0	0
Tulare	182	73	13	17	3241
Tuolumne	3	23	1	2	19
Ventura	151	94	27	5	1275
Yolo	118	26	7	27	919
Yuba	15	4	0	2	387
State total	**5452**	**4069**	**520**		**37,962**

Source: DPR 2002a.

a. Violations documented in agricultural pesticide use inspections (including fieldwork inspections). More than one violation may occur per inspection. Violations found in poisoning investigations excluded.

b. Total Warning Letters and Violation Notices (no fine) issued for all agricultural and non-agricultural pesticide regulation violations issued for all (agricultural and non-agricultural) inspections and investigations of pesticide poisoning.

c. Average number of annual fines for agricultural pesticide safety violations (Agricultural Civil Penalties) between 1991 and 1997 as reported in *Fields of Poison.*

d. An Agricultural Pesticide Use Permit must be obtained by each property owner or operator intending to have restricted pesticides applied for agricultural production on their property.