Greater Risks, Fewer Rights: U.S. Farmworkers and Pesticides

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Pesticide Action Network, United Farmworkers of America, and California Rural Legal Assistance Foundation analyzed California government data on agricultural poisonings and enforcement of worker safety standards. Nearly 500 pesticide poisonings were reported for California farmworkers every year from 1997 to 2000. The actual number of pesticide-related illnesses is unknown, since many poisonings go unreported. Most poisonings occurred as a result of soil fumigation and pesticide applications to grapes, oranges, and cotton. Pesticide drift accounted for 51% of the cases, and another 25% resulted from exposures to pesticide residues. Violations of worker safety laws were common, contributing to 41% of reported poisonings. No violations occurred in another 38%, indicating that existing laws inadequately protect workers from pesticide exposure. This snapshot of human rights abuse through pesticide exposure in California—the site of some of the world's most stringent pesticide use and worker safety laws—illustrates the global problem of pesticide poisoning among agricultural workers. *Key words*: human rights; farmworkers; pesticides; worker safety laws; agricultural poisonings.

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Agriculture is one of the most hazardous occupations in the world. In the United States, the death rate among agricultural workers was an estimated 20.9 per 100,000 workers in 1996, compared with the average for all industries of 3.9 per 100,000 workers.[1] In addition to long workdays and high risk of physical injury, the estimated 2 million farmworkers in the United States* face a greater risk of pesticide exposure than any other segment of the population.

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Farmworkers, and often their children, are regularly exposed to pesticides in many ways—mixing or applying pesticides; during planting, weeding, thinning, irrigating, pruning, harvesting, and processing crops; or living in or near treated fields. This constant exposure to dangerous chemicals—often without full knowledge of the exposure or its potential effects—represents a clear violation of the rights of individual farmworkers and farmworker communities.

California has the largest agricultural economy in the U.S. and employs about 700,000 men and women (about 35% of the U.S. farmworker population). Its systems for reporting pesticide use and pesticide-related illnesses, managed by California's Department of Pesticide Regulation (DPR), are "widely considered the most extensive in the world."[3] Pesticide Action Network North America, together with United Farmworkers of America, AFL-CIO (UFW), and California Rural Legal Assistance Foundation recently analyzed California agricultural poisoning data and enforcement information for the period from 1997 to 2000 and compared the results with similar data from the previous period (1991 to 1996). This paper includes major findings presented to state regulators and the public in a recent report produced by the 170-member statewide coalition Californians for Pesticide Reform.[4]

Pesticide Use Trends in California

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 the 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.

*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 (Reeves et al.[2]) considered 2.5 million the best estimate, which we round off to 2 million.

Approximately one third of the 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.[6] In 1999, though total reported pesticide use decreased, use 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% to 172 million in 2000, mostly due to decreased use of some soil fumigants and the fungicide sulfur. Data for the year 2000 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 of this pesticide 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.[6,7]

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, their tendency to drift off-site, and exorbitant application rates (100–400 pounds per acre) make them among the most hazardous used in California.[8]

Linking Pesticides and Worker Illnesses

The U.S. Environmental Protection Agency (EPA) estimates that U.S. agricultural workers experience 10,000–20,000 acute‡ pesticide-related illnesses each year, based on extrapolation from physician-reported cases in California.[9] This is probably a significant underestimate, since many illnesses are never officially reported, a process that requires workers to identify the problem and seek treatment, and physicians to correctly diagnose and report poisonings to appropriate authorities.[10] 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."[3]

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.[11,12] Causes of chronic illnesses are particularly difficult to document for a number of reasons, including that illness may take many years to develop and may result 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,[13,14] spontaneous abortion,[15] and cancer).[16,17]

For example, recent analysis of cancers among 146,000 California Latino farmworkers who had been UFW members showed that, compared with the general Latino 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%.[18] 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.[19] In addition, several studies link pesticide exposure of parents to increased risk of childhood cancer.[20–22]

RESEARCH METHODS

California's Pesticide Use Reporting (PUR) system and Pesticide Illness Surveillance Program (PISP) are designed to help policymakers and the public understand the scope of pesticide use and poisoning in the state. Although the systems provide vital information for the evaluation of farmworkers' exposures to pesticides, both have important limitations.

†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.

‡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.

For example, the use-reporting system requires reporting of pesticides' active ingredients only. It excludes "inert" ingredients, despite their large volume in pesticide formulations and the potential or known toxicity of these chemicals.§[23,24]

California's illness-reporting system collects pesticide poisoning data from both the state's Workers Compensation system and physicians' reports to county health officers and county agricultural commissioners. The data collected are critically deficient, as they address only acute health effects. Chronic effects are rarely reported[11] and not included at all in PISP data. Other barriers to accurate accounting of pesticide-related illnesses include physician misdiagnoses,[25] workers' preference for medical care in Mexico,[26] and fear that reporting a work-related illness may lead to employer reprisal and loss of work.[3]

Despite these limitations, data collected through California's PUR system and the PISP reveal disturbing continued use of toxic pesticides and worker poisonings. We analyzed DPR illness reporting data from 1991 to 2000, and we refer to analyses of pesticide-use data from the same period.[27]

In our analysis of illness data we included all cases that were 1) identified by the DPR as definitely, probably, or possibly related to pesticide exposures, and 2) listed as agricultural incidents (provided a crop name, pesticide use linked to production of agricultural commodities, or the affected person worked for a food-processing facility).[28] Our analysis excluded livestock, food workers, and janitors (most reported exposures for these occupations are to chlorine and other sanitizers) and lumber workers. We included the following as crops or application sites: turf (major departments in most university agriculture programs and users of substantial quantities of pesticides), golf courses, and commercial nurseries. Packing/processing was included when it involved preparation of fresh produce.

Prior to 1998, the DPR did not identify pesticides by their probable causal relationships to reported illnesses. Relevant tables therefore list those pesticides assigned a degree of 1 (primary contributor) or 2 (potential contributor) for 1998–2000 only.

For analyses of worker safety law enforcement, we used the California DPR Enforcement and Compliance Database that includes enforcement actions (agricultural civil penalties/fines) and compliance actions (warning letters and violation notices). Information about county inspections and enforcement and compliance actions was obtained from the Annual Report 5 Summary of Agricultural Commissioners' Activities for Fiscal Year 2000/2001.[29]

FINDINGS: FARMWORKERS FACE PESTICIDE EXPOSURE WITH FEW PROTECTIONS

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

Between 1991 and 1996, the DPR reported an annual average of 665 pesticide poisonings among farmworkers.[2] Poisoning rates continued to be high between 1997 and 2000, with a total of 1,899 reported cases for the period, for an annual average of 475 poisoning incidents.

This drop in reported illnesses, possibly an encouraging trend, may reflect reduced use of some high-toxicity pesticides. Unfortunately, the data preclude the required comparisons, since prior to 1998 the DPR did not consistently indicate which pesticides in mixtures were held responsible for reported poisonings. Furthermore, we know that underreporting remains a serious problem, with many—perhaps most—poisonings going unreported. In addition, recent demographic changes in the U.S. and California farmworker populations indicate that factors favoring underreporting have increased. These changes include an increase in the number of undocumented workers, lower earnings, fewer weeks worked, and reduced use of social services.[30]

Pesticide Uses on Grapes and Soil Cause the Greatest Numbers of Reported Poisonings

Farmworkers working in or near grape fields rank first in reported illnesses, attributed in part to frequent high level applications of sulfur. The broad category of "soil"—identified first in 1998 as an application site—ranks number two, with 222 cases listed (Table 1). Of those, 195 (97%) involved exposures to soil fumigants. Soil fumigants are broad-spectrum pesticides used to sterilize soil before planting various crops, such as strawberries and tomatoes.

The California DPR recently improved pesticide illness data by including more information about crops and sites involved. The percentage of cases for which no crop or site was identified fell from 29% in 1991–

§Inerts—pesticide formula additives not currently classified as active—serve to enhance pesticide potency or application. They include solvents, spreaders, stickers, wetting agents, carriers, fillers, and other chemicals. Of approximately 2,300 inerts, a fourth are chemically, biologically, or toxicologically active and 610 are known to be hazardous.

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

1996 to 7% in 1997–2000, making it easier to identify the most problematic production systems.

Particularly Hazardous Pesticides Linked to Poisonings

In 1998 the California DPR improved the analytical power of the Pesticide Illness Surveillance Program (PISP) database by including the DPR's interpretation of degree of relationship of each listed pesticide to the associated poisoning. Table 2 data show the top 20 pesticides considered by the DPR to be primary or potential contributors to reported illnesses occurring between 1998 and 2000.

Fourteen of the top 20 pesticides linked to reported illnesses are classified as particularly hazardous "bad sctor" pesticides. 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 linked to reported illnesses are "bad actor pesticides.

Of particular note is the number of illnesses linked to organophosphate pesticides, which are among the most toxic pesticides targeted under the Federal Food Quality Protection Act (FQPA), a law created to reduce non-occupational exposures to pesticide residue, especially among children.** For example, chlorpyrifos—recently banned for almost all domestic uses under the FQPA—was implicated in 156 reported poisonings. Dimethoate, another organophosphate, was implicated in 103 poisonings.

Most Poisonings Result from Drift or Residue Exposures

> 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 4:45 A.M. . . . 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.
>
> We arrived at the work site at about 5:20 A.M. There was a strong odor at the field 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

TABLE 1. Acute Poisoning Cases among California Farmworkers—Top Ten Crops,* 1997–2000 and 1991–1996

Crop	Cases 1997–2000 (4 Years)	Cases 1991–1996 (6 Years)
Grapes	331	539
Soil	222	†
Oranges	124	165
Cotton	116	399
Packing/processing	99	‡
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	**1,283**	**1,991**
All other crops/sites	488	856
Unknown	128	1,144
TOTAL	**1,899**	**3,991**
ANNUAL AVERAGE	**475**	**665**

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

In addition to identifying the crop (or site) where the incidents occur and the pesticides involved, the 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 accounted for 51% and 25% of poisoning cases from 1998 to 2000. Of 681 drift cases, 170 (25%) involved a single incident in 1999 in Earlimart, Tulare County (see description below). Three hundred thirty-six of the total reported cases were caused by exposure to pesticide residues on plants or in the field. Most of the remaining exposures the DPR listed involved direct sprays or spills and occurred most often among pesticide applicators. Figure 1 shows the distribution of exposure types for 1998–2000, information not available in the same format for 1997.††

**The Food Quality Protection Act of 1996 (Sect. 408 of the Federal Food, Drug and Cosmetic Act) directed the 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. The FQPA excluded direct exposure of farmworkers, including their children, to field pesticide residues.

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

TABLE 2. Top 20 Pesticides Implicated in Reported Poisoning Cases of California Farmworkers, 1998–2000*

Pesticide*	Cases†	Bad Actor	Nerve Toxin‡	Acute Toxicity§	Develop Toxicant§	Cardinogen§	Endocrine Disruptor§
Not Determined	509						
Adjuvant¢	251						
Sulfur**	202		No	Slight	Not listed	Not listed††	Not listed
Metam-sodium	194	Yes	No	Not available	Yes	Known, P65‡‡	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 available	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).

*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."

†DPR reported a total of 1,344 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.

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

§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.

¶Adjuvants are added to a pesticide mixture before application to improve deposition or otherwise enhance pesticide effectiveness. They are not required to undergo extensive toxicology testing.

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

††"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.

‡‡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.

Examples of Fieldworker Pesticide Poisonings

The following cases illustrate the real circumstances under which reported poisonings occur. They include descriptions of workers' illnesses and employers' responses as well as enforcement outcomes.

Drift Exposure in Monterey County, April 2000. On April 22, 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. The workers were transported to the doctor and an investigation was promptly initiated.[31]

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 the workers' symptoms had resulted from breathing pesticide vapors moving through the field. Twenty-two cases are listed in the DPR's pesticide-related illness database.

Drift exposure in 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.‡‡[32,33]

Outcome. In a historic settlement brought about through persistent efforts of Earlimart residents and the United Farmworkers Union, the pesticide application company 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 waited five months for payment of 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 applications and a prohibition of night-time metam-sodium application. This falls short of the one-mile buffer zone for these applications imposed by two other counties following a similar incident earlier that year. The DPR's pesticide illness database lists 170 cases.

Residue exposure in Kern County, September 1999. On September 27, 1999, at 3 P.M., eight workers were transported to the doctor when it was learned that the cotton field they had been working in all day had been treated with the defoliant tribufos (DEF) at 3 A.M. That day only one worker experienced slight headache and nausea. In subsequent weeks and months seven of the workers 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.[34,35]

Outcome. **The** 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 $1,000 for failing to provide notice that the field was under a restricted-entry interval. The applicating company was fined $1,405 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.

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

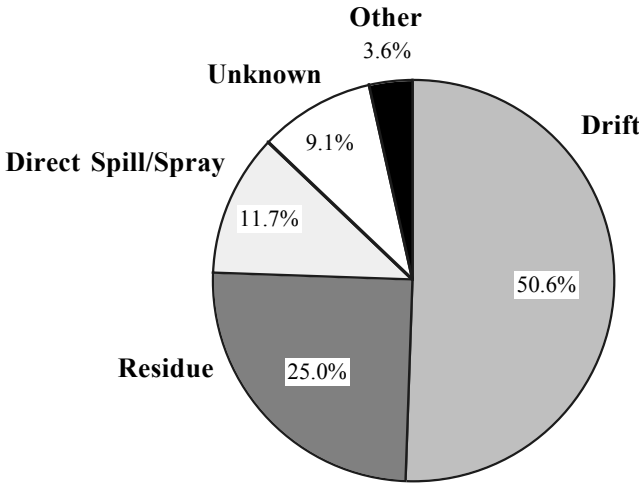

Figure 1—Exposure routes for poisoning cases among California farmworkers, 1998–2000. Source: California DPR PISP data 2002.

Worker Safety Laws Are Weak and Poorly Enforced

In 1995, the U.S. EPA implemented the federal Worker Protection Standard (WPS) to "reduce the risks of illness or injury resulting from workers' and handlers' occupational exposures to pesticides."[36] The WPS establishes posting and restricted entry rules for fields where pesticides are applied and requires employers to provide pesticide-use 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, the WPS and additional pesticide safety requirements are implemented and enforced by the DPR in coordination with agricultural commissioners in each county.

Our analysis found that violations of worker protection laws are common and include failure to provide useable protective equipment, inadequate washing/decontamination facilities, and lack of fieldworkers' access to pesticide information. In its investigations, the DPR found that 88% of protective equipment violations were due to employers' negligence, and only 12% to workers' failure to utilize available protective equipment.

When violations were found, local regulatory authorities issued few fines, responding primarily with letters of warning and violation notices. During fiscal year 2000–2001 authorities issued 4,069 letters of warning or notices of violation, and imposed only 520 fines statewide. Most fines ranged from $151 to $400.

Violations contributed to reported illnesses in 41% of all reported cases from 1997 to 2000. In another 38% of reported poisonings, the DPR determined that no relevant violation had occurred. This indicates that in a substantial number of cases, apparent compliance with existing laws and regulations failed to protect workers from poisoning. For the remaining 21% of reported pesticide illnesses the DPR failed to deter-

mine whether or not violations had occurred, reflecting the inadequacy of investigations.

DISCUSSION: U.S. FARMWORKERS DENIED BASIC RIGHTS

U.S. farmworkers have lacked basic protections enjoyed by workers in other industries for decades. In many states farmworkers are denied the right to organize, receive no compensation for workplace injuries,[§§] and are not paid at a higher rate 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 eligible only after a ten-hour day or a 60-hour week.

Farmworkers are also often overlooked when health-based regulatory decisions ban or restrict the use of particularly hazardous pesticides. Recently, for example, the U.S. EPA issued a cancellation order for virtually all chlorpyrifos home-use products to reduce risks to children, with phase-out over three years.[38] Almost all agricultural uses remain allowed, regardless of risks to farmworker children in the field, through drift, and from residue on parents' clothes.

A similar case illustrates the relative importance of economic versus public health concerns. The 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. The U.S. EPA acknowledges its risks for farmworkers and applicators but concludes that growers' need for continued use outweighs the potential harm to farmworker health.[39]

Children Are Particularly Vulnerable

Children are more vulnerable than adults to pesticide exposures. 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 exposures 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." The GAO also called on the EPA to reevaluate the time period required before reentry into fields after pesticide application (restricted-entry intervals) to ensure that farmworker children are protected.[40]

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 the U.S. EPA's chronic reference dose for azinphos-methyl—a highly toxic nerve poison.[41]

Poverty, Lack of Health Care Increase Risk and Underreporting

The risks and consequences of pesticide exposures among farmworkers are exacerbated by the conditions of poverty in which they live and work. According to a U.S. Department of Labor (DOL) study, U.S. agricultural workers' wages declined throughout the 1990s relative to non-agriculture workers. In the late 1990s the median farmworker family earned less than $10,000 and 61% had family incomes below the poverty level.[30] In California, per-capita income among farmworkers in 1998 was between $3,690 and $4,420 (compared with $28,163 for all Californians).[42]

Access to and knowledge about social services are influenced by immigrant status, among other factors. Throughout the 1990s the numbers of recent immigrants increased. In 1997–98 81% of U.S. farmworkers were foreign-born, with about 77% from Mexico.[30] Farmworker demographics are similar in California, with 92% of farmworkers being foreign-born.[43]

The initial report from a large-scale California Agricultural Workers Health Survey (CAWHS) indicated 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 employers. Only three of seven CAWHS sites had community or migrant clinics to serve the farmworker populations. Although 16.5% said their employer offered insurance, some workers found it cost-prohibitive. Nearly half of CAWHS subjects and family members had reportedly paid "out-of-pocket" for most recent medical visits.[43]

Economic insecurity, poor housing, language barriers, lack of health insurance, and poor work conditions exacerbate the problems of pesticide exposure for most farmworkers. Recommendations to bathe at the end of each workday, wear clean work clothes every day, and

§§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 coverage of farmworkers. In 25, coverage is more limited in agriculture than in other industries. U.S. Department of Labor (DOL).[37]

wash work clothes separately from family clothes ring hollow when one's living quarters have no running water or washing machine. At least 800,000 farmworkers across the country lack adequate shelter and may be found camping in parking lots, living in their cars or in groups of ten to 12 in trailers, or occupying garages, tool sheds, caves, tents, and hotel rooms.[44]

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

A Safe Work Environment is a Human Right

According to the United Nations (UN) Commission on Human Rights, all people have the right to live in a world free from toxic pollution and environmental degradation. In a recent decision, the Commission clearly recognized that environmental conditions help determine the extent to which people enjoy their basic rights to life, health, adequate food and housing, and traditional livelihood and culture.[45] A number of international treaties take environmental rights into account, including the Convention on the Rights of the Child and the ILO Convention 169 concerning Indigenous and Tribal Peoples in Independent Countries. Some important developments have also taken place at regional and national levels.

At the regional level, the United States is party to the North American Agreement on Labor Cooperation (NAALC)—the labor-side agreement under the North America Free Trade Agreement (NAFTA). The NAALC is the only one of several existing bilateral or multilateral trade-related agreements that contains express labor rights standards and allows for sanctions. While the majority of NAALC cases have dealt with violations of the right to freedom of association and the right to organize, nine cases filed under the agreement allege violations of the labor principle of *Prevention of Occupational Injuries and Illnesses*. One such case against apple producers in Washington State presented evidence of unsafe pesticide use, lack of regulation, and failure to enforce existing laws leading to disproportionately high rates of poisoning of migrant workers and low rates of penalizing employers. Ministerial consultations led to an agreement on the case in May 2000, but the problem of poor enforcement of existing laws was not addressed by the agreement, which involved only training to educate workers about their rights.[46]

At the national level, the right to a safe work and home environment has been recognized formally in over 90 national constitutions since 1992.[47] While environmental rights are not included in the U.S. Constitution, the federal government has recognized that lower-income communities and minority populations have historically been the target of many sources of pollution. In 1994, then-president Bill Clinton issued an Executive Order on environmental justice—"fair treatment for people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies." Since then environmental justice is presumably no longer an issue addressed only by affected communities, but a focus of the federal government as well.[48]

Agricultural Pesticide Poisonings around the Globe

Worldwide, the International Labor Organization estimates that 1.3 billion workers are engaged in agricultural production, accounting for 59% of workers in less developed regions. As in the United States, agriculture is one of the most hazardous industries, with pesticide poisonings accounting for 14% of all known occupational injuries and 10% of all fatal occupational injuries.[49]

International data linking pesticide exposures and farmworker illnesses are, like the data from California, severely limited by underreporting. The country-specific data that are available present a sobering picture of the public health effects of pesticide use. For example, a 1987 estimate based on surveys in four Asian countries indicated that 2–7% of agriculture workers suffered pesticide related illness each year, suggesting a global estimate of 25 million poisoning cases annually.[50] A 1993 survey in Bolivia indicated 10% of agricultural workers are poisoned annually,[51] while a recent study in Costa Rica found 4.5% of farmworker poisonings linked to pesticides.[52] In Indonesia, a 1995 study found 9% of agricultural workers suffered pesticide poisoning annually.[53]

Studies involving direct observation rather than self-reporting show even higher rates of pesticide poisoning, and confirm significant underreporting. A prospective study based on direct observation of 204 farmers and 24 professional sprayers in Indonesia over two consecutive growing seasons found that 21% of all applications resulted in three or more neurobehavioral, gastrointestinal, and/or respiratory signs and symptoms of poisoning. Only 9% of the farmers in this study self-reported being poisoned during this period, and less than 1% of those with symptoms ever went to a local health center.[53] Recent studies in Sumatra and Vietnam resulted in similar findings.[54,55]

Worldwide, the agricultural workforce is poorly compensated and inadequately protected. When laws do exist they are weakly enforced, exacerbating the problems inherent to an agricultural system that relies on

widespread use of hazardous pesticides. From California to Indonesia, from Bolivia to Vietnam, agricultural workers continuously face the risk of serious health effects from pesticide exposures simply by performing the tasks required of the job.

CONCLUSION

Agricultural pesticides are designed to disrupt or destroy living organisms. Workers who handle these chemicals and work in fields where they are applied face a tremendous and ongoing risk to their own health and the health of their families. While tougher pesticide safety regulations and effective enforcement of those regulations are essential, the fact that many of the illnesses reported in California are not linked to violations shows that even the most stringent safety laws simply do not adequately protect fieldworkers or pesticide handlers from pesticide poisoning.

Ultimately, farmworkers' rights to a safe work environment are best protected by elimination of hazardous pesticides and their replacement with safer, less toxic pest-management tools. The accelerating growth of organic food markets worldwide demonstrates that commercial production free of agricultural chemicals is a viable alternative. The continued growth of these ecologically sustainable production methods is the cornerstone for reducing acute and chronic pesticide-related illnesses among farmworkers and protecting the health and human rights of this often vulnerable community.

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