

# Preventing Pesticide-Related Illness in California Agriculture

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Pesticides pose significant health risks to the men, women, and children who apply these toxic substances in fields and orchards and who harvest the food and fiber upon which we all depend. California has led the nation in developing regulatory protections for agricultural workers, including mandatory training for applicators, restrictions on field entry after spraying, use of personal protective equipment, and provision of sanitation facilities. The effectiveness of these controls has been severely limited, however, by the toxicological, demographic, and economic realities of agriculture. Hundreds of different pesticides are applied in thousands of different settings, posing different risks of acute poisoning, reproductive and nervous system damage, and cancer. Farmworkers frequently lack the training to fully understand the risks they face and the political influence to successfully combat them. The farm economy is seasonal, reliant on contractors to manage labor, and exempt from much of the basic social legislation that protects workers' interests in other sectors.

The traditional regulatory approach has been ineffective in controlling occupational health risks in agriculture. A fundamentally new strategy is needed, one that will include three components.

First, a new *risk assessment* approach is needed to identify in an expeditious manner the most hazardous pesticides needing control, using available data on acute and chronic risks to farmworkers, to their communities, and to the rural ecosystem. The current regulatory system has amassed an enormous quantity of information but has failed to develop a mechanism for translating the science into a priority ranking for public policy.

Second, a new *risk management* approach is needed to focus attention on high-priority problems, establish genuinely protective controls, and effectively enforce the measures taken. The current system has achieved some successes but is falling further and further behind the changes in use patterns and labor relations.

Third, and most importantly, a new *risk prevention* approach is needed that promotes the reduction of chemical dependency and substitution of less-toxic alternatives. Environmental policy in other arenas is shifting from an emphasis on "end of pipe" controls to "pollution prevention" through changes in what is being produced and how it is being produced. For pesticides, the analogous paradigm shift will be from "safe use" to a socially and environmentally "sustainable" agriculture.

The report on which this brief is based lays the groundwork for the development of new public policy in each of these three areas. The risk assessment section brings together data on volume of use, worker poisonings, and acute and chronic toxicity for 70 high-profile pesticides in California as a first step toward setting priorities for intervention. Particular emphasis is placed on worker poisoning reports, which are used to identify high-risk pesticides, crops, and occupations. The report's risk management section surveys the range of controls developed over the past two decades and evaluates their strengths and weaknesses in order to highlight possible reforms to the pesticide regulatory process. The risk prevention section proposes that a new tax be placed on the sales of all pesticides, both to discourage toxic chemical use and to raise revenues to support the development and diffusion of sustainable agricultural practices.

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## RISK ASSESSMENT: SETTING HEALTH-BASED PRIORITIES

Given the multitude of different pesticides and different contexts in which they are applied, virtually all social efforts to control use and exposure have sought to establish priorities. No consistent and coherent method for sifting the scientific data has been developed, however, and each effort relies on only a partial assessment of the range of health risks. Substances that rank high on one priority ranking frequently are ignored altogether in another. As a first step to rectifying the current confusion, the full report brings together the available data for 70 high-profile pesticides applied in California, covering volume of use, worker poisonings, acute toxicity, chronic toxicity, and cancer potency. For each pesticide, the report provides its numerical data and priority rank according to each risk attribute.

Table 1 presents the 10 top-ranked pesticides from the basic set of 70 pesticides, which rank very differently depending on risk attributes. Those that would receive special attention using one attribute could receive little or no attention using another. The two highest-volume substances are sulfur and petroleum oil, which are not conventionally included in policy discussions of pesticide use reduction. Propargite ranks high in worker poisonings and cancer potency but ranks much lower in acute and chronic toxicity rankings. Aldicarb exhibits the highest acute toxicity and third-highest chronic toxicity based on laboratory experiments but does not appear high on the volume, worker poisoning, and cancer rankings. The full report demonstrates that the worker poisoning and acute toxicity rankings are reasonably well correlated for the larger universe of pesticides, especially when attention is restricted to systemic and respiratory illnesses.

Table 1: Priority Rankings for High-Profile Pesticides Using Data on Volume Applied, Worker Poisonings, Acute Toxicity, Chronic Toxicity, and Cancer Potency [partial information]

1) sulfur; 2) petroleum oil; 3) methyl bromide; 4) metam sodium; 5) 1,3- dichloropropene; 6) sodium chlorate; 7) copper hydroxide; 8) cryolite; 9) copper sulfate; 10) chloropicrin

Available data can also be used to set priorities among different crops and farmworker activities. The full report develops short case studies to illustrate the ways in which different data sources can be used to focus regulatory attention on the most important problems. The six crops accounting for the largest number of worker poisonings between 1984 and 1990 are grapes, oranges, cotton, almonds, lettuce, and tomatoes. Different crops manifest quite different patterns of pesticide usage and illness. Grape production accounts for 33% of all commodity-associated pesticide illnesses reported in California. Predominantly skin and eye poisonings, these illnesses are caused by field exposures to residues of sulfur as well as mixtures of other pesticides. For each major crop, the report documents which pesticides are associated with the largest numbers of poisoning cases and examines whether problem pesticides have been subjected to regulatory controls.

Substantial information is also available on the occupations and exposure contexts responsible for worker pesticide poisoning. The full report analyzes the pesticides, crops, and types of illness most commonly associated with residue, mixer/loader/applicator, and drift exposures. Most regulatory efforts have focused on mixer, loader, and applicator activities under the impression that these generate the highest exposure to pesticides. Hazardous exposure patterns, however, exist in many other agricultural activities. In fact, residue exposure to harvest and packing workers accounts for a larger fraction of total poisonings, and for over two-thirds of all cases in grapes and oranges. Reviewing regulatory agency data, the report shows that workers in every job category can be exposed to daily doses of pesticides that significantly exceed levels determined to be safe.

Different rankings of pesticides across risk attributes are not merely a matter of scientific interest.

Several of these attributes have been selected as the exclusive priority-setting mechanism in recent legislative and judicial initiatives. Some proposals would establish a target for pesticide use reduction that would specify a percentage reduction in pounds applied. Farmers could comply with the letter if not the spirit of these proposals by reducing use of high-volume but relatively nonpersistent and nontoxic substances. Another legislative initiative would phase out pesticides based on laboratory measures of their acute toxicity. This approach would miss several substances responsible for large numbers of worker poisonings plus some substances posing especially high chronic health risks. A recent judicial ruling has focused attention at the national level on pesticides that pose cancer risks as a result of food residues, while ignoring those responsible for many worker poisonings.

Each of these approaches suffers from limitations in terms of the number of substances covered, the quality of the underlying data, and completeness of reporting. None can serve adequately as the sole basis for a priority-setting mechanism. Together, however, they provide a reasonable assessment of the range of the health problems posed by pesticides and can be used to establish a composite list of substances for policy attention. Scientists and public health programs are continually developing new and better data that can be included in the priority-setting mechanism as they become available. It is not necessary, however, to await more data before acting.

A detailed numerical index of all the various pesticide-related risks is neither possible, given existing data limitations, nor necessary. Rather, the available data can be used as the basis for assigning individual pesticides to a set of categories ranging from low to high risk. The U.S. Environmental Protection Agency currently maintains a ranking scheme with four categories based on the pesticides' acute toxicity in laboratory experiments. This approach could and should be expanded to take into account data on worker poisonings and chronic health risks. As emphasis is broadened beyond farmworker health, additional risk attributes would include community exposures (e.g., structural pest control, consumer products), food residues, groundwater contamination, and ecosystem damage. Future analyses by the Environmental Health Policy Program will address these issues, with dissemination through CPS reports and briefs.

## **RISK MANAGEMENT: REFORMING THE REGULATORY FRAMEWORK**

State and federal governmental agencies pursue numerous efforts to control farmworker exposure to toxic chemicals, as summarized in Table 2. Each of these strategies offers some benefits but suffers from important limitations. The key question for public policy concerns the appropriate mix of strategies to be emphasized, given the scientific, demographic, and economic difficulties plaguing any serious effort at control.

### **Table 2**

#### **Overview of Strategies for**

#### **Managing Occupational Risks**

#### **Pesticide Use Controls**

Premarket screening through registration process

Product bans or phaseouts

Regulatory restrictions on use (e.g., use only by certified applicators)

Taxes on sales

### **Safe Work Practices**

Reentry intervals

Permissible exposure limits

Technological controls that limit exposure

Personal protective equipment

Field sanitation and decontamination provisions

### **Worker Education and Training**

Hazard communication and training requirements

Illness prevention planning

Collective bargaining

### **Compensation**

Wage replacement: Workers Compensation

Punitive liability: private tort compensation

The foundation of all policy efforts to control pesticide-related illness lies in the registration process, which requires pesticides to be evaluated for health and ecosystem effects prior to marketing. These rules, which are embedded in both federal and California state law, can be used to prevent especially toxic substances from being released at all, to ban the use of previously authorized substances, or to restrict use of toxic substances to specially trained and certified applicators. Sales taxes fall under this strategy to the extent they provide disincentives for pesticide use.

The pesticide use control framework, though impressive in principle, has been disappointing in practice. The great majority of pesticides in use today have still not been fully evaluated for health and ecosystem effects; their continued application is permitted through a "grandfather" clause in the federal statute. Of the 70 major California pesticides analyzed in *Preventing Pesticide-related Illness*, for example, only two have been fully evaluated and registered for use by the U.S. Environmental Protection Agency. The use restrictions have not been effectively applied. Of the 26 pesticides accounting for the largest number of worker poisonings, less than half are restricted to certified applicators and less than one-quarter are subject to strong warning requirements or handling precautions. This anomaly is due in part to the emphasis by the EPA risk categorization scheme on acute toxicity results from laboratory experiments, with little attention paid to data on actual illness.

The second type of worker protection mandates safe work practices to be used in conjunction with registered pesticides. Workers who mix, load, and apply pesticides are subject to various requirements for personal protective equipment and, in a few cases, use of specific technological controls (e.g., closed mixing systems). Reentry intervals are intended to prevent farmers and farm labor contractors from

sending harvest workers into fields for a specified number of hours after particular pesticides have been applied, in order to permit the chemicals to degrade into less-toxic substances. The field sanitation regulation requires farmers and contractors to provide drinking water and sanitation facilities, which can be used in cases of acute pesticide exposure.

These safe work practice provisions are woefully underenforced. Less than half of the 70 high-profile California pesticides have reentry intervals of more than one day and many have no reentry interval at all. The protective equipment and sanitation requirements are widely ignored; a recent "targeted" enforcement effort documented the manner in which even the most elementary hygienic practices are disregarded.

The "right to know" movement among industrial workers and urban communities exposed to toxic chemicals has exerted a modest beneficial impact on public policy towards pesticide-exposed farmworkers. Under state law growers and farm labor contractors are required to inform workers of the risks they face and train them in safe handling techniques. Written illness prevention plans are formally required. These "right to know" provisions are supported, in principle, by the "right to act" provisions of federal and state labor law, which guarantee to workers the right to join labor unions and bargain collectively with employers. These worker-oriented regulations have not been observed in practice.

Some incentives for the prevention of pesticide-related illness are created by the Workers Compensation and tort liability systems, which compensate workers who suffer illness and disability due to exposures on the job. The Workers Compensation system is designed to replace a fraction of the wages foregone by disabled workers through a mandatory insurance system financed by employers. Reductions in injuries and illnesses translate into lower insurance premiums, thereby providing a visible incentive for prevention activities. The tort liability system provides a much more uncertain but potentially much larger payment to ill workers, since compensation can cover pain and suffering as well as lost wages. The Workers Compensation and tort liability systems are at their weakest, however, when applied to farmworkers exposed to pesticides. Farmworkers, many of whom are transient, undocumented, and Spanish-speaking, are very reluctant to file for compensation even if they know the systems exist, and their chances of successfully overcoming a legal defense by the agricultural and insurance industries are minimal.

The results of the various risk management efforts undertaken to date are not particularly impressive. In part this reflects the limitations of the "safe work practice" approach for controlling inherently unsafe substances. The available regulatory framework can be improved, however, and should not be ignored even as society develops an alternative "use reduction" paradigm. Several efforts to reform the regulatory system are underway and should be encouraged. Most obviously, the federal and state registration process must be accelerated so as to bring the most hazardous pesticides quickly under the purview of certification and labeling requirements. This can lead to removal from the market of the most toxic substances and accelerate movement onto the market of newer and less-toxic biological controls. The reentry interval, hazard communication, and mandatory training provisions must be applied more widely to cover all major sources of farmworker illness. A set of priority-ranking categories could facilitate this extension if based on a more complete assessment of the different types of risks. For example, a pesticide should be assigned to the highest-priority category, and hence be subject to more stringent safe use practices, if it is responsible for a high number of reported poisonings or ranks high in laboratory experiments for neurotoxic or reproductive effects, even if its rank for acute effects in laboratory experiments is low. Targeted enforcement of both pesticide-related and other worker protections should be continued and strengthened. Over the long term, state and federal labor law will need amendment to provide meaningful protections for workers wishing to unionize and engage in collective bargaining.

## **RISK PREVENTION: TRANSITION TO A SUSTAINABLE AGRICULTURE**

Farmers are caught on a pesticide treadmill. The application of synthetic herbicides, fungicides, and insecticides can upset the balance of field and orchard ecosystems, damaging beneficial organisms that prey on undesired pests. When the next generation of pests returns, sometimes with a genetic resistance to the pesticide, the natural predators are no longer there, and even greater doses of synthetic poison are required. Each growing season brings greater pest resistance, fewer natural controls, and increased demand for applications.

The traditional risk assessment and risk management system is caught on its own pesticide treadmill. The scientific community, industry, and governmental regulators are overwhelmed by the demands for multiple studies of myriad pesticides. The registration process is falling further and further behind, leaving highly toxic substances in commercial use while inhibiting the marketing of less-toxic alternatives. Continued use of problem pesticides because of regulatory loopholes and scientific data gaps inevitably leads to human health or ecological damage. Crises involving major spills or contaminated food generate public demands for the immediate ban of the "chemical of the month." Farmers then substitute even larger quantities of the remaining pesticides and the regulatory agencies scramble to evaluate their health risks.

The time has come for California to get off the pesticide treadmill. We can no longer claim that our conventional risk assessment and risk management tools are up to the task we have set them: ensuring the safe use of unsafe materials. The only solution is to move towards a completely new paradigm, one that emphasizes the reduction of pesticide use and substitution of less-toxic alternatives. For farmers and the agricultural industry, this requires a transitional phase of pesticide use reduction through "integrated pest management," with a clear goal of eliminating pesticide use and relying on natural predators, crop rotation, judicious matching of crops with local ecosystem attributes, and other components of a sustainable agriculture. For public policymakers and the regulatory agencies, this requires the formulation of broad-spectrum incentives that simultaneously discourage the use of toxic pesticides and encourage the development and diffusion of alternative farming practices.

The risk prevention approach to farmworker health and safety will require many creative ideas and committed participants. The foundation of this approach is easy to identify, however. A steep sales tax on pesticides can be simultaneously stick and carrot, providing disincentive for their use while raising revenues to fund development and diffusion activities. When imposed at the wholesale level, a tax would be enforced easily and would cover all pesticides, escaping the current system's endemic problems of incomplete and unenforced control. When revenues are targeted at helping farmers shift to sustainable practices, the tax approach can provide positive incentives for reducing environmental health risks.

The broad-based tax contrasts with traditional efforts to ban individual pesticides. The elimination of one pesticide usually leads to the increased use of others, because no support is provided for nontoxic alternatives. The reason pesticides are used so widely today is that the short-run costs of alternative production techniques remain higher than for pesticide-based approaches. The only way to achieve lasting toxics use reduction is by developing economically as well as environmentally sustainable practices.

The proposed sales tax would differ from California's current tax on pesticides in three salient dimensions. First, it would be significantly higher than the current rate of 2.2%, which is so low as to be ignored by most farmers and applicators. Second, it would be adjusted according to the risks posed by particular pesticides. The current tax penalizes the highest-priced substances, not those that impose the highest risks. The proposed tax could include a risk-weighted modifier based on the risk categories

discussed earlier. For example, the modifier could take the value of 1.0 for the least-toxic substances, 3.0 for those posing moderate risks, and 5.0 to 10.0 for those posing the greatest risks. Individual pesticides would be assigned to particular risk categories, and hence be subject to particular tax modifiers, based on the full range of worker health, community health, and ecosystem damage data. Third, revenues from the proposed tax would fund a range of socially desirable activities, including farmworker protections and research into nontoxic production methods.

Revenues from the current tax exclusively support the risk assessment and risk management activities of the CalEPA Department of Pesticide Regulation. These regulatory activities deserve continued support but should not consume the majority of pesticide tax revenues. Worker protection activities fundable by pesticide tax revenues could include training programs and health care clinics. Development and diffusion activities fundable through the pesticide tax could include research on agricultural conversion and the training of agricultural extension specialists in integrated pest management and sustainable agricultural practices.

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*This is the first of six reports of the Environmental Health Policy Program, established in 1993 by the University of California Center for Occupational and Environmental Health under a three-year grant from the Clarence E. Heller Charitable Foundation. The program's goals were to assess the effectiveness of current approaches to managing chemical risks and develop new strategies to reduce use of toxic substances. Program activities included preparing issue papers identifying priority problems and risk management options, as well as organizing workshops and conferences to provide a forum for interested participants to develop innovative policy recommendations. The California Policy Seminar disseminated the program's analyses of specific problems and potential solutions.*